From: Michael Cosgrove
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Sunday, 26 May 2019 1:42:54 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

After a very long wait, I have now had brief opportunity to review the Environmental Impact Statement (EIS) prepared by the proponent.

Following that, I strongly believe this development should not proceed at Smith Bay.

More specific responses to EIS guidelines appear below, but the unresolved question remains:

- Why was this company privileged with Major Development Status for a deliberately destructive proposal for Smith Bay, when it's abundantly clear there are multiple, more suitable site options available on Kangaroo Island – including a former industrial wharf the company already owns?

A proposal like this elsewhere on Kangaroo Island will deliver the same jobs and economic benefit as those it speculates for Smith Bay but without wholesale destruction of the marine and terrestrial environment, public infrastructure, social amenity and long-term sustainable businesses.

With regard to the EIS, my major concerns relate to the potential destruction of Smith Bay's native flora and fauna protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC).

Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

- Smith Bay is fortunate to be regularly visited by southern right whales. Over recent years the shallow bay has emerged as a biologically important area for these threatened marine mammals and their calves.
- Southern right whales are listed as endangered under the EPBC mainly thanks to the impacts of commercial whaling.
- The whales that call Smith Bay home for large periods of the year are at grave risk from the inevitable debilitating noise, dredging and vessel disturbance, vessel strike, pollution, leachate and consequent toxicity the development of the Seaport will bring to the bay.
- Proposed dredging activities to gouge 100,000 cubic metres from the floor of Smith Bay, ongoing port operations and an inevitable future dredging program. This will have a significant impact on the marine environment by disturbing and smothering benthic biota and habitats, degrading water quality through elevated turbidity, bioavailability of pollutants and reducing dissolved oxygen in the water column.
- The proponent's means to address this assault are inadequate at best and are

presented in a careless manner.
- Smith Bay is host to a number of threatened and endangered species that will be impacted by this proposal, including white bellied sea eagles, southern brown bandicoots and echidnas.
- The construction of the proponent's Seaport and on-land infrastructure will force those that survive the construction phase, away from Smith Bay – to where?
- The operation of the Seaport - including B-double truck movements around the clock - will inevitably contribute to unacceptable mortality rates.
- Although South Australia's koalas are not listed in the EPBC, the proponent must reveal how it intends to simultaneously manage the local koala population while destroying its habitat.
- On my reading, the proponent's EIS fails to adequately address any of these risks in sufficient detail, or provide credible mitigation.

Native Vegetation and Fauna

- The proponent admits its industrial facility at Smith Bay will result in a significant loss of seagrass in Smith Bay.
- It estimates - and on past record, we are certain underestimates – it will destroy 100,000 square metres (10 hectares!) of seagrass in the bay.
- Noise and light emissions from dredging will disrupt larger sea mammals such as southern right whales and dolphins, while future dredging, plus propeller wash and contamination from commercial shipping vessels, will prohibit regrowth.
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- AusOcean's revelations included the discovery of an ancient two-metre-tall coral head and more than 10 new species of fish.
- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Michael Cosgrove

From: Sandra Caballero
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Sunday, 26 May 2019 12:04:56 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Sandra Caballero

From:	Thomas West
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Sunday, 26 May 2019 11:59:31 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Thomas West

From: Glenys Perri
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Sunday, 26 May 2019 11:55:40 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Glenys Perri

From:	Shaana Schillier
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Sunday, 26 May 2019 11:46:02 AM

Dear Minister,

RE: **Biosecurity concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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A proposal like this elsewhere on Kangaroo Island will deliver the same jobs and economic benefit as those it speculates for Smith Bay but without wholesale destruction of the marine and terrestrial environment, public infrastructure, social amenity and long-term sustainable businesses.

With regard to the EIS, my major concerns relate to biosecurity hazards the proponent agrees are inevitable as the result of its actions in Smith Bay, and the risks to Kangaroo Island's unique flora and fauna.

Biosecurity

- Historically on Kangaroo Island, exotic marine pests have only been found where there is major shipping infrastructure. This includes Kingscote Jetty, Kingscote Wharf, the Bay of Shoals anchorage, Christmas Cove and American River anchorage. These discoveries have been directly linked to vessel traffic from infected mainland ports.
- During a coast and marine survey conducted by Natural Resources Kangaroo Island in 2018, the Biosecurity Advisory Committee found Smith Bay to be exotic marine pest free, which is also testament to the tight biosecurity management regime of the onshore abalone farm that has operated in Smith Bay for more than 20 years.
- The KI Seaport proponent acknowledges it will create a major biosecurity risk and some form of surveillance will be needed. Kangaroo Island Plantation Timbers has committed to help fund such a program assuming, as it does with its entire proposal, that ratepayers and taxpayers will leap to cover the community costs its refuses to meet. While surveillance is necessary it does not remove the threat. Once Smith Bay has been contaminated with exotic marine pests, they are there forever.
- Since 1983, the waters around Adelaide have been contaminated with Asian date or bag mussels. This exotic pest which can be introduced via ship ballast water, on

vessel hulls or in internal seawater systems, grows quickly and smothers seabed life affecting the productivity of commercial fisheries and aquaculture. This is not to mention last year's outbreak of Pacific Oyster Mortality Syndrome (POMS) in the Port River. Smith Bay should not be exposed to these risks, nor should the operation of the successful, sustainable businesses it hosts and supports be threatened in such a way.
- Based on the Australian Government's interactive map of marine pests in Australia, most major shipping ports in Australia have seen the introduction of exotic marine pests.
- It remains a mystery how Smith Bay can be protected from this inevitability by the actions of a proponent with no experience of marine environment management or infrastructure build of any sort, a cavalier attitude to biosecurity, and a belief that the rest of us – not it – will willingly wear the cost of its actions.

Coast and Marine

- The KI Seaport proposal presents a massive assault on the marine and coastal environment of an isolated and relatively unspoilt part of Kangaroo Island's coastline.
- The Federal Government has already expressed concerns regarding the proposal and has delegated its authority under the Environment Protection and Biodiversity Conservation Act 1999 to the South Australian Government.
- We would expect the South Australian Government and its agencies to fully comply with these requirements, and to act in the interest of science and community expectations.
- In testimony to the Natural Resources Committee in the South Australian House of Assembly on 19 May 2017, Kangaroo Island Plantation Timbers Director Shauna Black described the existing former industrial wharf at Ballast Head, which the company owns as "…almost the opposite of Smith Bay in two crucial areas: it has steep land and shallow sea."
- The full Hansard account of Ms Black's patchy account is here.
- It is ignorant at best for her, a resident of Kangaroo Island and chief spruiker for Kangaroo Island Plantation Timbers' outlandish plans, to claim Smith Bay is deep and Ballast Head is shallow.
- If Ms Black genuinely believes this, she has realistically never been to either site, let alone reviewed the available data.
- The proposal for a claimed deep-water Seaport for super-Panamax ships requires a depth of at least 15 metres to operate. Smith Bay is shallow, only reaching 10 metres depth some 350 metres from the shore.
- The volume of soil blasted and scraped from the seabed by the proponent's dredges is equivalent to filling 40 Olympic-size swimming pools, resulting in:
    - the loss of **at least** 100,000 square metres of seagrass – admitted by the proponent, which claims it can "offset" by simply planting some seagrass in another place (if only it were so simple)
    - sediment uplift into the water column
    - marine life mortality due to choking hazards, suffocation and red tide potential from disruption of toxic organisms in the sediment

The proponent is poorly-qualified to submit this proposal, and I trust it is not too late for that to be considered.

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Shaana Schillier

From:	Anthony Hoff
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Sunday, 26 May 2019 11:45:10 AM

Dear Minister,

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I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Anthony Hoff

From:	Olivia Weatherspoon
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Tuesday, 28 May 2019 2:20:26 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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With regard to the EIS, my major concerns relate to the potential destruction of Smith Bay's native flora and fauna protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC).

Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

- Smith Bay is fortunate to be regularly visited by southern right whales. Over recent years the shallow bay has emerged as a biologically important area for these threatened marine mammals and their calves.
- Southern right whales are listed as endangered under the EPBC mainly thanks to the impacts of commercial whaling.
- The whales that call Smith Bay home for large periods of the year are at grave risk from the inevitable debilitating noise, dredging and vessel disturbance, vessel strike, pollution, leachate and consequent toxicity the development of the Seaport will bring to the bay.
- Proposed dredging activities to gouge 100,000 cubic metres from the floor of Smith Bay, ongoing port operations and an inevitable future dredging program. This will have a significant impact on the marine environment by disturbing and smothering benthic biota and habitats, degrading water quality through elevated turbidity, bioavailability of pollutants and reducing dissolved oxygen in the water column.
- The proponent's means to address this assault are inadequate at best and are

presented in a careless manner.

- Smith Bay is host to a number of threatened and endangered species that will be impacted by this proposal, including white bellied sea eagles, southern brown bandicoots and echidnas.
- The construction of the proponent's Seaport and on-land infrastructure will force those that survive the construction phase, away from Smith Bay – to where?
- The operation of the Seaport - including B-double truck movements around the clock - will inevitably contribute to unacceptable mortality rates.
- Although South Australia's koalas are not listed in the EPBC, the proponent must reveal how it intends to simultaneously manage the local koala population while destroying its habitat.
- On my reading, the proponent's EIS fails to adequately address any of these risks in sufficient detail, or provide credible mitigation.

Native Vegetation and Fauna

- The proponent admits its industrial facility at Smith Bay will result in a significant loss of seagrass in Smith Bay.
- It estimates - and on past record, we are certain underestimates – it will destroy 100,000 square metres (10 hectares!) of seagrass in the bay.
- Noise and light emissions from dredging will disrupt larger sea mammals such as southern right whales and dolphins, while future dredging, plus propeller wash and contamination from commercial shipping vessels, will prohibit regrowth.
- As referenced on page 44 of the proponent's EIS, the company insists its industrial operations will only result in the deaths of between six to 12 of endangered echidnas. Surely, any deliberate mortality of the endangered echidna should be considered unacceptable.
- To "offset" its dead echidnas, Kangaroo Island Plantation Timbers says it will assist with a feral cat eradication program which it claims is "the main factor threatening the echidna population".
- The Kangaroo Island echidna was recently listed as endangered under the EPBC, and therefore any added mortality risk to this endangered species should not be overlooked – regardless of the claimed "offset".
- Outside this EIS, in December 2018, AusOcean - a not-for-profit Australian Ocean Lab - conducted the first detailed underwater marine survey of Smith Bay.
- Kangaroo Island Plantation Timbers barely scratches the surface in its own survey to support its proposal, some of which was conducted without appropriate permits and should therefore be invalid in its documentation
- While the proponent not surprisingly found little to wonder at in Smith Bay, AusOcean made startling discoveries that should provide the template for your Government to re-assess the value in these waters.
- AusOcean's revelations included the discovery of an ancient two-metre-tall coral head and more than 10 new species of fish.
- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Olivia Weatherspoon

From: Damon Weatherspoon
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Tuesday, 28 May 2019 2:21:43 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

After a very long wait, I have now had brief opportunity to review the Environmental Impact Statement (EIS) prepared by the proponent.

Following that, I strongly believe this development should not proceed at Smith Bay.

More specific responses to EIS guidelines appear below, but the unresolved question remains:

- Why was this company privileged with Major Development Status for a deliberately destructive proposal for Smith Bay, when it's abundantly clear there are multiple, more suitable site options available on Kangaroo Island – including a former industrial wharf the company already owns?

A proposal like this elsewhere on Kangaroo Island will deliver the same jobs and economic benefit as those it speculates for Smith Bay but without wholesale destruction of the marine and terrestrial environment, public infrastructure, social amenity and long-term sustainable businesses.

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Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Damon Weatherspoon

From: Ebonie Ragless
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Tuesday, 28 May 2019 2:26:31 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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Native Vegetation and Fauna

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Ebonie Ragless

From:	Jason Leanet
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Tuesday, 28 May 2019 2:28:06 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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Native Vegetation and Fauna

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Jason Leanet

From: Karen Hewitt
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Monday, 27 May 2019 1:03:09 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

After a very long wait, I have now had brief opportunity to review the Environmental Impact Statement (EIS) prepared by the proponent.

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More specific responses to EIS guidelines appear below, but the unresolved question remains:

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A proposal like this elsewhere on Kangaroo Island will deliver the same jobs and economic benefit as those it speculates for Smith Bay but without wholesale destruction of the marine and terrestrial environment, public infrastructure, social amenity and long-term sustainable businesses.

With regard to the EIS, my major concerns relate to the potential destruction of Smith Bay's native flora and fauna protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC).

Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

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presented in a careless manner.
- Smith Bay is host to a number of threatened and endangered species that will be impacted by this proposal, including white bellied sea eagles, southern brown bandicoots and echidnas.
- The construction of the proponent's Seaport and on-land infrastructure will force those that survive the construction phase, away from Smith Bay – to where?
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- Although South Australia's koalas are not listed in the EPBC, the proponent must reveal how it intends to simultaneously manage the local koala population while destroying its habitat.
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Native Vegetation and Fauna

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- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Karen Hewitt

From:	Will Sanson
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 12:38:26 PM

Dear Minister,

RE: **Local infrastructure concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

After a very long wait, I have now had brief opportunity to review the Environmental Impact Statement (EIS) prepared by the proponent.

Following that, I strongly believe this development should not proceed at Smith Bay.

More specific responses to EIS guidelines appear below, but the unresolved question remains:

- Why was this company privileged with Major Development Status for a deliberately destructive proposal for Smith Bay, when it's abundantly clear there are multiple, more suitable site options available on Kangaroo Island – including a former industrial wharf the company already owns?

A proposal like this anywhere on Kangaroo Island will deliver the same jobs and economic benefit as those it speculates for Smith Bay but without wholesale destruction of the marine and terrestrial environment, public infrastructure, social amenity and long-term sustainable businesses.

With regard to the EIS, my major concerns relate to the potential destruction of Kangaroo Island's road network and the community's trust in its local businesses.

Traffic and Transport

- Kangaroo Island's road network has limited carrying capacity and has not been developed to support the heavy vehicle traffic proposed by Kangaroo Island Plantation Timbers. It can barely cope with existing vehicles and their frequency.
- The company's EIS in support of its own proposal does not address or outline how it intends to fund the necessary road upgrades to better protect other users, or the maintenance of roads to support its Smith Bay infrastructure.
- It proposes heavy vehicles not used on Kangaroo Island's sub-standard roads, and without making any contribution to road safety or capacity, presents the Island with the certain threat of what has happened with log trucks in Glenelg Shire in Victoria.
- Kangaroo Island Plantation Timbers' land is mainly on the west of the island, more than 100 kilometres from Smith Bay and the sealed KI Ring Route. So why build this Seaport so far from its own plantations?
- Why replicate the horror of the Glenelg Shire, whose bitumen highways have been torn apart by B-doubles carrying logs to a chip mill at Portland? The Green Triangle's roads have been asked to support 535 heavy-vehicle movements a day.
- To maintain the current Kangaroo Island road network, an average of at least $5 million will be required annually for the next decade.

In response to a Parliamentary question from Mark Parnell MLC, the Minister for Transport, Infrastructure and Local Government, Stephan Knoll, confirmed Kangaroo Island Plantation Timber's "….proposed freight routes would require upgrading to accommodate the freight task…" and that as "….the roads in question are local roads under the care and control of Kangaroo Island Council, there is no intention for the State Government to commit to a contribution towards the upgrade of local roads, should the development be approved…."

- Does this mean if your Government gives this proposal a green light – despite the guaranteed impact seen across the border in Victoria – it also expects a small community of Kangaroo Island ratepayers not just to live with this road trauma nightmare, but also to pay the costs of your decision?
- Degrading the road network so dramatically threatens the tourism industry (already at risk). It also constrains mobility for other industries (particularly primary producers) reliant on roads to trade, damages amenity across the island, and places the lives of every road user at greater risk.

Community

- In its spruiking for a seaport at Smith Bay, Kangaroo Island Plantation Timbers has been fluid with the truth, not least in how it stacks up the apparent benefits for Kangaroo Island.
- The EIS suggests this proposal will create approximately 230 FTE jobs on the Island.
- That is, indeed, a bold claim, Minister. Especially since there is no picture of the long-term viability of these jobs, who will fill them, what skills will be required, how many will fly in/fly out, and how many will be imported. This will put under even greater pressure an already challenging housing, energy and public infrastructure supply.
- By comparison, two other much larger woodchipping facilities at the Port of Portland in Victoria and at Bunbury Fibre Exports in Bunbury, Western Australia employ less than 70 and 16 full time employees respectively.
- The entire workforce of OneFortyOne Plantations totals 64 FTE managing 80,000 hectares of Green Triangle plantations. Kangaroo Island Plantation Timbers manages 14,000 hectares. The company's claim of 230 FTE is, in the true sense of the word, incredible.

Thank you for taking the time to consider my objection to this proposal.

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Will Sanson

From:	William Sanson
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 12:36:28 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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- Although South Australia's koalas are not listed in the EPBC, the proponent must reveal how it intends to simultaneously manage the local koala population while destroying its habitat.
- On my reading, the proponent's EIS fails to adequately address any of these risks in sufficient detail, or provide credible mitigation.

Native Vegetation and Fauna

- The proponent admits its industrial facility at Smith Bay will result in a significant loss of seagrass in Smith Bay.
- It estimates - and on past record, we are certain underestimates – it will destroy 100,000 square metres (10 hectares!) of seagrass in the bay.
- Noise and light emissions from dredging will disrupt larger sea mammals such as southern right whales and dolphins, while future dredging, plus propeller wash and contamination from commercial shipping vessels, will prohibit regrowth.
- As referenced on page 44 of the proponent's EIS, the company insists its industrial operations will only result in the deaths of between six to 12 of endangered echidnas. Surely, any deliberate mortality of the endangered echidna should be considered unacceptable.
- To "offset" its dead echidnas, Kangaroo Island Plantation Timbers says it will assist with a feral cat eradication program which it claims is "the main factor threatening the echidna population".
- The Kangaroo Island echidna was recently listed as endangered under the EPBC, and therefore any added mortality risk to this endangered species should not be overlooked – regardless of the claimed "offset".
- Outside this EIS, in December 2018, AusOcean - a not-for-profit Australian Ocean Lab - conducted the first detailed underwater marine survey of Smith Bay.
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- AusOcean's revelations included the discovery of an ancient two-metre-tall coral head and more than 10 new species of fish.
- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

William Sanson

From:	Peter Fuller
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 12:37:33 PM

Dear Minister,

RE: **Biosecurity concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

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A proposal like this elsewhere on Kangaroo Island will deliver the same jobs and economic benefit as those it speculates for Smith Bay but without wholesale destruction of the marine and terrestrial environment, public infrastructure, social amenity and long-term sustainable businesses.

With regard to the EIS, my major concerns relate to biosecurity hazards the proponent agrees are inevitable as the result of its actions in Smith Bay, and the risks to Kangaroo Island's unique flora and fauna.

Biosecurity

- Historically on Kangaroo Island, exotic marine pests have only been found where there is major shipping infrastructure. This includes Kingscote Jetty, Kingscote Wharf, the Bay of Shoals anchorage, Christmas Cove and American River anchorage. These discoveries have been directly linked to vessel traffic from infected mainland ports.
- During a coast and marine survey conducted by Natural Resources Kangaroo Island in 2018, the Biosecurity Advisory Committee found Smith Bay to be exotic marine pest free, which is also testament to the tight biosecurity management regime of the onshore abalone farm that has operated in Smith Bay for more than 20 years.
- The KI Seaport proponent acknowledges it will create a major biosecurity risk and some form of surveillance will be needed. Kangaroo Island Plantation Timbers has committed to help fund such a program assuming, as it does with its entire proposal, that ratepayers and taxpayers will leap to cover the community costs its refuses to meet. While surveillance is necessary it does not remove the threat. Once Smith Bay has been contaminated with exotic marine pests, they are there forever.
- Since 1983, the waters around Adelaide have been contaminated with Asian date or bag mussels. This exotic pest which can be introduced via ship ballast water, on

vessel hulls or in internal seawater systems, grows quickly and smothers seabed life affecting the productivity of commercial fisheries and aquaculture. This is not to mention last year's outbreak of Pacific Oyster Mortality Syndrome (POMS) in the Port River. Smith Bay should not be exposed to these risks, nor should the operation of the successful, sustainable businesses it hosts and supports be threatened in such a way.
- Based on the Australian Government's interactive map of marine pests in Australia, most major shipping ports in Australia have seen the introduction of exotic marine pests.
- It remains a mystery how Smith Bay can be protected from this inevitability by the actions of a proponent with no experience of marine environment management or infrastructure build of any sort, a cavalier attitude to biosecurity, and a belief that the rest of us – not it – will willingly wear the cost of its actions.

Coast and Marine

- The KI Seaport proposal presents a massive assault on the marine and coastal environment of an isolated and relatively unspoilt part of Kangaroo Island's coastline.
- The Federal Government has already expressed concerns regarding the proposal and has delegated its authority under the Environment Protection and Biodiversity Conservation Act 1999 to the South Australian Government.
- We would expect the South Australian Government and its agencies to fully comply with these requirements, and to act in the interest of science and community expectations.
- In testimony to the Natural Resources Committee in the South Australian House of Assembly on 19 May 2017, Kangaroo Island Plantation Timbers Director Shauna Black described the existing former industrial wharf at Ballast Head, which the company owns as "…almost the opposite of Smith Bay in two crucial areas: it has steep land and shallow sea."
- The full Hansard account of Ms Black's patchy account is here.
- It is ignorant at best for her, a resident of Kangaroo Island and chief spruiker for Kangaroo Island Plantation Timbers' outlandish plans, to claim Smith Bay is deep and Ballast Head is shallow.
- If Ms Black genuinely believes this, she has realistically never been to either site, let alone reviewed the available data.
- The proposal for a claimed deep-water Seaport for super-Panamax ships requires a depth of at least 15 metres to operate. Smith Bay is shallow, only reaching 10 metres depth some 350 metres from the shore.
- The volume of soil blasted and scraped from the seabed by the proponent's dredges is equivalent to filling 40 Olympic-size swimming pools, resulting in:
  - the loss of **at least** 100,000 square metres of seagrass – admitted by the proponent, which claims it can "offset" by simply planting some seagrass in another place (if only it were so simple)
  - sediment uplift into the water column
  - marine life mortality due to choking hazards, suffocation and red tide potential from disruption of toxic organisms in the sediment

The proponent is poorly-qualified to submit this proposal, and I trust it is not too late for that to be considered.

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Peter Fuller

From:	Michael Wooldridge
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 12:15:22 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

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With regard to the EIS, my major concerns relate to the potential destruction of Smith Bay's native flora and fauna protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC).

Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

- Smith Bay is fortunate to be regularly visited by southern right whales. Over recent years the shallow bay has emerged as a biologically important area for these threatened marine mammals and their calves.
- Southern right whales are listed as endangered under the EPBC mainly thanks to the impacts of commercial whaling.
- The whales that call Smith Bay home for large periods of the year are at grave risk from the inevitable debilitating noise, dredging and vessel disturbance, vessel strike, pollution, leachate and consequent toxicity the development of the Seaport will bring to the bay.
- Proposed dredging activities to gouge 100,000 cubic metres from the floor of Smith Bay, ongoing port operations and an inevitable future dredging program. This will have a significant impact on the marine environment by disturbing and smothering benthic biota and habitats, degrading water quality through elevated turbidity, bioavailability of pollutants and reducing dissolved oxygen in the water column.
- The proponent's means to address this assault are inadequate at best and are

presented in a careless manner.
- Smith Bay is host to a number of threatened and endangered species that will be impacted by this proposal, including white bellied sea eagles, southern brown bandicoots and echidnas.
- The construction of the proponent's Seaport and on-land infrastructure will force those that survive the construction phase, away from Smith Bay – to where?
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- Although South Australia's koalas are not listed in the EPBC, the proponent must reveal how it intends to simultaneously manage the local koala population while destroying its habitat.
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Native Vegetation and Fauna

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- AusOcean's revelations included the discovery of an ancient two-metre-tall coral head and more than 10 new species of fish.
- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Michael Wooldridge

From:	Maureen Campbell
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 11:31:54 AM

Dear Minister,

RE: **Biosecurity concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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vessel hulls or in internal seawater systems, grows quickly and smothers seabed life affecting the productivity of commercial fisheries and aquaculture. This is not to mention last year's outbreak of Pacific Oyster Mortality Syndrome (POMS) in the Port River. Smith Bay should not be exposed to these risks, nor should the operation of the successful, sustainable businesses it hosts and supports be threatened in such a way.
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The proponent is poorly-qualified to submit this proposal, and I trust it is not too late for that to be considered.

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Maureen Campbell

From: Liam Lynch
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Monday, 27 May 2019 11:26:59 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

- Smith Bay is fortunate to be regularly visited by southern right whales. Over recent years the shallow bay has emerged as a biologically important area for these threatened marine mammals and their calves.
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- The whales that call Smith Bay home for large periods of the year are at grave risk from the inevitable debilitating noise, dredging and vessel disturbance, vessel strike, pollution, leachate and consequent toxicity the development of the Seaport will bring to the bay.
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Native Vegetation and Fauna

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- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Liam Lynch

From: Tony Austin
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Monday, 27 May 2019 11:18:34 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

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Native Vegetation and Fauna

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Tony Austin

From:	Julie Szappanos
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 10:45:05 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I believe that the marine/terrestrial wildlife is already endangered enough. My first visit to the island was 2005, I decided to make it my home because of the pristine and wilderness. I've been traveling here and there, and I have to say there is nowhere like it. I know a lot of people feels the same way as me.

It makes me sad that the environment often come last.

I hope Smith Bay will be saved.

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

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Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

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pollution, leachate and consequent toxicity the development of the Seaport will bring to the bay.

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Native Vegetation and Fauna

- The proponent admits its industrial facility at Smith Bay will result in a significant loss of seagrass in Smith Bay.
- It estimates - and on past record, we are certain underestimates – it will destroy 100,000 square metres (10 hectares!) of seagrass in the bay.
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- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Julie Szappanos

From:	Garry Boreham
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 10:36:43 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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With regard to the EIS, my major concerns relate to the potential destruction of Smith Bay's native flora and fauna protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC).

Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

- Smith Bay is fortunate to be regularly visited by southern right whales. Over recent years the shallow bay has emerged as a biologically important area for these threatened marine mammals and their calves.
- Southern right whales are listed as endangered under the EPBC mainly thanks to the impacts of commercial whaling.
- The whales that call Smith Bay home for large periods of the year are at grave risk from the inevitable debilitating noise, dredging and vessel disturbance, vessel strike, pollution, leachate and consequent toxicity the development of the Seaport will bring to the bay.
- Proposed dredging activities to gouge 100,000 cubic metres from the floor of Smith Bay, ongoing port operations and an inevitable future dredging program. This will have a significant impact on the marine environment by disturbing and smothering benthic biota and habitats, degrading water quality through elevated turbidity, bioavailability of pollutants and reducing dissolved oxygen in the water column.
- The proponent's means to address this assault are inadequate at best and are

presented in a careless manner.
- Smith Bay is host to a number of threatened and endangered species that will be impacted by this proposal, including white bellied sea eagles, southern brown bandicoots and echidnas.
- The construction of the proponent's Seaport and on-land infrastructure will force those that survive the construction phase, away from Smith Bay – to where?
- The operation of the Seaport - including B-double truck movements around the clock - will inevitably contribute to unacceptable mortality rates.
- Although South Australia's koalas are not listed in the EPBC, the proponent must reveal how it intends to simultaneously manage the local koala population while destroying its habitat.
- On my reading, the proponent's EIS fails to adequately address any of these risks in sufficient detail, or provide credible mitigation.

Native Vegetation and Fauna

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

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Garry Boreham

From: Prue Gordon
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Monday, 27 May 2019 10:36:38 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

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Yours faithfully

Prue Gordon

From:	Mischa Peters
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 10:36:29 AM

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

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Yours faithfully

Mischa Peters

From:	John Power
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 10:30:36 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

John Power

From:	john anderson
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 10:22:47 AM

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Yours faithfully

john anderson

From:	Cynthia O"Neil
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 10:18:09 AM

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- AusOcean's revelations included the discovery of an ancient two-metre-tall coral head and more than 10 new species of fish.
- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Cynthia O'Neil

From: Darren Harris
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Monday, 27 May 2019 10:13:31 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

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With regard to the EIS, my major concerns relate to the potential destruction of Smith Bay's native flora and fauna protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC).

Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

- Smith Bay is fortunate to be regularly visited by southern right whales. Over recent years the shallow bay has emerged as a biologically important area for these threatened marine mammals and their calves.
- Southern right whales are listed as endangered under the EPBC mainly thanks to the impacts of commercial whaling.
- The whales that call Smith Bay home for large periods of the year are at grave risk from the inevitable debilitating noise, dredging and vessel disturbance, vessel strike, pollution, leachate and consequent toxicity the development of the Seaport will bring to the bay.
- Proposed dredging activities to gouge 100,000 cubic metres from the floor of Smith Bay, ongoing port operations and an inevitable future dredging program. This will have a significant impact on the marine environment by disturbing and smothering benthic biota and habitats, degrading water quality through elevated turbidity, bioavailability of pollutants and reducing dissolved oxygen in the water column.
- The proponent's means to address this assault are inadequate at best and are

presented in a careless manner.
- Smith Bay is host to a number of threatened and endangered species that will be impacted by this proposal, including white bellied sea eagles, southern brown bandicoots and echidnas.
- The construction of the proponent's Seaport and on-land infrastructure will force those that survive the construction phase, away from Smith Bay – to where?
- The operation of the Seaport - including B-double truck movements around the clock - will inevitably contribute to unacceptable mortality rates.
- Although South Australia's koalas are not listed in the EPBC, the proponent must reveal how it intends to simultaneously manage the local koala population while destroying its habitat.
- On my reading, the proponent's EIS fails to adequately address any of these risks in sufficient detail, or provide credible mitigation.

Native Vegetation and Fauna

- The proponent admits its industrial facility at Smith Bay will result in a significant loss of seagrass in Smith Bay.
- It estimates - and on past record, we are certain underestimates – it will destroy 100,000 square metres (10 hectares!) of seagrass in the bay.
- Noise and light emissions from dredging will disrupt larger sea mammals such as southern right whales and dolphins, while future dredging, plus propeller wash and contamination from commercial shipping vessels, will prohibit regrowth.
- As referenced on page 44 of the proponent's EIS, the company insists its industrial operations will only result in the deaths of between six to 12 of endangered echidnas. Surely, any deliberate mortality of the endangered echidna should be considered unacceptable.
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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Darren Harris

From:	Benjamin Plush
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 10:05:45 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Benjamin Plush

From:	Toby Oakley
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 10:05:25 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Toby Oakley

From:	Hugh Atchison
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 10:05:14 AM

Dear Minister,

RE: **Biosecurity concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

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A proposal like this elsewhere on Kangaroo Island will deliver the same jobs and economic benefit as those it speculates for Smith Bay but without wholesale destruction of the marine and terrestrial environment, public infrastructure, social amenity and long-term sustainable businesses.

With regard to the EIS, my major concerns relate to biosecurity hazards the proponent agrees are inevitable as the result of its actions in Smith Bay, and the risks to Kangaroo Island's unique flora and fauna.

Biosecurity

- Historically on Kangaroo Island, exotic marine pests have only been found where there is major shipping infrastructure. This includes Kingscote Jetty, Kingscote Wharf, the Bay of Shoals anchorage, Christmas Cove and American River anchorage. These discoveries have been directly linked to vessel traffic from infected mainland ports.
- During a coast and marine survey conducted by Natural Resources Kangaroo Island in 2018, the Biosecurity Advisory Committee found Smith Bay to be exotic marine pest free, which is also testament to the tight biosecurity management regime of the onshore abalone farm that has operated in Smith Bay for more than 20 years.
- The KI Seaport proponent acknowledges it will create a major biosecurity risk and some form of surveillance will be needed. Kangaroo Island Plantation Timbers has committed to help fund such a program assuming, as it does with its entire proposal, that ratepayers and taxpayers will leap to cover the community costs its refuses to meet. While surveillance is necessary it does not remove the threat. Once Smith Bay has been contaminated with exotic marine pests, they are there forever.
- Since 1983, the waters around Adelaide have been contaminated with Asian date or bag mussels. This exotic pest which can be introduced via ship ballast water, on

vessel hulls or in internal seawater systems, grows quickly and smothers seabed life affecting the productivity of commercial fisheries and aquaculture. This is not to mention last year's outbreak of Pacific Oyster Mortality Syndrome (POMS) in the Port River. Smith Bay should not be exposed to these risks, nor should the operation of the successful, sustainable businesses it hosts and supports be threatened in such a way.
- Based on the Australian Government's interactive map of marine pests in Australia, most major shipping ports in Australia have seen the introduction of exotic marine pests.
- It remains a mystery how Smith Bay can be protected from this inevitability by the actions of a proponent with no experience of marine environment management or infrastructure build of any sort, a cavalier attitude to biosecurity, and a belief that the rest of us – not it – will willingly wear the cost of its actions.

Coast and Marine

- The KI Seaport proposal presents a massive assault on the marine and coastal environment of an isolated and relatively unspoilt part of Kangaroo Island's coastline.
- The Federal Government has already expressed concerns regarding the proposal and has delegated its authority under the Environment Protection and Biodiversity Conservation Act 1999 to the South Australian Government.
- We would expect the South Australian Government and its agencies to fully comply with these requirements, and to act in the interest of science and community expectations.
- In testimony to the Natural Resources Committee in the South Australian House of Assembly on 19 May 2017, Kangaroo Island Plantation Timbers Director Shauna Black described the existing former industrial wharf at Ballast Head, which the company owns as "…almost the opposite of Smith Bay in two crucial areas: it has steep land and shallow sea."
- The full Hansard account of Ms Black's patchy account is here.
- It is ignorant at best for her, a resident of Kangaroo Island and chief spruiker for Kangaroo Island Plantation Timbers' outlandish plans, to claim Smith Bay is deep and Ballast Head is shallow.
- If Ms Black genuinely believes this, she has realistically never been to either site, let alone reviewed the available data.
- The proposal for a claimed deep-water Seaport for super-Panamax ships requires a depth of at least 15 metres to operate. Smith Bay is shallow, only reaching 10 metres depth some 350 metres from the shore.
- The volume of soil blasted and scraped from the seabed by the proponent's dredges is equivalent to filling 40 Olympic-size swimming pools, resulting in:
    - the loss of **at least** 100,000 square metres of seagrass – admitted by the proponent, which claims it can "offset" by simply planting some seagrass in another place (if only it were so simple)
    - sediment uplift into the water column
    - marine life mortality due to choking hazards, suffocation and red tide potential from disruption of toxic organisms in the sediment

The proponent is poorly-qualified to submit this proposal, and I trust it is not too late for that to be considered.

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Hugh Atchison

From:	Lachlan Murrell
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 10:05:05 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Lachlan Murrell

From: Adam Sandow
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Monday, 27 May 2019 10:04:09 AM

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RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Adam Sandow

From:	Ulla Greenwood
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 9:36:58 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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With regard to the EIS, my major concerns relate to the potential destruction of Smith Bay's native flora and fauna protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC).

Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

- Smith Bay is fortunate to be regularly visited by southern right whales. Over recent years the shallow bay has emerged as a biologically important area for these threatened marine mammals and their calves.
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- The proponent's means to address this assault are inadequate at best and are

presented in a careless manner.

- Smith Bay is host to a number of threatened and endangered species that will be impacted by this proposal, including white bellied sea eagles, southern brown bandicoots and echidnas.
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- The operation of the Seaport - including B-double truck movements around the clock - will inevitably contribute to unacceptable mortality rates.
- Although South Australia's koalas are not listed in the EPBC, the proponent must reveal how it intends to simultaneously manage the local koala population while destroying its habitat.
- On my reading, the proponent's EIS fails to adequately address any of these risks in sufficient detail, or provide credible mitigation.

Native Vegetation and Fauna

- The proponent admits its industrial facility at Smith Bay will result in a significant loss of seagrass in Smith Bay.
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- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Ulla Greenwood

From:	Eddie Morrison
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 9:09:10 AM

Dear Minister,

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I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

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Eddie Morrison

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From:	Bridget Ellery
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 8:39:00 AM

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From: Peter Frost Peter Frost
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay
Date: Monday, 27 May 2019 8:22:26 AM

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Peter Frost Peter Frost

From:	Lynette Stone
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 7:18:56 AM

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Lynette Stone

From:	Sharni Loweke
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Monday, 27 May 2019 6:41:01 AM

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Sharni Loweke

From:	Chantelle Dean
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay CD
Date:	Tuesday, 28 May 2019 12:28:31 PM

Dear Minister,

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- The whales that call Smith Bay home for large periods of the year are at grave risk from the inevitable debilitating noise, dredging and vessel disturbance, vessel strike, pollution, leachate and consequent toxicity the development of the Seaport will bring to the bay.
- Proposed dredging activities to gouge 100,000 cubic metres from the floor of Smith Bay, ongoing port operations and an inevitable future dredging program. This will have a significant impact on the marine environment by disturbing and smothering benthic biota and habitats, degrading water quality through elevated turbidity, bioavailability of pollutants and reducing dissolved oxygen in the water column.
- The proponent's means to address this assault are inadequate at best and are

presented in a careless manner.

- Smith Bay is host to a number of threatened and endangered species that will be impacted by this proposal, including white bellied sea eagles, southern brown bandicoots and echidnas.
- The construction of the proponent's Seaport and on-land infrastructure will force those that survive the construction phase, away from Smith Bay – to where?
- The operation of the Seaport - including B-double truck movements around the clock - will inevitably contribute to unacceptable mortality rates.
- Although South Australia's koalas are not listed in the EPBC, the proponent must reveal how it intends to simultaneously manage the local koala population while destroying its habitat.
- On my reading, the proponent's EIS fails to adequately address any of these risks in sufficient detail, or provide credible mitigation.

Native Vegetation and Fauna

- The proponent admits its industrial facility at Smith Bay will result in a significant loss of seagrass in Smith Bay.
- It estimates - and on past record, we are certain underestimates – it will destroy 100,000 square metres (10 hectares!) of seagrass in the bay.
- Noise and light emissions from dredging will disrupt larger sea mammals such as southern right whales and dolphins, while future dredging, plus propeller wash and contamination from commercial shipping vessels, will prohibit regrowth.
- As referenced on page 44 of the proponent's EIS, the company insists its industrial operations will only result in the deaths of between six to 12 of endangered echidnas. Surely, any deliberate mortality of the endangered echidna should be considered unacceptable.
- To "offset" its dead echidnas, Kangaroo Island Plantation Timbers says it will assist with a feral cat eradication program which it claims is "the main factor threatening the echidna population".
- The Kangaroo Island echidna was recently listed as endangered under the EPBC, and therefore any added mortality risk to this endangered species should not be overlooked – regardless of the claimed "offset".
- Outside this EIS, in December 2018, AusOcean - a not-for-profit Australian Ocean Lab - conducted the first detailed underwater marine survey of Smith Bay.
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- AusOcean's revelations included the discovery of an ancient two-metre-tall coral head and more than 10 new species of fish.
- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Chantelle Dean

From: Jack Strempel
To: DPTI:State Commission Assessment Panel
Subject: Concerns about KPT"s Seaport development at Smith Bay JS
Date: Tuesday, 28 May 2019 12:26:01 PM

Dear Minister,

RE: **Biosecurity concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

After a very long wait, I have now had brief opportunity to review the Environmental Impact Statement (EIS) prepared by the proponent.

Following that, I strongly believe this development should not proceed at Smith Bay.

More specific responses to EIS guidelines appear below, but the unresolved question remains:

- Why was this company privileged with Major Development Status for a deliberately destructive proposal for Smith Bay, when it's abundantly clear there are multiple, more suitable site options available on Kangaroo Island – including a former industrial wharf the company already owns?

A proposal like this elsewhere on Kangaroo Island will deliver the same jobs and economic benefit as those it speculates for Smith Bay but without wholesale destruction of the marine and terrestrial environment, public infrastructure, social amenity and long-term sustainable businesses.

With regard to the EIS, my major concerns relate to biosecurity hazards the proponent agrees are inevitable as the result of its actions in Smith Bay, and the risks to Kangaroo Island's unique flora and fauna.

Biosecurity

- Historically on Kangaroo Island, exotic marine pests have only been found where there is major shipping infrastructure. This includes Kingscote Jetty, Kingscote Wharf, the Bay of Shoals anchorage, Christmas Cove and American River anchorage. These discoveries have been directly linked to vessel traffic from infected mainland ports.
- During a coast and marine survey conducted by Natural Resources Kangaroo Island in 2018, the Biosecurity Advisory Committee found Smith Bay to be exotic marine pest free, which is also testament to the tight biosecurity management regime of the onshore abalone farm that has operated in Smith Bay for more than 20 years.
- The KI Seaport proponent acknowledges it will create a major biosecurity risk and some form of surveillance will be needed. Kangaroo Island Plantation Timbers has committed to help fund such a program assuming, as it does with its entire proposal, that ratepayers and taxpayers will leap to cover the community costs its refuses to meet. While surveillance is necessary it does not remove the threat. Once Smith Bay has been contaminated with exotic marine pests, they are there forever.
- Since 1983, the waters around Adelaide have been contaminated with Asian date or bag mussels. This exotic pest which can be introduced via ship ballast water, on

vessel hulls or in internal seawater systems, grows quickly and smothers seabed life affecting the productivity of commercial fisheries and aquaculture. This is not to mention last year's outbreak of Pacific Oyster Mortality Syndrome (POMS) in the Port River. Smith Bay should not be exposed to these risks, nor should the operation of the successful, sustainable businesses it hosts and supports be threatened in such a way.
- Based on the Australian Government's interactive map of marine pests in Australia, most major shipping ports in Australia have seen the introduction of exotic marine pests.
- It remains a mystery how Smith Bay can be protected from this inevitability by the actions of a proponent with no experience of marine environment management or infrastructure build of any sort, a cavalier attitude to biosecurity, and a belief that the rest of us – not it – will willingly wear the cost of its actions.

Coast and Marine

- The KI Seaport proposal presents a massive assault on the marine and coastal environment of an isolated and relatively unspoilt part of Kangaroo Island's coastline.
- The Federal Government has already expressed concerns regarding the proposal and has delegated its authority under the Environment Protection and Biodiversity Conservation Act 1999 to the South Australian Government.
- We would expect the South Australian Government and its agencies to fully comply with these requirements, and to act in the interest of science and community expectations.
- In testimony to the Natural Resources Committee in the South Australian House of Assembly on 19 May 2017, Kangaroo Island Plantation Timbers Director Shauna Black described the existing former industrial wharf at Ballast Head, which the company owns as "…almost the opposite of Smith Bay in two crucial areas: it has steep land and shallow sea."
- The full Hansard account of Ms Black's patchy account is here.
- It is ignorant at best for her, a resident of Kangaroo Island and chief spruiker for Kangaroo Island Plantation Timbers' outlandish plans, to claim Smith Bay is deep and Ballast Head is shallow.
- If Ms Black genuinely believes this, she has realistically never been to either site, let alone reviewed the available data.
- The proposal for a claimed deep-water Seaport for super-Panamax ships requires a depth of at least 15 metres to operate. Smith Bay is shallow, only reaching 10 metres depth some 350 metres from the shore.
- The volume of soil blasted and scraped from the seabed by the proponent's dredges is equivalent to filling 40 Olympic-size swimming pools, resulting in:
    - the loss of **at least** 100,000 square metres of seagrass – admitted by the proponent, which claims it can "offset" by simply planting some seagrass in another place (if only it were so simple)
    - sediment uplift into the water column
    - marine life mortality due to choking hazards, suffocation and red tide potential from disruption of toxic organisms in the sediment

The proponent is poorly-qualified to submit this proposal, and I trust it is not too late for that to be considered.

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Jack Strempel

From:	Lauren Buchanan
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay LB
Date:	Tuesday, 28 May 2019 12:27:02 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

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A proposal like this elsewhere on Kangaroo Island will deliver the same jobs and economic benefit as those it speculates for Smith Bay but without wholesale destruction of the marine and terrestrial environment, public infrastructure, social amenity and long-term sustainable businesses.

With regard to the EIS, my major concerns relate to the potential destruction of Smith Bay's native flora and fauna protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC).

Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

- Smith Bay is fortunate to be regularly visited by southern right whales. Over recent years the shallow bay has emerged as a biologically important area for these threatened marine mammals and their calves.
- Southern right whales are listed as endangered under the EPBC mainly thanks to the impacts of commercial whaling.
- The whales that call Smith Bay home for large periods of the year are at grave risk from the inevitable debilitating noise, dredging and vessel disturbance, vessel strike, pollution, leachate and consequent toxicity the development of the Seaport will bring to the bay.
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- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Lauren Buchanan

From:	Emma Bridgman
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Tuesday, 28 May 2019 10:21:30 AM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

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- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Emma Bridgman

From:	Tony Willson
To:	DPTI:State Commission Assessment Panel
Subject:	Deep Water Port Facility, Smith Bay, Kangaroo Island
Date:	Monday, 27 May 2019 1:41:15 PM

Minister for Planning
c/- Robert Kleeman
Unit Manager Policy & Strategic Assessment
GPO Box 1815, Adelaide SA 5000

Dear Minister

Deep Water Port Facility, Smith Bay, Kangaroo Island

As a fifth generation Islander, I am keen to see this development be approved and for Kangaroo Island to grow and prosper. As with any development of this magnitude there will be positives and negatives however, I believe the positives outweigh the negatives.

Kangaroo Island, as with many rural communities, is desperate for employment growth which this project can deliver.

We operate a family earthmoving and construction company both on Kangaroo Island and the mainland established in 1987. Our workforce fluctuates between 10 and 18 employees. We are engaged in roadworks upgrades, agricultural, commercial, forestry and quarrying activities. One of the major problems on Kangaroo Island is the seasonal fluctuations in work which obviously effects full time employment opportunities. I believe K.I.P.T.'s proposal will alleviate this problem and gives certainty to local employees and businesses.

Road upgrades will be required which can only be seen as a positive, however there is concern re the extra vehicle traffic. We own four of approximately 30 local heavy vehicles operating on the island. There are negligible incidents between heavy vehicles and local drivers or tourists and with the upgrades in heavy vehicle braking systems in recent years (e.g. P.B.S.) I believe heavy vehicles can coexist safely with other road users.

Forestry companies operating on Kangaroo Island have in the past for the most part been either underfunded or financially unstable. K.I.P.T. have a clear vision and have invested significant resources in managing the plantations and seeking development of a Port Facility. There is tens of millions of dollars of timber resource which to some degree could be considered renewable because three rotations can be achieved before replanting is required. Some would like to see the trees bulldozed, burnt and the country returned to pasture for sheep or cattle production. Whilst this is achievable it is a)expensive b) time consuming c) will not create significant increases in employment d) will also have significant impact on roads e) be a waste of timber from plantations.

I firmly believe this decision must be based on fact not emotion. Smith Bay does have an industrial aquaculture facility, which according to the E.I.S. can coexist with a Port Facility.

I urge you to approve the K.I.P.T. export facility so Kangaroo Island can continue to prosper and grow.

Yours sincerely

Tony Willson
A & G Willson Earthmovers P/L
PO Box 291 Lonsdale SA 5160
Ph 08 83845577
Email tonyw@earthmoving.net.au

From: Debbie Clarke
To: DPTI:State Commission Assessment Panel
Subject: Deep Water Port Facility Smith Bay Kangaroo Island EIS submission.
Date: Monday, 27 May 2019 3:57:04 PM

Deb Foster,
[redacted]

I think the proposed development Deep Water Port Facility, Smith Bay, will be very important to the economy of the island, very necessary and of huge benefit to the islands economic sustainable development.

The EIS has been very thorough and I understand there will always be many risks particularly with a major development of this type that covers some many different environments. I also the understand the EIS outcomes, risks and concerns must be responded to by the KIPT and I have faith that sound mitigation strategies will be put into place as KIPT are aware that their activities will be closely monitored by the community in particular.

I am mostly concerned about the road safety risk and would expect to see a lot of work will be done to improve the roads and prevent potential accidents – in particular on tourist routes – hopefully keeping tourists from taking these routes where ever possible – Dedicated trucking routes would be ideal.

I can understand that people who live, work and have other interests in Smith Bay are not happy about this development. But I agree that Smith Bay is the best site for the port. I am bemused with the council rejecting Smith Bay but suggesting Cape Dutton for the port site which goes against all the science and studies covered in the EIS.

From: Phyll Bartram
To: DPTI:State Commission Assessment Panel
Subject: Kangaroo Island / Victor Harbor Dolphin Watch KIPT EIS Response
Date: Monday, 27 May 2019 10:23:55 PM
Attachments: image002.jpg
0 COVER NOTE KIVH Dolphin Watch KIPT EIS Response May 27th 2019.docx
1 PREAMBLE & CONTEXT Dolphin Watch KIPT EIS Response May 27th 2019.docx
2 TOXICITY KIVH Dolphin Watch KIPT EIS Response May 27th 2019.docx
3 WHALES & DOLPHINS KIVH Dolphin Watch KIPT EIS Response May 27th 2019.docx
4 NOISE & STRESS KIVH Dolphin Watch KIPT EIS Response May 27th 2019.docx
5 VESSEL IMPACTS KIVH Dolphin Watch KIPT EIS Response May 27th 2019.docx
6 CUMULATIVE IMPACTS KIVH Dolphin Watch KIPT EIS Response May 27th 2019.docx
7 ALTERNATIVE ECONOMICS KIVH Dolphin Watch KIPT EIS Response May 27th 2019.docx
8 APPENDICES May 27th 2019.docx
Appendix 1 Cetacean Sightings MASTER Summary Smith Bay KI May 25th 2019.docx
Appendix 2 Whales of Smith Bay KI - David Connell Jan 8th 2019 C.docx
Appendix 3 KIPT Dolphin Watch EPBC Response Nov 22nd 2016.docx
Appendix 4 New Evidence for Bottlenose Connectivity Paper.pdf

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Mr Robert Kleeman,
DPTI
Adelaide, SA, 5000

Dear Mr Kleeman,

Please find attached our submission in response to Kangaroo Island Plantation Timbers EIS for the Smith Bay Wharf proposal.

Thank you for your consideration in this matter.

Kind regards,

Tony Bartram

Kangaroo Island / Victor Harbor Dolphin Watch Coordinator
PO Box 30 American River, Kangaroo Island, South Australia 5221
bartram@kin.on.net 08 85537190 0429870006

Eyes Collage Phyll Bartram

Kangaroo Island / Victor Harbor Dolphin Watch

in partnership with

Whale and Dolphin Conservation

www.kangarooislanddolphinwatch.com.au www.islandmind.com
www.twitter.com/KIDolphinWatch www.instagram/kivhdolphinwatch
www.facebook/kangarooislandvictorharbordolphinwatch

PO Box 30 American River, Kangaroo Island, SA 5221

bartram@kin.on.net 08 85537190 0429870006

May 27th 2018

Kangaroo Island Plantation Timbers Environmental Impact Statement Response

Kangaroo Island / Victor Harbor Dolphin Watch

Dolphin Watch is an award winning, data rich, citizen led, volunteer project in partnership with Whale and Dolphin Conservation, monitoring dolphin populations in South Australia, on Kangaroo Island since 2005 and Victor Harbor since 2011. Developing understandings of custodianship of these fascinating creatures and their habitats, dolphins are monitored unobtrusively, minimising impacts and behavioural change, collecting vital baseline data to globally inform practise.

Scientists and dedicated volunteers of all ages collaborate on effective "Citizen Science" in surveys on Eco Tourism vessels: Kangaroo Island Marine Adventures and The Big Duck Boat Tours, Victor Harbor, plus land-based monitoring, contributing a staggering number of hours over nearly 14 years. Images and video footage are collected, identifying individual dolphins by distinctive dorsal fins and body markings. Vital data is recorded on movements and habitats, creating a sustainable, longitudinal study of extraordinary international significance.

Dolphin Watch Charter:

- reengaging volunteers of all ages in education

- contributing to knowledge and understandings about Cetaceans in our environment
- developing a baseline position with respect to population groups and habitat
- protecting dolphins, whales and their habitat
- assisting other schools / communities to develop Cetacean protection and study programmes
- providing personal growth and leadership opportunities for youth

Our considerable issues and major concerns with the Smith Bay port proposal leading to this response to the EIS, are many, varied and wide ranging.

This longitudinal Citizen Science project works in collaboration with Whale and Dolphin Conservation - the world's leading charity dedicated to matters of Cetacean welfare.

Therefore we have summarised our myriad concerns into:

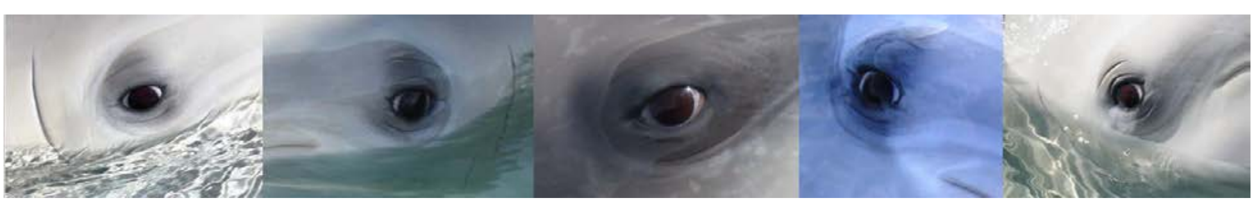
7 major areas focussing on this critical habitat for Cetaceans and the marine biodiversity of the pristine, North Coast of Kangaroo Island.

1. Preamble and Context
2. Toxicity
3. Whales and Dolphins
4. Noise and Stress
5. Vessel Impacts
6. Cumulative Impacts
7. Alternative Economics
8. Appendices

Thankyou very much for your consideration.

Tony Bartram

Kangaroo Island / Victor Harbor Dolphin Watch Coordinator



Kangaroo Island / Victor Harbor Dolphin Watch

in partnership with

Whale and Dolphin Conservation

www.kangarooislanddolphinwatch.com.au www.islandmind.com
www.twitter.com/KIDolphinWatch www.instagram/kivhdolphinwatch
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PO Box 30 American River, Kangaroo Island, SA 5221

bartram@kin.on.net 08 85537190 0429870006

May 27th 2018

Kangaroo Island Plantation Timbers Environmental Impact Statement Response

PREAMBLE and CONTEXT

Introduction

As a preamble we would like to draw your attention to the following comments which we believe are relevant in this instance.

- **Reference - Article / Paper / Fact Sheet 1:**

"Conserving Australia's Marine Environment Key Directions" IUCN 2013

"Key Directions Statements from the IUCN Australia's Conserving Australia's Marine Environment Symposium"

1. **Avoid a short term approach to multiple threats**:
   All governments need to address these threats over the long term in a systematic and integrated manner and avoid short-term, politically driven decision making.
2. **Address cumulative impacts:**
   Appropriately scaled strategic frameworks that contain consistent environmental standards and provide a robust basis for both planning and approvals processes can be a key mechanism to avoid cumulative impacts.
3. **Exclude critically sensitive areas from extraction:**
   Places in our marine environment of high ecological and cultural values should be permanently off limits to damaging activities and protected under a range of mechanisms.

4. **Improve knowledge and ensure transparency of resource extraction industries:** Policy and legislation should ensure any industry operating in Australian waters meets the highest standards to avoid or reduce environmental impacts from their operations and such industries should contribute directly to marine conservation efforts."

The cetaceans which inhabit and migrate through the Smith's Bay Area of the North Coast of Kangaroo Island are entitled to much greater consideration than that currently afforded them by the Kangaroo Island Plantation Timber's Referral detailed above.

Given many of the species are accorded **protected status under the EPBC Act of 1999**, much greater attention to their welfare should be evident in this document.

We are aware through our association with the SA Museum and our familiarity with their data, together with data collected regarding observations by eco-tourism operator, and our associate and operational partner Kangaroo Island Marine Adventures, that there is **very high likelihood of interactions with whales and dolphins in this precinct**.

Extensive data collection and analysis of nearly 14 years of Citizen Science monitoring dolphin populations and movements through this area, clearly illustrates the vital importance of maintaining the migratory pathway between North Cape and Dashwood Bay - both critical sites, which lay either side of Smith's Bay.

Kangaroo Island / Victor Harbor Dolphin Watch Data Summary:

1. **Surveys commenced in Nov. 2005** with the 1st Dashwood Bay survey in May 2007
2. **49 Surveys** have been conducted at Dashwood Bay to date – each survey covers adjacent Smith Bay
3. **97.96% Bottlenose Dolphin sightings in Dashwood Bay** and regularly on the edge or in Smith Bay. ie 1 survey with no sightings in 2009
4. **Bottlenose Sightings Numbers on surveys:**
    - 1 survey: 0 sightings
    - 14 surveys: >25 dolphins
    - 23 surveys: 26 > 50
    - 11 surveys: 51 >
5. **Numbers are increasing** with 6 surveys recordings 70 > 100+ dolphins!
6. **High numbers of calf / juvenile sightings** in this monitoring area - new calves are regularly sighted and females often observed interacting with and teaching the calves and juveniles.
7. **High levels of residency and significant transience along the North Coast** between North Cape and Dashwood Bay. Both areas are resting / feeding / mating / socialising / nursery sites for Bottlenose dolphins, plus a large number of visiting or transient Bottlenose dolphins on occasions, which is steadily increasing.
   This data conclusively indicates a very important **"migratory corridor."**
8. **Transience analysis** in Oct. 2015 indicated high levels of transience:
    - 27.7% of Dashwood Bay dolphins had been sighted in both sites
    - 54.1% of North Cape dolphins had been sighted in both sites

9. Ongoing data collation and analysis currently being undertaken in 2019 is indicating much higher levels of transience ie regular movements along the North Coast past Smith Bay.
10. Occasional **Shortbeaked Common dolphins** are sighted along the North Coast.

The relevance of our position with respect to this referral is outlined below.

Right from the first promulgation of its plans to the ASX and potential investors, **Kangaroo Island Plantation Timbers has shown scant regard for environmental concerns, and in particular Matters of National Environmental Significance.**

Managing Director John Sergeant, stated there would be **no need to refer under the EPBC Act** which was misleading and very obviously wrong. Later, following a full referral, as required, KIPT considered their proposal to **not constitute a controlled action**.

The Minister and the Department disagreed deeming the proposal a controlled action. This disdain for **environmental protection law** has characterised KIPT's attitude to date and their "minimalist" approach to necessary mitigation of threats and risks, as is clearly demonstrated in their EIS.

This is most clearly evident in relation to the highly endangered eastern population of the **Southern Right whales** *Eubalaena australis* which has its own Conservation Management Plan and the migratory species of **Common Bottlenose dolphins** *Tursiops sp.* and **Short Beaked common dolphins** *Delphinus delphis* which frequent Smith Bay as part of their important migratory pathways and critical habitat.

Failure to adequately mitigate the possible impacts upon these, and indeed upon other marine fauna, including protected species, in Smith Bay, will in effect lead to disastrous consequences and a high likelihood of loss of biodiversity and species loss as this submission will detail.

No arrogant, patronising diminishment of the threats presented is acceptable given what is at stake.

The following **state document** makes salutary reading when considering a proposal of this nature:

- **Reference - Article / Paper / Fact Sheet 2:**

"South Australia's Environment trend and conditions report card 2018."

Booklet 36 Marine Animals

Coastal and marine: native fauna

“**Population trends and percentage threatened**

This report is a work in progress. As resource monitoring improves, so too will our ability to describe trends in condition.

Trend: The statewide trend in populations of coastal and marine native fauna is getting worse.

This report card is based on expert assessments of the abundance and distribution for 174 taxa, across six groups, that are considered to be coastal and marine native fauna. Marine fishes are not included in this assessment. Notable taxa include southern right whale, bottlenose dolphin, little penguin and Australian sea lion. Population trends are stable in five natural resources management regions (Alinytjara Wilur̲ara [AW], Eyre Peninsula [EP], Kangaroo Island [KI], South Australian Arid Lands [SAAL] and South East [SE]) and getting worse in three regions (Adelaide and Mt Lofty Ranges [AMLR], Northern and Yorke [NY] and South Australian Murray–Darling Basin [SAMDB]) (top figure). The fair reliability score for this assessment is due to the data being relatively aged, limited in scope and availability, and largely based on expert opinion.

Condition: The percentage of coastal and marine native fauna considered to be threatened statewide is fair when compared with a worldwide benchmark. Species with a conservation rating of regionally extinct, critically endangered, endangered or vulnerable are considered threatened. An estimated 23% of coastal and marine native fauna is threatened in South Australia. At the regional level, estimates are 33% in AMLR (fair), 14% in AW (fair), 18% in EP (fair), 25% in KI (fair), 21% in NY (fair), 7% in SAAL (fair), 21% in SAMDB (fair) and 17% in SE (fair) (bottom figure). Populations of coastal and marine native fauna are getting worse in parts of the state with the highest population and development.

Why are coastal and marine native fauna important? South Australia's coastal and marine native fauna, including southern right whale and Australian sea lion, are iconic. Their conservation is central to the maintenance of natural heritage. Collectively, coastal and marine native fauna help people connect with nature, providing mental and physical health benefits, as well as attracting people to visit South Australia.

What are the pressures? Pressures on coastal and marine native fauna include inappropriate development, pollution, invasive species, habitat loss and fragmentation, fishing, interaction with commercial fisheries and climate change.

What is being done? State and national legislation protects coastal and marine native fauna and their habitats from inappropriate development, damage and clearing. Implementation of the Adelaide Water Quality Improvement Plan is improving habitat for coastal and marine native fauna by reducing nutrient and sediment inputs to Adelaide coastal waters. The commercial fishing industry works with government to minimise impacts on coastal and marine native fauna.”

Overview Statement

The EIS process was set up by the State Government to address criteria concerning Economic, Social and Environmental impacts upon Kangaroo Island and its residents. Much has been made of the economic benefits, although with inconsistencies and constantly changing figures which could be worthy of challenge.

At the same time the real impacts at both a social and environmental level have been understated. The EIS process has therefore just become a sham and effectively a marketing ploy which means it fails to address its own essential terms of reference and purpose.

This is particularly relevant in the environmental impacts where the proponents have sought to use the most convenient data sets to suit their purposes while failing to address the real issues which are patently obvious.

This minimization process has led to an extraordinary number of misleading statements such as B-Double trucks being referred to as *"small vans",* the large seaport proposed being referred to as a *"small piece of enabling infrastructure"* and the 100,000-200,000 tonnes of dredging being referred to as a *"small scraping to simply flatten the sea floor"*.

All these comments and more have been espoused in various forms of media; local, regional and mainstream radio, newspapers and television, and are therefore **on public record**. They denote a rather questionable strategy of minimization of harmful impacts while talking up economic benefits.

This approach was borne out early when Mr Sergeant as Managing Director of KIPT in his original address to the ASX claimed there would be ***no need for an EPBC referral.***

When the minister deemed it necessary it became a situation of claiming it would ***not be a controlled action***. Again the minister and Department of Environment and Energy begged to differ, deeming the proposal a controlled action.

The die was cast early accordingly and for us, an organisation committed to Cetacean welfare, we have been totally frustrated by KIPT's position with respect to such matters.

Having addressed these matters at the **Stakeholders' Reference Group Meeting in November 2017** we expected, somewhat naively perhaps, that proper attempts would be made to develop appropriate mitigation strategies. This has not occurred and attempts to avoid full responsibility for potential impacts have characterised the whole approach as presented in the EIS.

Our submission refutes much of the EIS statements regarding the Southern right whales in our waters, relying upon expert advice to confirm our position. We have on occasions included full papers as part of our submission to show the complexities involved and the scientific uncertainties which abound from this inappropriate proposal.

It is these uncertainties so inadequately addressed in the EIS which lead to

the conclusion that, as dictated by the EPBC Act 1999

the Precautionary Principle should apply.

Kangaroo Island / Victor Harbor Dolphin Watch

in partnership with

Whale and Dolphin Conservation

www.kangarooislanddolphinwatch.com.au www.islandmind.com
www.twitter.com/KIDolphinWatch www.instagram/kivhdolphinwatch
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May 27th 2019

Kangaroo Island Plantation Timbers Environmental Impact Statement Response

TOXICITY

This proposal will introduce high levels of toxicity to the marine environment in Smith Bay.

- It will **compromise the water quality** in the water column with consequent impacts.
- The **toxicity will be borne by a number of vectors**, especially airborne through dust and waterborne through leachate runoff.

Neither has been fully or adequately addressed in the EIS.

- **The affects of bioaccumulation** which is an enormous issue with respect to cetacean populations which frequent Smith Bay, is of particular concern to us.

The following articles and papers from around the world describe this potential situation clearly.

The following paper has been modified with tables and detailed scientific information removed to facilitate reading and emphasise the findings regarding leachate impacts.

This paper is especially thorough and although dealing with different timbers from those proposed for Smith Bay, it **sounds alarms about leachate escaping into aquatic environments**. The total paper is worthy of consideration - these are just pertinent excerpts.

- **Reference - Article / Paper / Fact Sheet 1:**

"Communication Investigating Potential Toxicity of Leachate from Wood Chip Piles Generated by Roadside Biomass Operations"

John Rex 9 February 2016

Abstract:

"Roadside processing of wood biomass leaves chip piles of varying size depending upon whether they were created for temporary storage, spillage, or equipment maintenance. Wood chips left in these piles can generate leachate that contaminates streams when processing sites are connected to waterways.

Leachate toxicity and chemistry were assessed for pure aspen (Populus tremuloides Michx.), lodgepole pine (Pinus contorta Dougl.), hybrid white spruce (Picea engelmannii ˆ glauca Parry), and black spruce (Picea mariana (Mill.) Britton) as well as from two wood chipping sites using mixes of lodgepole pine and hybrid or black spruce. Leachate was generated using rainfall simulation, a static 28-day laboratory assay, and a field-based exposure. Leachate generated by these exposures was analyzed for organic matter content, phenols, ammonia, pH, and toxicity. Findings indicate that all wood chip types produced a toxic leachate despite differences in their chemistry. The consistent toxicity response highlights the need for runoff management that will disconnect processing sites from aquatic environments.

Rainfall Simulation 1.

Introduction

Wood is the most prominently used renewable energy source on the planet owing to its broad availability and usage across a range of technologies including direct incineration and production of bio-oils

[1]. Commercial development of wood biomass as an energy source is increasing owing to public and policy concerns over the reliance on fossil fuels for energy in light of climate change [2]. In British Columbia, wood biomass as an energy source is supported by the desire to utilize a substantial feedstock of standing dead pine trees no longer suitable for saw-log production following a mountain pine beetle epidemic. Wood biomass energy technology, production capacity, and economic sustainability studies are prominent, but the influence of biomass operations on environmental sustainability requires more attention. This paper addresses the potential aquatic effects of wood biomass operations by investigating the chemistry and aquatic toxicology of leachate generated from biomass chip piles.

Wood leachate studies have primarily focused on log storage yards that produce large quantities of leachate due to the high volume of wood stored and the frequent watering of logs required to prevent them from cracking or succumbing to biological attack. A synthesis by Hedmark and Scholz notes that log-yard leachate is variable amongst tree species and that it generally increases with the amount of water the wood has contacted. Although some chemical differences existed among tree species, all leachate generated by log piles was found to have high organic matter levels and correspondingly high chemical oxygen demand (COD), both of which are known to decrease oxygen levels in receiving waters. Tao et al. noted that within species, there may be a difference based upon age; leachate generated from fresh piles of cedar waste (Thuja plicata Don ex D. Don), trimmings, off-specification wood chips, shredded bark and roots, and sawdust was light colored, acidic, with high oxygen demand and toxicity, while 1.5-year-old cedar piles produced darker leachate that was less acidic with lower oxygen demand and toxicity.

Leachate generation can occur when logs are stored prior to processing, a time period that may extend weeks to months after harvesting. During processing, wood chip piles can be created by spillage, regular cleaning of grinding equipment, and for storage when large chip piles are left on-site in response to market condition or processing capabilities. Although these piles vary in size, they will contribute leachate to local soils and runoff unless they are spread or removed.

Runoff is particularly important for aquatic environments because roadside processing can increase the probability of leachate reaching ditches and subsequently streams. Previous work has found that leachate can degrade receiving environment water quality and is toxic to aquatic life. Machrafi et al., also document terrestrial toxicity, noting that bark-covered areas in Quebec remained free of vegetation many years after harvesting due to toxic phenols in soil that took 20 years to degrade. The aquatic response to leachate may be due to COD, phenols, organic compounds, or resin acids such as isopimaric acid (IA) and dehydroabietic acid (DHAA). Ecotoxicology studies of pulp mill effluent have determined that IA is the most toxic of the group of acutely toxic resin acids but it is the rarest. DHAA, in contrast, is one of the least toxic but it is often identified in pulp & paper toxicology literature because it is the most soluble resin acid and can be reduced to retene, which is also toxic to aquatic organisms.

Leachates are also problematic in biomass combustion because of the inorganic constituents that they contain. In the presence of alkali, sulfur, carbonates and silica, turning wood and agroresidues into renewal biofuel comes with technical difficulties. Among others, combustion of leachates creates ash-related problems and produces emission of acid gas, contributing to reduced thermal conversion efficiency. As a result, different methods are currently in use to treat biomass leachates such as reverse osmosis, washing the raw fuels with water and using additives.

The work presented here complements and adds to the information provided by previous studies because it is operationally focused and assesses leachate generation across a variety of sub-boreal tree species used for biomass energy production. The objective of this work is to identify leachate characteristics across tree species commonly used in biomass operations and to identify the toxicity of leachate generated at field sites, in static solution, and in simulated short-duration rain events.

2. Experimental Section

The difference in wood chip size can influence leachate generation. The smaller wood chips have a larger surface area to volume ratio and may consequently produce leachate more readily and of higher concentration, particularly under short duration exposure during the rain event simulations. Hedmark and Scholz noted that leachate levels increased with the amount of water in contact with wood. Wood chipped for the laboratory studies was gathered from debris piles in two separate mountain pine beetle salvage blocks.Tree stems were removed from the pile and identified as lodgepole pine, hybrid spruce, or black spruce using bark and needles. Aspen was identified by bark alone.

Samples were collected after spring melt as well as late summer and fall rains over the 23-month period. During sample collection, the entire volume of leachate contained in each container was removed. Leachate was generated in the laboratory using de-ionized water in a static exposure and rainfall simulation experiment. The static exposure consisted of placing 2 kg of wood chips in a polypropylene 1-cm opening mesh bag in 18 L of water for 28 days at room temperature and ambient light. The quantity of chips and water selected follows the 9:1 ratio of water to wood recommended by Taylor et al. Static exposure tests were completed using duplicate samples of lodgepole pine, hybrid spruce, black spruce, and aspen separately chipped. Water samples were drawn weekly to provide information on short-term chemistry and toxicity signals. Duplicate samples of dry chips of lodgepole pine, hybrid spruce, black spruce, and aspen as well as the two operational sites were exposed to the rain event after which they were placed in water and then exposed to another rain event to simulate a saturated response to rainfall.

2.3. Chemical and Toxicity Analysis

Operational site leachate samples were collected in phosphate-free soap-washed 20-L plastic containers with lids. Sub-samples were collected from the 20-L containers in the laboratory using sterilized 120-mL amber glass (for phenol analysis) or acid-washed plastic (for all other analyses) bottles by dipping the bottle into the container after mixing the solution. Bottles were inserted in an inverted position until mid-depth where they were then turned right-side up to collect the sample. Static test leachate samples were collected in the same manner as operational samples because the wood chip samples were placed in 20-L buckets. Simulated rainfall samples were collected from a receiving bin below the wood chip sample that was exposed to rainfall. Once collected, all samples were stored at 4 ˝C until they were shipped with ice to commercial laboratories for analyses using standard techniques and detectable thresholds. Quality assurance and control protocols included the submission of blank samples, duplicates, and spiked samples. Microtox™ analysis used the luminescent bacterium Vibrio fischeri and processing followed standard techniques at dilutions of 0%, 10.2%, 20.4%, 40.9%, and 81.8%. For this study, Microtox™ tests were used to determine the effective concentration of leachate that reduced the bacterial population by 50% within 15 min. Toxicity was then inferred by the concentration required to cause population reduction, the lower the leachate sample concentration required, the higher its toxicity. Statistical analyses involved comparison of samples using the Kruskal-Wallis or Mann-Whitney test for non-parametric data in Systat 12™ while figures were constructed using SigmaPlot™.

3. Results and Discussion

3.1. Operational Samples

Operational samples showed some difference in chemistry between parameters and sites over the 548-day exposure period. The COD levels in leachate samples drawn from larger chips are significantly lower than those those drawn from the smaller chips.There is also a temporal decline with final COD levels that are approximately 25% those of the initial readings. Higher surface area to volume ratio of the smaller chips contributed to greater COD. Elevated COD levels are associated with increased toxicity as shown by previous work with aspen leachate, pulp mill effluent and municipal landfill leachates. True color also differed between sites, with the smaller chips producing more highly colored leachate than the larger chips. Although there were no significant difference in phenols between samples, there was an increase in phenols at both sites during the first spring sampling followed by a decreased over the remaining sampling period. The spring sample was collected after snowmelt when the majority of chips in the container were underwater and contributing leachate to the solution. Hedmark and Scholz identified that leachate increased with more exposure of wood to water while Taylor and Carmichael noted a positive correlation between the generation of aspen leachate and precipitation. The remaining parameters of ammonia and pH showed no difference between sites but generally followed similar trends of decreasing ammonia and increasing pH over time. The latter observation is similar to findings from Taylor et al. who noted pH levels in aspen leachate became less acidic with increased exposure time.

Organic compounds decreased over the exposure period but remained quite high (COD > 1000 mg¨ L ´1 , TOC > 500 mg¨ L ´1 and color > 500 TCU). Accordingly, remnant chip piles from spillage or equipment cleaning can be a long-term source of dissolved organics to receiving streams; high concentrations of organic compounds in streams may lower dissolved oxygen levels. High COD or COD in combination with other chemical concentrations is associated with aquatic toxicity. Due to the availability of only one toxicity sample during the final two sample dates, no statistical analysis was conducted; however, it can be seen that there is some variability between samples but not an obvious pattern. Although statistical comparison is not possible, it is noteworthy that all samples collected over the 580 days of exposure produced a toxic response within the 15-min test period

Accordingly, it is reasonable to suggest that residual chip piles can produce toxic leachate for close to two years following biomass operations, if not longer. Similarly, Taylor and Carmichael noted that an 18-m3 aspen log pile produced toxic leachate after two years and that only 10% of leachable material had been removed from the pile over the two-year exposure period. Although our piles consisted of chips not logs, and conifers not angioperms, and were considerably smaller at approximately 0.33 m3 our findings agree with others and indicate the potential for leachate generation where wood chip or log piles exist.

3.2 Static Samples

Coniferous leachate chemistry was relatively consistent over the 28-day exposure period with pine samples generally being lower than the two spruce samples for all parameters. Aspen leachate was significantly higher for all measured parameters except pH, which was significantly lower than any of the coniferous samples. Aspen phenols, pH, and ammonium decreased over the 4-week sampling period. All leachate samples showed a consistent toxicity response over the 4-week period, with each sample being toxic at concentrations less than 10% by volume. Rainfall Simulations Wood chip moisture levels increased considerably over the 1-h rainfall event with an observed range of approximately 19% to 28% moisture increase by volume. Aspen moisture level increase was less than that of the coniferous species. Pine showed the highest increase in moisture content by species and the operational samples all exhibited the highest starting moisture content for the wet sample run. Coniferous wood chips generally lost a small amount of moisture compared to their starting condition over the course of the wet sample run. This observation appears to be counterintuitive but may be due to differences between deciduous and coniferous wood chips as well as the loss of moisture by coniferous wood chips inside the pile that were not being wetted by precipitation during the rainfall simulation. Wet chip samples generally produced a leachate that had higher concentrations of measured chemical characteristics except for ammonia where data were variable and standard errors overlap, but not all differences were statistically significant. In the dry condition, wood chips produced leachate that was relatively similar across tree species whereas in the wet condition, aspen leachate was generally of higher concentration for each parameter except pH, which was lower; true color was not measured. Wood chip moisture mean levels for dry and saturated runs as well as moisture gained in the rainfall simulation experiment. Coniferous leachate samples generated from wet and dry wood chips were similar across species except for the low color values in pine compared to spruce and mixed samples. Overall, the leachate chemical composition generated from these 1-h rainfall simulations was of the same magnitude as the operational samples and was also similar to the 28-day static samples. There was no significant difference in the toxicity of leachate between dry and wet exposures within tree species or among tree species. Coniferous leachate samples generated from wet and dry wood chips were similar across species except for the low color values in pine compared to spruce and mixed samples. Overall, the leachate chemical composition generated from these 1-h rainfall simulations was of the same magnitude as the operational samples and was also similar to the 28-day static samples. There was no significant difference in the toxicity of leachate between dry and wet exposures within tree species or among tree species.

4. Conclusions

Six types of wood chips were assessed over an array of tests during this study. Aspen chips produced the most acidic leachate with higher organic, phenolic, and ammonia concentrations compared to the coniferous and mixed samples. Coniferous samples showed some subtle differences with the spruce samples being more similar to each other than they were to pine. Regardless of the treatment type, i.e., operational, static, or rainfall simulation, the wood chip source produced leachate that was toxic to V. fischeri in Microtox™. Resin acid concentrations for isopimaric and DHAA, both known to be highly toxic, were lowest in aspen. This indicates that either the high organic component of the leachate or the combination of organic compounds and resin acids is responsible for the toxicity response.

Consequently, by analogy residue, the storage chip piles, which tend to have higher quantities of wood chips than those used here, have **the capacity to release leachate quickly and for an extended period of time**. These findings indicate the need for chip piles and their leachate runoff to be disconnected from streams by diverting ditch lines and potential sites of surface runoff during development and maintenance activities."

- **Reference - Article / Paper / Fact Sheet 2:**

"Acute Toxic Effects Caused by Leachate from Five Different Tree Species on *Artemia Salina* and *Vibro Fischeri*."

Henric Svensson et al.
Journal of Biobased Materials and Bioenergy, Volume 6, Number 2, April 2012, pp. 214 – 220 (7)
https://doi.org/10.1166/jbmb2012.1202

"In this study, leachates resulting from leaching tests carried out with sawdust from five tree species were investigated. The studied species were: Pedunculate oak (*Quercus robur*), Scots pine (*Pinus sylvestris*), European larch (*Larix decidua*), Norway spruce (*Picea abies*) and European beech (*Fagus sylvatica*).

The analyses included chemical parameters such as pH, TOC and phenolic compounds (reported as total poly-phenols) and acute toxicity on two different organisms, the crustacean *Artemia salina* and the bacteria *Vibro fischeri* (Microtox®).

There are very high amounts of different phenolic compounds in the leachate, and large differences between tree species. The leachates produced by sawdust and bark of different tree species presented great variation regarding acute toxicity. *V. fischeri* was more sensitive than *A. salina* and leachates from pine sawdust and pine bark produced the highest toxicity response from *V. fischeri*.

This study indicates that bark is one component of the tree anatomy that needs to be handled as a potential hazardous material to the aquatic environment.

The large variation in toxicity presented by different tree species need to be taken into account when assessing the impacts to surrounding watercourses and constructing wastewater treatment facilities for the wood-based industry such as irrigation water, stormwater runoff from storage areas."

- **Reference - Article / Paper / Fact Sheet 3:**

"Marine Mammals Have Lost a Gene That Now They May Desperately Need"

Carl Zimmer

A version of this article appears in print on Aug. 14, 2018, on Page D3 of the New York Times with the headline: *Marine Mammals Lost a Gene They Now May Need.*

"Dolphins, manatees, sea lions, elephant seals and other animals no longer produce an enzyme that protects land mammals against harmful chemicals, including some pesticides."

As elephant-like mammals evolved into manatees, they lost an enzyme that today protects against certain pesticides. Credit Scott Audette/Reuters

"About 50 million years ago, dog-like mammals returned to the seas, eventually evolving into whales and dolphins. Around then, too, an early cousin of elephants took the plunge, giving rise to manatees and dugongs. About 20 million years later, bearlike mammals also waded back into the sea, evolving into seals, sea lions and walruses. Each of these marine species adapted to the aquatic life in its own way. Manatees and dugongs slowly graze on sea grass. Seals and their relatives dive deep underwater after prey, but still haul themselves onto beaches to mate and rear pups.

Whales and dolphins have made the most radical adaptations, including blowholes, baleen and echolocation. But a study published on Thursday reveals a common bond: In all three groups of mammals, many species stopped making the same enzyme. Now that loss may come back to haunt them. The enzyme provides an essential defense against certain kinds of harmful pesticides. The new study raises the possibility that **marine mammals may be particularly vulnerable to these chemicals**, which are carried from farm fields into coastal waters.

"It's too important not to pay attention to." said Nathan L. Clark, a co-author of the new study and an evolutionary biologist at the University of Pittsburgh.

Charles Darwin was the first to recognize that marine mammals evolved from ancestors on land. The clues were in their anatomy: Seal flippers are just modified feet. The whale's blowhole is a nose that has migrated. More recently, the DNA of marine mammals has revealed more details about their adaptations. Some genes evolved to do new things, but others simply stopped working, scientists have found. Dr. Clark and his colleagues recently developed a new way to search for these genes and looked for those more likely to be broken in marine mammals than in terrestrial ones. The scientists ended up with a short list of genes that were repeatedly shut down in marine mammals. Most were involved in smelling, which supported earlier studies showing that marine mammals have little or no sense of smell. But at the top of the list was a gene that had nothing to do with smell, called PON1. Wynn K. Meyer, a postdoctoral researcher at the University of Pittsburgh and co-author of the new study, said she was taken aback when she found out what the gene is best known for: a defense against some toxic chemicals.

These chemicals are called organophosphates, a class of compounds that includes certainpesticides as well as nerve agents like sarin gas. PON1 encodes an enzyme called paraoxonase that can quickly break down organophosphates. Mice genetically engineered without paraoxonase die quickly when they're exposed to the chemicals. Dr. Meyer and her colleagues found that all marine mammals have broken copies of the PON1 gene, with a few exceptions: walruses, fur seals and spotted seals.

To see if the gene were truly kaput, the researchers gathered blood plasma from a range of mammal species. They then added pesticides to the plasma. The plasma from land mammals quickly broke down the chemicals. But plasma from dolphins, manatees, sea lions and elephant seals failed to clear the pesticides. Mammals didn't evolve the paraoxonase enzyme to fight the pesticides humans have invented over the past century. After all, the animals have had the adaptation for millions of years. But paraoxonase breaks down other harmful molecules that our own bodies naturally produce. These oxygen-bearing molecules can damage our cells, causing a variety of problems like a buildup of plaque on the walls of blood vessels. People who make low levels of paraoxonase run a greater risk of atherosclerosis and heart disease.

So why did marine mammals lose such an important gene? One possibility is that their bodies abandoned paraoxonase when they started taking long dives. In preparation, the animals suck in tremendous amounts of oxygen, which may create a lot of damaging oxygen-bearing molecules. Marine mammals may have evolved a new, more powerful way to defend against oxygen-bearing molecules, making PON1 unnecessary, Dr. Meyer and her colleagues speculated.

They are carrying out more research to pin down the reason, and they're also investigating **what this legacy means today with the introduction of organophosphates as pesticides**.

Some organophosphate pesticides are widely used on farms, despite decades of research indicating that they can cause brain damage in children. In some parts of the world, marine mammals may be exposed to the chemicals on a regular basis. In Florida, for example, manatees swim up canals that run straight through farmland. Bottlenose dolphins spend a lot of time in bays where farm runoff ends up.

Marine mammals may be slowly accumulating the pesticides in their bodies. Or exposure may take the form of a sudden influx if a hard rain comes down right after farmers spray their fields. Dr. Clark and his colleagues plan to examine manatees and dolphins for a buildup of organophosphates with a test now given to farm workers.

"I don't have any foregone conclusions." said Dr. Clark. ***"I just want to get some answers."*** *"*

The following paper is not quoted to suggest Chlordecone is a chemical utilised in this situation, but rather to demonstrate the **susceptibility of cetacean species to chemical pollution** and also to show the complexity of such issues which are not addressed in the EIS.

- **Reference - Article / Paper / Fact Sheet 4:**

"From banana fields to the deep blue: Assessment of chlordecone contamination of oceanic cetaceans in the eastern Caribbean"

Paula Méndez-Fernandeza et al. Marine Pollution Bulletin October 2018
https://www.researchgate.net/publication/328096269

"ABSTRACT: In the French West Indies (Caribbean), the insecticide Chlordecone (CLD) has been extensively used to reduce banana weevil (Cosmopolites sordidus) infestations in banana plantations. Previous studies have shown high CLD concentrations in freshwater and coastal communities of the region. CLD concentrations, however, have not yet been assessed in marine top predators. We investigated CLD concentrations in cetacean blubber tissues from Guadeloupe, including Physeter macrocephalus, Lagenodelphis hosei, Stenella attenuata and Pseudorca crassidens.

Chlordecone was detected in all blubber samples analysed, with the exception of four P. macrocephalus. Concentrations (range: 1 to 329 ng·g−1 of lipid weight) were, however, lower than those found in species from fresh and brackish water. Ecological factors (open ocean habitat), CLD kinetics, and cetacean metabolism (high or specific enzymatic activity) might explain low concentrations found in cetacean blubber. Future analyses that include internal organ sampling would help to confirm CLD levels observed in this study.

1. Introduction

Chlordecone (also known as Kepone, CLD) is an organochlorine insecticide once used worldwide (Europe, USA, Latin America, Africa and Asia) to control banana weevil (Cosmopolites sordidus) infestations in banana plantations, including in the French West Indies (FWI) (Fintz, 2009; Le Déault and Procaccia, 2009). This molecule is highly persistent in the environment (Cabidoche et al., 2009), and biomagnifies through food webs (UNEP, 2006; Coat et al., 2011; Dromard et al., 2018).

Therefore, this compound, which poses a **significant risk for wildlife and human populations** (Cabidoche et al., 2009; Coat et al., 2011; Multigner et al., 2010) is still being found in the local environment (i.e. soils, rivers, spring water, etc.) despite having been banned since 1993 in the FWI. Chlordecone can induce a wide range of pathologies in birds and mammals, including reproductive impairment or neurotoxicity (Epstein, 1978; Huff and Gerstner, 1978).

It is **carcinogenic** and has been shown to cause hepatic tumours in laboratory rats and mice (Sirica et al., 1989), but also prostate cancer in humans (Multigner et al., 2010). The carcinogenic and hormonal properties of CLD and its long biological half-life raise the possibility of long-term effects. For all these reasons, CLD was prohibited by the Stockholm Convention in 2009 (UNEP, 2017). The first assessment of CLD contamination in the FWI was conducted in soil and aquatic organisms from the rivers of Guadeloupe in late 70′s (Snegaroff, 1977; Kermarrec, 1980), when it was still in use. Bocquené (2002) and Bocquené and Franco (2005) highlighted CLD contamination after the ban in the suspended organic matter and sediments in rivers of Martinique (FWI), and for the first time, CLD contamination in two marine species (Acanthurus bahianus and Panulirus argus).

More recently, studies have expanded to a diversity of taxa from coastal ecosystems, and on the ecological drivers of observed concentrations such as foraging habitat preferences (e.g. Coat et al., 2006; Bodiguel et al., 2011; Salvat et al., 2012; Dromard et al., 2016; Dyc et al., 2015). CLD is highly lipophilic with a log Kow (octanol-water partition coefficient) between 4.5 and 6.0 (Howard et al., 1991; Hansch et al., 1995). Consequently, CLD tended to be associated to organic particulate matter and is prone to biomagnification and bioaccumulation in food webs (UNEP, 2006).

However, little information has been reported in marine wildlife, and no information was available on CLD https://doi.org/10.1016/j.marpolbul.2018.10.012

T concentrations in marine top predators such as marine mammals in the Eastern Caribbean.

Therefore, the aim of this study is to provide the first information of CLD contamination in the pelagic marine environment analysing the blubber of four species of odontocete cetaceans from the west coast of Guadeloupe Island, FWI.

2. Material and methods

2.1. Sample collection and species studied: Samples were collected off the leeward coast of Guadeloupe (16° 15′ N, 61° 34′ W), in the FWI in April 2015. Skin and blubber biopsy samples of cetaceans were obtained opportunistically during boat-based cetacean surveys. When groups were encountered, individual animals were sampled using a crossbow (BARNETT Veloci-Speed® Class, 68-kg draw weight) with Finn Larsen (Ceta-Dart, Copenhagen, Denmark) bolts and tips (dart 25-mm long, 5-mm-diameter). The animals were hit below the dorsal fin when sufficiently close (5–15 m) to the research boat and samples were preserved individually frozen at −20 °C before shipping and subsequent analysis. CLD analyses were performed using the blubber. A total of 46 individuals belonging to four cetacean species having different feeding habits and habitats were sampled: sperm whales (Physeter macrocephalus, n = 10) are resident population in the Eastern Caribbean that mainly fed on mesopelagic cephalopods (Whitehead, 2003; Gero et al., 2014), false killer whales (Pseudorca crassidens, n = 1) occur in deep oceanic and insular slope waters of tropical archipelagos and mostly feed on high trophic level epipelagic fish (Würsig et al., 2018). Fraser's dolphins (Lagenodelphis hosei, n = 5) also occur in deep oceanic waters, but feed on lower trophic level mesopelagic fishes (myctophids), cephalopods, and crustaceans (Dolar et al., 2003; Wang et al., 2012).

The pantropical spotted dolphin (Stenella attenuata, n = 30) has a relatively similar distribution and foraging behaviour than Fraser's dolphins, but also feed on epipelagic prey (Wang et al., 2012). Biopsy sampling was conducted under scientific permit delivered by DEAL Guadeloupe (12 February 2015, Autorisation Préfectorale de Dérogation pour la Perturbation Intentionnelle de Spécimens d'Espèces Animales Protégées)."

2.2. Analyses of chlordecone (CLD) concentrations 2.3. Sex determination 2.4. Data analysis

3. **Results and discussion**

Chlordecone was present in all the blubber samples analysed with the exception of four P. macrocephalus (Pm_6, 7, 8 and 10) (Table 1). Only P. macrocephalus and S. attenuata showed significant differences on CLD concentrations (Kruskal-Wallis post-hoc test, $p = 0.0067$), moreover there is no significant difference among sexes of this last species (Wilcoxon, $p > 0.05$). There was, however, considerable variation among individual sperm whales in recorded CLD concentrations (LQ – 34.9 ng·g−1 ww) and S. attenuata had the highest median values, followed by P. P. Méndez-Fernandez et al. Marine Pollution Bulletin 137 (2018) 56–60 57 crassidens, L. hosei and P. macrocephalus (4.62 > 3.92 > 1.91 > 0.374 ng·g−1 ww, Fig. 1). These concentrations are lower than those found by Coat et al. (2011) in other marine taxa (e.g. American eel, Anguilla rostrata, 5863 ng·g−1 ww) and considerably lower compared to fresh and brackish water species (e.g. river goby, Awaous banana, 1350–12,366 ng·g−1 ww and wild tilapia, Oreochromis spp., 196–386 ng·g−1 ww; Coat et al., 2006, 2011). CLD concentrations in cetaceans were lower compared to those reported in two sea turtle species from Guadeloupe, which ranged from the limit of quantification to 378 for the green turtle (Chelonia mydas) and to 26.7 ng·g−1 ww for the hawksbill turtle (Eretmochelys imbricata) (Dyc et al., 2015).

The use of CLD was banned in 1990 in France, but used by exemption until 1993 in the FWI. Nevertheless, this molecule is still detected in the environment and high concentrations were found in terrestrial products (meat, milk and eggs), root vegetables (DIREN, 2001; DSDS, 2001; Cabidoche et al., 2009), as well as in fresh and marine water ecosystems in the FWI after the ban (e.g. fish, crustaceans and marine turtles; Coat et al., 2006, 2011; Dyc et al., 2015; Dromard et al., 2016). Coat et al. (2011) investigated CLD concentrations in a large number of aquatic animal species (fresh and marine ecosystems) collected in 2006 in Guadeloupe.

This previous study revealed a significant positive relationship between CLD concentrations and the trophic position of sampled species supporting the biomagnification of this pollutant along food webs. They also observed that species from the same genus within a trophic level exhibited contamination levels twice as high when living in static waters (e.g. Macrobrachium faustinum and M. acanthurus) than in rapid running waters (e.g. M. heterochirus and M. crenulatum) (Coat et al., 2011). In addition, CLD concentrations were also correlated with foraging habitat preferences (carbon sources) inferred from δ13C values. Indeed, three of the four fish species studied (Anguilla rostrate, Eleotris perniger, Awaous banana) that exhibited the highest CLD concentrations fed on 13C-enriched food sources (Coat et al., 2011).

Therefore, considering that cetaceans are high trophic level consumers in marine ecosystems we were expecting relatively higher CLD concentrations in blubber tissues than those we observed. Our finding of relatively low CLD concentrations could be due to several non-mutually exclusive factor including:

1) the ecology and biology of the species investigated (i.e. offshore foraging habitats spatially removed from pollution sources, relative trophic level)

2) CLD kinetics and its special affinity for particular tissues or organs of the body (i.e. organotropism) not analysed here and

3) the species physiology concerning its ability to metabolise the molecule etc"

"In conclusion, the presence of chlordecone in the blubber of cetaceans revealed that this controversial and persistent molecule has reached deep sea food webs in areas with deep waters

close to shore. However, the low concentrations we found compared to other aquatic organisms likely are the result of dilution of the molecule with distance from points of origin and the ecology of the species we studied (i.e. found in open ocean habitats and food webs), CLD kinetics and cetacean metabolism (high enzymatic activity). Around tropical islands, stranded cetacean carcasses are quite infrequent and rarely accessible for internal organ tissue collection. Nevertheless, using existing stranding networks in the French West Indies, future studies using internal organ sampling will be conducted to compare CLD concentrations between organs in order to confirm levels reported in this study."

The following excerpt from *Reynolds, Wells and Eide*, although somewhat dated, clearly outlines the **impacts of chemical pollutants on dolphins** and suggests linkages to diseases ...... a matter of enormous concern given later research and the susceptibility of our own dolphin populations, as demonstrated in **the morbillivirus outbreak in 2013 in SA waters.**

- **Reference - Article / Excerpt 5:**

"The Bottlenose Dolphin – Biology and Conservation"
by John E Reynolds III, Randall S. Wells, and Samantha D Eide 2000 Pages 6 - 9

In many regards, studies of the effects of anthropogenic toxicants on individual marine mammals and on population dynamics still are in their infancy.[24] However, experimental studies[25] on harbor seals (*Phoca vitulina*), which also live many years and which eat the same sorts of foods humans and dolphins do, have indicated impairment of immune function following consumption of contaminated fish. The magnitude of the immune response was inversely correlated with toxicant levels (especially PCBs) in blubber. Scientists have demonstrated in nonmarine mammals that the PCBs and PBBs (polychlorinated biphenyls and polybrominated biphenyls, respectively) are strong agents of immunosuppression.[26]

In all likelihood, in waters or food webs where toxicant levels are high, all bottlenose dolphins, not just the old males in which bioaccumulation is greatest, are affected. In fact, some of the highest concentrations of total DDTs for any cetacean were found in bottlenose dolphins off California.[27] Reproductive success may be impaired in a number of ways. For example, firstborn calves may receive and perhaps become debilitated from doses of toxic chemicals they cannot successfully combat (see discussion above). In California sea lions (*Zalophus californianus*), high levels of organochlorines in the late 1960s were thought to have led to premature births of pups,[28] although other factors, such as disease agents, may also have played an important role.[29] Other ways by which toxicants could impair reproduction have also been suggested in marine mammals. For example, a correlation exists between high levels of organochlorines and lowered testosterone levels in Dall's porpoises (*Phocoenoides dalli*).[30] In common, or harbor, seals, implantation of the embryo in the uterus of the mother was hindered in animals fed a diet high in organochlorines.[31] Even though no incidence of such problems has been reported for bottlenose dolphins, the possibility of physiological dysfunctions as a result of excessive exposure to toxicants certainly exists.

In addition, a number of studies of marine mammals suggest a tie between toxicant levels and susceptibility to disease.[32] Perhaps the most noteworthy example of this relationship involves beluga whales in the St. Lawrence estuary. These animals, long known to carry extremely high toxicant loads, also had a higher prevalence of cancer than has been reported in any other group of free-ranging cetaceans.[33] In fact, 37 percent of all tumors that have ever been reported from all cetacean species *worldwide* were found in this single small population of belugas, suggesting "an influence of contaminants through a direct carcinogenic effect and/or a decreased resistance to the development of tumors."[34]

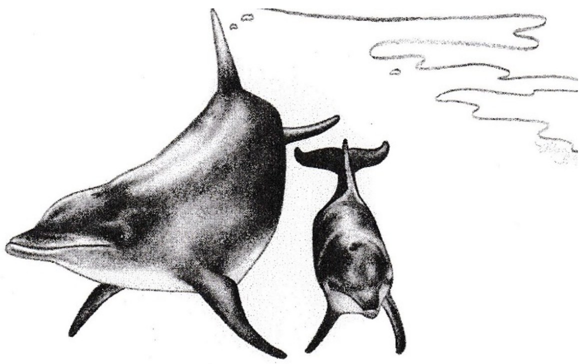


Fig. 1. A mother and calf swimming. Marya Willis-Glowka.

Altogether, it is abundantly clear that, due to the introduction of anthropogenic toxicants, the chemical makeup of dolphin habitat is not what it once was. And the change does not bode well for the animals.

Nor are anthropogenic toxicants the only chemical threats to marine mammals. Certain algae called dinoflagellates produce natural toxins, such as lipid-soluble brevetoxin and water-soluble saxitoxin. Brevetoxin, produced by the dinoflagellate (*Gymnodinium breve*) responsible for "red tides," has been identified as the cause of two die-offs of endangered Florida manatees (*Trichechus manatus latirostris*) in 1982 and 1996.[35] The latter event killed almost 150 individuals along the southwest coast of the state and made headlines internationally; less well advertised were the deaths of at least thirty dolphins, as well as countless fish, seabirds, and other marine organisms in the same area at the same time, and possibly from the same cause.

Brevetoxin was found in tissues and in the gut contents (primarily menhaden, *Brevoortia* spp.) of a few (eight out of seventeen tested) bottlenose dolphins that died as part of a massive die-off in 1987–88 of at least 750 animals along the Atlantic coast of the southeastern United States. Based on this finding, as well as lack of other compelling evidence as to the cause of the die-off, some scientists suggested that indirect effects of red tides were to blame.[36] However, to confuse the issue of cause of death, very high tissue concentrations of a variety of anthropogenic toxicants (including immunosuppressive substances) were found in the dead dolphins.[37] Scientists stated: "Although the impact of these contaminants is not fully known, their role as causative agents in this recent mass mortality must be considered."[38] Pathologists subsequently examined archived tissues and ultimately suggested that a distemper-like virus called morbillivirus accounted for the deaths of these animals.[39] The precise interplay between the natural toxins, the anthropogenic toxicants, the virus, immune dysfunction, opportunistic infections, and death are still unclear,[40] but the morbillivirus infection alone could certainly have led directly to some immunosuppression, thereby opening the door to secondary infections of various types.[41]

Serological evidence, in the form of antibodies, of past morbillivirus infections has been found in living, apparently healthy bottlenose dolphins in coastal waters of the Gulf of Mexico and the western Atlantic. Thus, recurrent epizootics (that is, diseases attacking a large number of animals simultaneously)[42] appear to have occurred in the animals since at least the early 1980s.[43] Offshore bottlenose dolphins appear to have even higher prevalence of morbillivirus antibodies, possibly because they may associate at sea with pilot whales (*Globicephala* spp.), in which the disease may be indigenous to a specific locality[44] (such diseases are said to be enzootic).[45] Why do some dolphins survive this deadly infection, whereas others perish? Possibly the latter have been compromised by heavy body burdens of toxicants, as has been suggested for striped dolphins (*Stenella coeruleoalba*) during a 1990–92 epizootic event in the Mediterranean Sea.[46] In fact, the experimental studies of harbor seal immunology noted above leave open the possibility that exposure to high levels of organochlorines could increase susceptibility to viral infections seen in a number of marine mammal species.

Saxitoxin was implicated in the deaths of fourteen humpback whales (*Megaptera novaeangliae*) off New England in 1987.[47] In addition, possibly over 70 percent of the three hundred or so Mediterranean monk seals (*Monachus monachus*) living off the western Sahara-Mauritanian coast may have succumbed to saxitoxin poisoning in 1997.[48] However, it is possible that a newly discovered morbillivirus caused the monk seal mortality.[49] Possibly scientists will discover, as they did with the 1987–88 die-off of bottlenose dolphins mentioned above, that synergistic effects of several factors may have been responsible for the monk seal die-off.[50] To date, no dolphin deaths have been attributed to saxitoxin exposure, but the incidence of saxitoxin-related die-offs in other marine mammals indicates that dolphins may be at risk.

One may notice that the older literature contains few records of die-offs of marine mammals due to exposure to biotoxins (brevetoxin or saxitoxin). Certainly, scientists are becoming more aware of, and better at detecting, biotoxins in marine mammals; that fact alone could account for the more recent diagnoses. However, the increase in frequency of reports may actually reflect developing conditions. For example, on a global basis (not necessarily in particular regions), it appears that outbreaks of toxic dinoflagellates have increased.[51] In fact, "the number of toxic blooms, the economic losses from them, the types of resources affected and the kinds of toxins and toxic species have all increased."[52] The changes in incidence probably have multiple causes, but they suggest a link, in at least some cases, with discharge of anthropogenic chemicals, including nutrients such as fertilizers used for agriculture. If this is the case, once again we face a situation where humans have modified natural systems to the great detriment of the inhabitants.

Other aspects of bottlenose dolphin habitat and lifestyle may jeopardize particular dolphin populations as well. Dolphins have the misfortune to seek for their food many of the same species people like to eat. The resulting competition can manifest itself in ways that harm dolphins directly or indirectly. For example, it has long been recognized that coastal netting along the North and South Carolina coasts kills a number of dolphins (possibly on the order of two to three dozen mortalities annually), and in one case even led to overharvest and commercial extinction of the target species, the sturgeon (*Acipenser oxyrhynchus*).[53] As the fisheries continued operating in the 1990s, dolphins continued to die. In 1993, seventy-four bottlenose dolphins were reported dead off the coast of North Carolina; of those, twenty-six (35.1 percent) showed evidence that human activities, including netting, caused death, and twenty-eight (37.8 percent) were not examined or were too decomposed to determine whether human interactions had occurred.[54] Most dolphin strandings in that region in 1993 took place during the spring (when ocean gill netting occurs) and fall (when stop nets receive heavy use). Depending on the status of particular stocks of dolphins, such mortality may or may not be sustainable.

The issues of anoxia and resultant algal blooms and the linkages to diminished water quality are borne out in the following papers.

The results can be devastating at both an **individual and population level**.

- **Reference - Article / Paper / Fact Sheet 6:**

"Death by Killer Algae"

Claudia Geib

Hakai Magazine 2017 https://www.hakaimagazine.com/features/death-killer-algae/.

"When 343 sei whales died from a harmful algal bloom in Chilean Patagonia, they opened a window into the effect changing climate is having on marine mammals, our oceans, and us."

"They didn't think much of the first dead whale. Dwarfed by the rugged cliffs of Patagonia's high green fjords, the team of biologists had sailed into a gulf off the Pacific Ocean searching for the ocean's smaller animals, the marine invertebrates they were there to inventory. That night, while hunting for an anchorage in a narrow bay, the team spotted a large, dead whale floating on the water's surface. But for the biologists, death—even of such an enormous animal—didn't seem so unusual. Not so unusual, that is, until they found the second whale, lying on the beach. And a third. And a fourth. In all, they found seven in that bay alone. Over the next day, they counted a total of 25 dead whales in the fjord. As the team of five researchers from Chile's Huinay Scientific Field Station sailed south across the Golfo de Penas, the dead were there, too: 200 kilometers away, they found four more whales on the beaches of the exposed, outer coast. At one point, someone's dog rolled in one of the corpses. The scent of dead whale hung in the boat for weeks.

"Everybody was clear about it—this is not normal." says Vreni Häussermann, director of Huinay station and the leader of the group that made the discovery in April 2015. Häussermann and her team found themselves drawn into a whodunit worthy of a detective show: they'd become accidental witnesses to a mass killing. But what had caused it, and just how many had fallen victim? Sure that it was too much of a coincidence to find two groups of dead whales so far apart, Häussermann and her colleague Carolina Gutstein of the University of Chile went to the National Geographic Society for the funds to run a survey flight. Winter was arriving in Patagonia, and the window for a small plane to fly was shrinking fast. Seizing on two days of good weather in June, Häussermann, Gutstein, and one of Gutstein's students crammed in next to the pilot and started counting dead whales.

"When we flew over the first of two fjords, we saw more than 70." Häussermann recalls. *"We were just all silent. Someone said: 'Oh, shit, this is a nightmare.'"*

By the end of the second day, after bad weather moved in and forced the airsick group to the ground, they knew they had something big on their hands. Häussermann thought they had marked down about 150 whales. It wasn't until they went through the GPS points that they realized the number was 360. Based on size, shape, and species known to frequent the region, the team posited that at least 343 of the dead were sei whales, the third-largest species of baleen whale and an endangered species. It was the largest baleen whale mortality ever recorded.

In a paper published in May 2017, Häussermann, Gutstein, and 10 colleagues from across several disciplines attribute the deaths of these enormous animals, which grow longer than a semi trailer, to something very small: *a toxic species of marine alga*. Most species of algae are harmless, and are an essential part of the food chain at that. Those that do produce toxins usually do so in small amounts. However, under the right conditions—warm water and a boost of nutrients—algae can grow so explosively that those toxins become a problem, creating what's called a harmful algal bloom, or HAB. The toxins end up in filter feeders, such as shellfish, which draw algae out of the water, and in the stomachs of zooplankton and other small animals that feed on algae. As larger animals eat these organisms, algal toxins get passed up the food chain.

Depending on the algal species, the impacts of toxins on animals will differ: from respiratory distress, to confusion and seizures, to full nervous system paralysis. The further up the food chain toxins accumulate, the more concentrated they become. The largest animals tend to receive the strongest dose, a phenomenon known as biomagnification. Though HABs are familiar fare for marine biologists—having been documented as far back as 1672—whale deaths by algae are not, making the Huinay team's discovery in 2015 largely unprecedented. Hoping to delve more into the mystery, an international group of seven scientists ventured twice to the Golfo de Penas—in February and May 2016—to gather more information about the role harmful algae had played in the whales' deaths and to gauge whether such a mass mortality might happen again.

With its wide maw open to the Pacific Ocean, the Golfo de Penas—the Gulf of Sorrows—is inaccessible by land and forbidding by sea. The weather in Chilean Patagonia is infamously unpredictable, with tides that can change daily by seven meters and a prevailing westerly wind that makes its exposed coastline one of the most wave-impacted on Earth. On February 1, 2016, after a full day of delays, the scientific team made it at last to Puerto Edén, the gateway to the Golfo de Penas. There they boarded the *Saoirse,* a private vessel captained by Keri-Lee Pashuk and Greg Landreth. The Huinay field station team had been aboard *Saoirse* when they first discovered the whales the year before, and Pashuk and Landreth had taken a particular interest in the case of the dead sei whales; over the 10 months after the troubling discovery, they'd chased down much of the funding needed to welcome this new party of scientists.

Wending through the gulf's maze of fjords, the crew of *Saoirse* found themselves in a land of the dead. Whales stranded the previous year were obvious—stripped clean to bone, or with mummified remnants clinging like shredded canvas to a fluke or a rib—but they weren't alone: freshly stranded whales had joined them, some only a few weeks gone. The science proceeded smoothly, and the beauty of the region and the novelty of living at sea was a welcome distraction. Yet a sense of unease slowly distilled among the crew.

"I feel what I can only explain as a profound sadness, the disassociation of the war photographer having worn thin." Pashuk wrote on the ship's blog after two and a half weeks of ferrying scientists to land.

On shore, the team spent long days measuring, sampling, and photographing carcasses, working through high winds, rainstorms, and clouds of flies. From the boat, they tested the temperature, salinity, oxygen levels, and plankton content in every fjord they threaded through, seeking information that could be linked to the mortality. The normally chilly gulf was so much warmer than usual that one of the researchers lingered in the water after repairing a blocked drain to collect squat lobsters, a favorite food of sei whales, in a jar. (Normally the team netted the crustaceans from the deck.)

That unusually warm water in the Golfo de Penas was a major clue in solving the mystery of the whales' deaths, and it reflected an event of global magnitude. From January 2015 through June 2016, the planet experienced an El Niño: a period in which easterly winds across the Pacific Ocean weaken, allowing warm water to flow into the space between Oceania and South America. The weather associated with El Niño and its effects are well documented: unusual rainfall in the Peruvian desert, droughts in Indonesia and Australia, and disastrous drops in South American fish populations, to name just a few. Only in the past few decades has another trend emerged: HABs, which seem to coincide with the changes in water temperature and nutrient availability brought on by El Niño.

Scientists often trace the rise of HABs back to 1997–98, previously the strongest El Niño year on record. In May of 1998, stranded California sea lions began having seizures on beaches all along central California. After an intensive investigation, researchers discovered the seizures were caused by domoic acid—a neurotoxin produced by a relatively common alga called *Pseudo-nitzschia*. Both humans and marine mammals exposed to domoic acid can suffer brain lesions, seizures, and memory loss. Scientists think that following the 1998 bloom *Pseudo-nitzschia* established itself more permanently along the west coast, causing small blooms nearly every spring and summer—and with them, annual sea lion seizures. Widespread ocean warming plays a role in that trend, as does nutrient runoff from human activities. But during warm weather events, like El Niño, the number of sick sea lions tends to skyrocket.

When they initially discovered the dead sei whales in 2015, Häussermann and her crew from the Huinay Scientific Field Station hadn't considered a HAB as the cause of death; they were experts in marine invertebrates, not in whales or HABs. Additionally, there was only one recent precedent for a HAB killing a group of whales: in 1987, 14 humpback whales off Cape Cod, Massachusetts, were killed by the paralyzing algal toxin saxitoxin. Before that, the closest analog seemed to be an ancient one. Gutstein had investigated a site in the Atacama Desert, some 2,500 kilometers north of the Golfo de Penas, in which dozens of baleen whales and other large mammals were believed to have been killed by a HAB between six and nine million years ago.

But by the time the second group of scientists boarded the *Saoirse* in 2016, harmful algae were their main suspects. Over the course of the previous year, as samples from the first expedition returned positive results for two different marine toxins, the researchers had watched as effects from El Niño spread across the western hemisphere. *"[2015] kind of rewrote what we understand about how these blooms work."* says Raphael Kudela, an algae researcher at the University of California, Santa Cruz. Kudela's lab was sampling algae in Monterey Bay, California, in April 2015—just before the Huinay team discovered the dead whales—when he began noticing rising levels of algal toxins.

"We didn't think it would be that large." he says. *"We happened to be in just the right spot and saw the toxins starting to show up. From there it just kept going."*

By the end of the summer, the bloom had spread from Santa Barbara in Southern California to Alaska's Aleutian Islands. The bloom broke all the records: it was the largest, the longest lasting, and the most toxic researchers had ever seen.

"There was literally these layers where it looked like straw or something, thick with all these cells." Kudela says. There were a mix of algal species in the bloom, but it was dominated by *Pseudo-nitzschia*. In the lab, healthy *Pseudo-nitzschia* can form chains of 20 to 30 of their golden-brown, needle-shaped cells; according to Kudela, wild chains in the 2015 bloom were 100 to 300 cells long. As the toxin progressed through the ecosystem, Kudela's lab found it everywhere they looked. The prevailing idea was that after small fish such as anchovies, ate the algal cells, the water-soluble toxin would reside only in their stomachs until it was excreted, usually within 24 hours. But during the 2015 bloom, Kudela's lab could find domoic acid integrated into anchovy muscle, brains, and gills. At local fish markets, they found it in salmon tissue and in squid, neither of which consume phytoplankton directly.

In late May 2015, the Department of Fish and Wildlife in Washington State discovered a sea lion having a seizure on a Washington beach. It had been poisoned by domoic acid—the farthest north algal poisoning had been confirmed in a marine mammal. And soon after, to the far north, along the coast of Alaska, dead whales began appearing, floating offshore. They ran the gamut: humpbacks, fin whales, gray whales, animals so decomposed that they couldn't be identified; multiple adults and at least one calf. They showed up near Anchorage's busy port and the remote rocky shores of the Alaska Peninsula, totaling 30 between May and August. Word of six more came from British Columbia down the coast. Unfortunately, many of the whales were too far decomposed to test, or couldn't be retrieved. The US National Oceanic and Atmospheric Administration (NOAA) said that the summer's coast-wide HAB was likely involved in the whales' deaths in Alaska, though the evidence simply wasn't there to discover.

A year later, in May 2016, threads of evidence from throughout the Pacific would start to come together when a landmark paper was published on domoic acid in the region: NOAA researcher Kathi Lefebvre—a member of the team who first made the link between domoic acid and sea lion seizures in 1998—detected the toxin in the tissues of 13 species of marine mammal in Alaska, from sea otters to massive bowhead whales. She had known the algal cells could survive in the chilly north; yet this showed that they had established a significant foothold, one strong enough that it was detectable high up on the food chain.

In the late hours of one rainy February night, during the first 2016 expedition to the Golfo de Penas, *Saoirse*'s captain Keri-Lee Pashuk was woken by a thunk that echoed through the ship's hull. She lay in the dark, listening as an eerie chorus of whistles and chirps resonated through the water around her. Earlier that evening, Pashuk and the crew had watched a group of killer whales pursuing at least one living sei whale into the fjord where the science team was collecting samples from a young, dead whale. The killer whales were relentless, biting the sei whale and breaching to land on top of it. Peering from the beach through a gathering curtain of rain until darkness fell, the crew watched as the sei whale tried frantically to escape, even if that meant nearly beaching itself. As she lay in the dark, Pashuk had a feeling that the ghostly sounds had something to do with the whales. She was right—when the team rose the next morning, they found a sei whale freshly dead on the beach.As that research trip wrapped in early March, the killer whale attack continued to disturb the crew. They couldn't say for sure that the attack had anything to do with the stranding, or that killer whales were responsible for the other stranded whales they'd found—but then again, could they say that they hadn't? This is the problem investigators face with marine mammal strandings: so many factors are in constant interplay, and conclusions often come down to an elaborate process of elimination.

"It was a little bit like CSI, or an Agatha Christie novel," says David Cassis, an expert in HABs and phytoplankton, who worked on the sei whale investigation, *"where you have the body of the dead person in a room with a locked door, no murder weapon, and no suspects."*

Thanks to Gutstein's expertise in taphonomy—which uses the condition of an animal to infer how it died—the scientists knew that 90 percent of the sei whales had died within a period of months, and they had died at sea: the whales were found lying on their backs or sides, indicating they had been floating, not swimming, when deposited on land. Additionally, ocean current models suggest the bodies came from at least five different locations around the region, meaning that the killer must have been able to affect those individuals across a distance of hundreds of kilometers. Faced with the evidence from their observations and research, the team labored to rule out several potential suspects. Underwater explosions, which can disorient whales and cause them to beach, were one possibility; but that would have left a mark on the whales' inner ears, which the scientists had found no evidence of. Death by disease, though difficult to disprove, likely would have depleted the whales' fat as they stopped feeding—but these whales were fat with blubber and had full stomachs at their time of death. And as shocking as the killer whale attacks had been, the researchers learned that most killer whales attack baleen whales to eat their tongues, the easiest organ to access. All of the sei whales they saw up close had tongues intact. Plus, it was near impossible for killer whales to have killed so many whales almost simultaneously.

That left only one plausible culprit—a killer alga. Two whales, as well as mussels sampled just after the initial 2015 Patagonia stranding, tested positive for both domoic acid and paralytic shellfish toxin (PST), which can cause muscle paralysis in mammals. Phytoplankton also tested positive for PST at the mouth of Seno Newman, a long fjord near the Golfo de Penas where 149 of the dead whales were found.

The team's paper, published in May 2017, states it definitively: *"Here, we show that the synchronous death of at least 343, primarily sei whales can be attributed to HABs during a building El Niño."* HABs that persisted in Chile throughout the investigation carried out from the *Saoirse* have continued to support this theory, and buoy comparisons to the bloom seen in the northeast Pacific Ocean that was linked to sick sea lions and dead whales. In early February and March 2016, at the same time the scientific team was investigating the Golfo de Penas, a massive bloom was steamrolling northern Patagonia, killing at least 39 million salmon and shuttering shellfish harvests. Chile's director of National Fisheries and

Aquaculture attributed the blooms primarily to the warm waters of El Niño. In January 2017, yet another bloom around the Golfo de Penas killed around 170,000 salmon in farms there.

On the opposite coast, harmful algae have also been named as a potential suspect for years of high mortality for southern right whale calves in Argentina. The El Niños most often linked with these HABs are cyclic, infrequent events. Yet years' worth of dogged work around the world suggests that HABs aren't just an occasional occurrence; they are increasingly becoming regular events, and are even called the "new normal" for certain areas.

On a warming planet, this killer has an accomplice. As the effects of climate change become more apparent, scientists have broadly begun connecting HABs with rising ocean temperatures. Kudela, for instance, found that large blooms off the west coast of North America have been associated with unusually warm water. Published studies have also made this association; a recent modeling study led by scientists at Stony Brook University in New York shows that ocean warming makes expansive areas in the North Atlantic and parts of the North Pacific more conducive to HABs by two species, *Alexandrium fundyense* and *Dinophysis acuminata*.

However, ocean warming is not uniform, and local climates can greatly impact how an area responds to broader ocean changes. As such, scientists don't expect the oceans will permanently resemble what the Pacific Ocean saw in 2015–16 any time soon; climate change is not quite so black and white. Yet some research suggests that climate change will make extreme events more extreme, making the fallout of landmark El Niño years like 2015–16 more common. In some areas, this could also lead to an increased frequency of HABs.

In the United States, a recent bill approved by the Senate Committee on Commerce, Science, and Transportation would make areas hardest hit by HABs eligible for emergency disaster relief. To advocates of this sort of legislation, HABs—given the havoc they wreak on wildlife, and on the seafoods that humans harvest—are just as much a natural disaster as a hurricane or a tsunami.

In this way, **the health of marine mammals and humans are knotted together**. HABs may signal broad changes happening in our ocean, changes so subtle that humans could easily overlook them. Because marine mammals are usually the first to show noticeable effects, they serve as **sentient early warning systems**, indicating changes to our food supply and marine ecosystems.

"On another level, you could say these are signals, these are canaries in the coal mine of what's in the food web." says Kathi Lefebvre. *"What's going to impact marine mammals can certainly impact humans. It's not necessarily a direct correlation, but the same biology occurs."*

Lefebvre was a graduate student in 1998, when Monterey Bay's sea lions first brought the impact of algal toxins on mammals into the public and scientific eye. The course of that investigation—which, like the sei whale mortality, mystified scientists for weeks—hooked Lefebvre. She was one of the first scientists to suggest domoic acid was behind the sea lion strandings and has since dedicated her career to untangling the effects that algal toxins can have, from the ecosystem level to the individual creature.

Some of her most recent research suggests that marine mammal strandings could signal even more insidious threats to humans than we realize. Lefebvre found that chronic, low-level exposures to domoic acid can have long-term effects on the brain. After about six months, mice injected with a low dose of domoic acid once a week showed significant learning deficits and hyperactivity, even though their brains appeared normal beneath a microscope. Though she can't yet say how these findings translate to human brains, Lefebvre's biggest worry for human health is algal toxins establishing an unseen presence in communities where seafood has always been a safe resource, particularly where local diets are supplemented with subsistence shellfish harvesting. These communities could be regularly consuming small amounts of these toxins. As warming waters move toward the poles, many remote northern communities are expected to encounter harmful algae—and large blooms—more often.

"You can really sort of stress any living system, but you can only stress things until they break." she says. Lefebvre's research found that the mice's brains could recover from the impacts of long-term toxin exposure, but only if they had no exposure to the toxin for at least nine weeks. But larger exposures, even of only a single dose, can have permanent and even fatal effects on both marine mammals and humans. After a HAB near Prince Edward Island, Canada in 1987, 12 of 102 people who became violently ill after eating shellfish experienced short-term memory loss and amnesia for months after the incident. Three of the afflicted died.

The past few years have made scientists certain of this: as climate change continues, HABs will be bigger, more toxic, and present in areas they have never been seen before. Yet beyond that, we are sailing on foreign seas—harmful algae could cause subtle, even far-reaching, side effects we've not yet discovered. The long-term impact they will have on marine life, from the tiniest of plankton to the largest of mammals, continues to unfold.

Here on Earth, we're all a bit like the science team on the *Saoirse,* sailing through unfamiliar fjords. We're on the lookout for something on the surface—but we don't know what may emerge with the next tide."

- **Reference - Article / Paper / Fact Sheet 7:**

"Stranded dolphins have amyloid plaques in their brains"

University of Miami March 2019

David A. Davis et al, Cyanobacterial neurotoxin BMAA and brain pathology in stranded dolphins
DOI: 10.1371/journal.pone.0213346

Dolphins stranded on the beaches of Florida and Massachusetts show in their brains amyloid plaques, a hallmark in human beings of Alzheimer's disease, together with an environmental toxin produced by cyanobacterial blooms. Credit: CC0 Public Domain

"An international team of scientists led by neuropathologist Dr. David Davis at the University of Miami Neurology Department discovered that stranded dolphins have both β-amyloid plaques and the environmental toxin BMAA in their brains.

"We found β-amyloid plaques and damaged neurons in brain tissues from dolphins that had died on the beaches of Florida and Massachusetts." Dr. Davis said. *"Dolphins are an excellent sentinel species for toxic exposures in the marine environment."* co-author Dr. Deborah Mash explained. *"With increasing frequency and duration of cyanobacterial blooms in coastal waters, dolphins might provide early warning of toxic exposures that could impact human health."*

Scientists have previously found that chronic dietary exposure to the cyanobacterial toxin BMAA triggers β-amyloid plaques and neurofibrillary tangles, both hallmarks of Alzheimer's disease, in laboratory animals. Neuropathological analysis was completed at the University of Miami, while chemical analysis of the toxins was conducted by Dr. Susan Murch at the University of British Columbia.

"We cannot say for sure that chronic exposure to cyanobacterial blooms can trigger Alzheimer's in humans but it is a risk that I personally am unwilling to take." oceanographer Larry Brand at Rosenstiel School of Marine Atmospheric Science cautions.

Ethnobotanist Paul Alan Cox at the Brain Chemistry Labs in Jackson Hole reports that the neuropathology and brain toxins in the dolphins are similar to those found in the brains of Chamorro villagers in Guam who suffered from an Alzheimer's-like disease.

"The $64,000 question is whether these marine mammals experienced cognitive deficits and disorientation that led to their beaching," Cox said.

"Until further research clarifies this question, people should take simple steps to avoid cyanobacterial exposure." "

- ## Reference - Article / Paper / Fact Sheet 8:

"Endocrine disruptors found in bottlenose dolphins"

American Geophysical Union September 2018 Leslie B. Hart et al, Urinary Phthalate Metabolites in Common Bottlenose Dolphins (Tursiops truncatus) from Sarasota Bay, FL, USA, *GeoHealth* (2018). DOI: 10.1029/2018GH000146

Bottlenose dolphins swim in Sarasota Bay. Credit: by Sarasota Dolphin Research Program under National Marine Fisheries Service Scientific Research Permit No. 20455.

"Bottlenose dolphins are being exposed to chemical compounds added to many common cleaning products, cosmetics, personal care products and plastics, according to a new study in GeoHealth, a journal of the American Geophysical Union.

The new research found evidence of exposure to these chemical compounds, called phthalates, in 71 percent of dolphins tested in Sarasota Bay, Florida during 2016 and 2017. Previous studies detected phthalate metabolites in the blubber or skin of a few individual marine mammals, but the new study is the first to document the additives in the urine of wild marine mammals. Some phthalates have been linked to hormonal, metabolic and reproductive problems in humans, including low sperm count and abnormal development of reproductive organs. The study's authors do not know what health impacts phthalate compounds may have on dolphins, but the presence of byproducts of the chemicals in the animals' urine indicates they have remained in the body long enough to process them.

"We focused on urine in dolphins because, in previous studies of humans, that has been the most reliable matrix to indicate short-term exposure." said Leslie Hart, a public health professor at the College of Charleston and the lead author of the new study.

Studies have linked human exposure to phthalates with use of products containing these additives, such as personal care products and cosmetics, but Hart said the source of dolphin exposure to phthalates is not yet known. Elevated concentrations in dolphin urine of a specific phthalate compound most commonly added to plastics hinted at plastic waste as a possible source of exposure for the dolphins, she said.

"These chemicals can enter marine waters from urban runoff and agricultural or industrial emissions, but we also know that there is a lot of plastic pollution in the environment." said Hart.

Understanding exposure in dolphins gives scientists insight into the contaminants in local waters and what other animals, including humans, are being exposed to, according to the study's authors. Gina Ylitalo, an analytical chemist at NOAA's Northwest Fisheries Science Center who was not involved in the study, said dolphins are good indicators of what is going on in coastal waters.

"Any animals in the near shore environment with similar prey are probably being exposed as well." she said. *"The dolphins are great sentinels of the marine environment."*

Ubiquitous contaminant

Phthalate compounds are added to a wide variety of products to confer flexibility, durability, and lubrication. Some phthalates interfere with body systems designed to receive messages from hormones such as estrogen and testosterone. This can disrupt natural responses to these hormone signals. Tests for phthalate exposure look for metabolites of the compounds, the products of initial breakdown of the compounds by the liver.

"We are looking for metabolites. These are indicators that the dolphins have been exposed somewhere in their environment and that the body has started to process them." Hart said.

About 160 dolphins live in Sarasota Bay, a subtropical coastal lagoon tucked between barrier islands and the cities of Sarasota and Bradenton on the southwest coast of Florida. The Chicago Zoological Society's Sarasota Dolphin Research Program has tracked individual dolphins since 1970, monitoring their health, behavior, and exposure to contaminants. The dolphins are residents of the area year-round, across multiple decades, with individuals living up to 67 years.

In 2016 and 2017, Hart and her colleagues tested the urine of 17 wild dolphins in and around Sarasota Bay for nine phthalates. They found phthalate metabolites in the urine of 71 percent of the dolphins tested. Hart compared the dolphin data to human data from the CDC's National Health and Nutrition Examination Survey (NHANES), which includes information about behavior and diet as well as blood and urine samples from a large cross section of the U.S. population. She found concentrations of one type of phthalate metabolite, monoethyl phthalate (MEP), were much lower in dolphins than in the human population surveyed by NHANES, but concentrations of another type of phthalate metabolite, mono-(2-ethylhexyl) phthalate (MEHP), were equivalent or higher to the levels found in humans.

"If you look at the primary uses of the parent compounds, MEP's parent is commonly used in cosmetics and personal care products including shampoos and body wash, whereas MEHP is a metabolite of a compound commonly added to plastic." Hart said.

Indicator species

Understanding what dolphins are exposed to gives researchers and the public a better idea of what is in the environment. The study is particularly valuable because of the long-term data available on the Sarasota dolphins' health and behavior, said Ylitalo. Bottlenose dolphins are good indicators of pollutant exposure in whales and dolphins that can't be easily sampled.

"We will not be getting urine samples from killer whales in my neck of the woods." Ylitalo said. *"They don't know what the health effects are yet, but if any group can do it, it will be these type of folks who start teasing it out."*

Documenting exposure was an important first step, Hart said. She wants to expand the sample size to continue investigating the extent and potential health impacts of exposure and start tracking down possible sources. Ultimately, she hopes this research could be used to help curtail the sources of contamination.

"We've introduced these chemicals, they are not natural toxins, and we have the ability to reverse it, to clean this up." Hart said. ”

- **Reference - Article / Paper / Fact Sheet 9:**

"How dolphins and whales fight disease threats."

Gisele Galoustian October 10th 2018 American Geophysical Union

"Dolphins, whales and other cetaceans are susceptible to many of the same health hazards as humans including mercury, brevotoxin (e.g. Red Tide), and lobomycosis. They also serve as important sentinel species to highlight concerns relevant to environmental and public health. Yet understanding how these aquatic mammals fight disease-causing pathogens, how they adapt to changing pathogenic threats, and how their immune responses are triggered has been challenging.

In a groundbreaking study published in *PLOS One* , researchers from FAU's Harbor Branch Oceanographic Institute found that cetaceans use several strategies for success in this evolutionary arms race. The immune response in vertebrates is mediated through a series of rapidly evolving genes called the major histocompatibility complex or MHC. The MHC acts as an early warning system against pathogens that not only sounds the alarm, but also activates an armed response. In order to do this, MHC proteins need to be able to distinguish "friend" from "foe" at a molecular level. Similar to a lock-and-key mechanism, an individual's MHC 'lock' has to be able to bind to a pathogen's peptide 'key' to launch the defense sequence.

The FAU team found that not only are these cetaceans preserving genetic diversity in the types of locks, that is, the conformation of the binding pockets that help trigger the immune response, they also are selecting for diversity in how to regulate the production of the many locks that are needed. MHC is regulated to prevent too much activity, where the immune system might attack one's own cells as well as too little activity, where the immune system does not react quickly or strongly enough to a real threat."

- **Reference - Article / Paper / Fact Sheet 10:**

“PCB pollution threatens to wipe out killer whales.”

Aarhus University September 2018 J.-P. Desforges et al.

science.sciencemag.org/cgi/doi … 1126/science.aat1953

https://phys.org/news/2018-09-pcb-pollution-threatens-killer-whales.html#jCp

In some areas, killer whales feed primarily on sea mammals and big fish like tuna and sharks and are then threatened by PCBs. In areas where the killer whales primarily feed on small fish like herring, they are less threatened. Credit: Audun Rikardsen

“More than 40 years after the first initiatives were taken to ban the use of PCBs, the chemical pollutants remain a deadly threat to animals at the top of the food chain. A new study, just published in the journal Science, shows that the current concentrations of PCBs could lead to the disappearance of half of the world's populations of killer whales from the most heavily contaminated areas within a period of just 30 to 50 years.

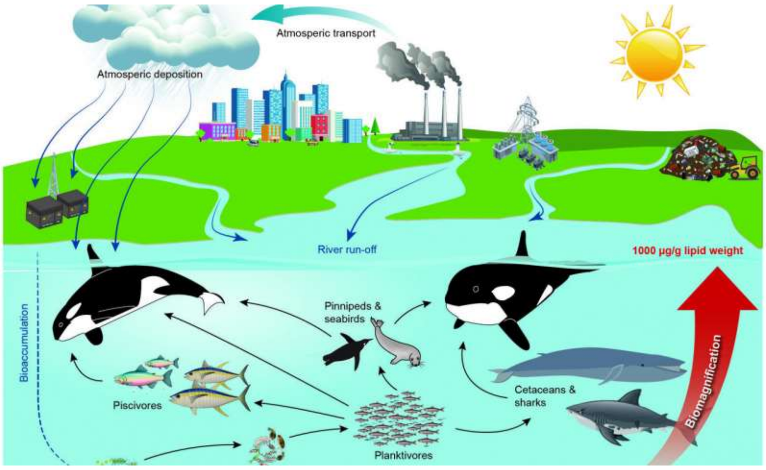
Killer whales (Orcinus orca) form the last link in a long food chain and are among the mammals with the highest level of PCBs (polychlorinated biphenyls) in their tissue. Researchers have measured values as high as 1300 milligrams per kilo in the fatty tissue (blubber) of killer whales. For comparison, a large number of studies show that animals with PCB levels as low as 50 milligrams per kilo of tissue may show signs of infertility and severe impacts on the immune system.

Together with colleagues from a wide range of international universities and research institutions, researchers from Aarhus University have documented that the number of killer whales is rapidly declining in 10 out of the 19 killer whale populations investigated and that the species may disappear entirely from several areas within a few decades. Killer whales are particularly threatened in heavily contaminated areas like the waters near Brazil, the Strait of Gibraltar and around the U.K. Around the British Isles, the researchers estimate that the remaining population counts less than 10 killer whales. Also along the east coast of Greenland, killer whales are effected due to the high consumption of sea mammals like seals.

PCBs accumulate in the food chain

The killer whale is one of the most widespread mammals on Earth and is found in all of the world's oceans from pole to pole. But today, only the populations living in the least-polluted areas include a large number of individuals. Overfishing and man-made noise may also affect the health of the animals, but PCBs can have a dramatic effect on the reproduction and immune system of the killer whales.

The diet of killer whales includes seals and large fish such as tuna and sharks the accumulate PCBs and other pollutants stored at successive levels of the food chain. It is these populations of killer whales that have the highest PCB concentrations and it is these populations that are at the highest risk of population collapse. Killer whales that primarily feed on small-sized fish such as herring and mackerel have a significantly lower content of PCBs and are thus at lower risk of effects.



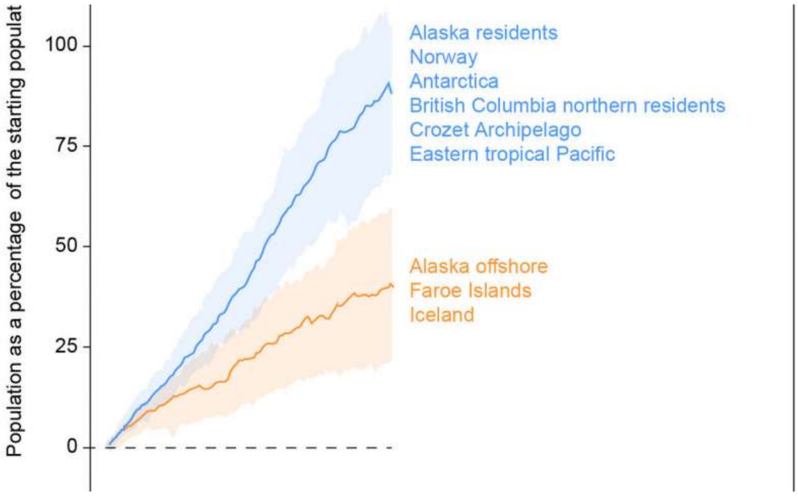
When foreign hazardous substances enter the marine environment, they are assimilated into the first link in the food chain, phytoplankton. The phytoplankton is consumed by zooplankton, which in turn is consumed by smaller fish, etc. The more PCBs have been used around the world since the 1930s. More than 1 million tonnes of PCBs were produced and used in, among other things, electrical components and plastics. Together with DDT and other organic pesticides, PCBs have spread around the global oceans. Through the 1970s and 1980s, PCBs were banned in several countries, and in 2004, through the Stockholm Convention, more than 90 countries have committed themselves to phase out and dispose of the large stocks of PCBs. PCBs are only slowly decomposed in the environment. Moreover, PCBs are passed down to orca offspring through the mother's fat-rich milk. This means that the hazardous substances remain in the bodies of the animals, instead of being released into the environment where they eventually deposit or degrade.

Global investigation of killer whales

"We know that PCBs deform the reproductive organs of animals such as polar bears. It was therefore only natural to examine the impact of PCBs on the scarce populations of killer whales around the world." says Professor Rune Dietz from the Department of Bioscience and Arctic Research Centre, Aarhus University, who initiated the killer whale studies and is co-author of the article.

The research group, which includes participants from the United States, Canada, England, Greenland, Iceland and Denmark, reviewed all the existing literature and compared all data with their own most recent results. This provided information about PCB levels in more than 350 individual killer whales around the globe—the largest number of killer whales ever studied. Applying models, the researchers then predicted the effects of PCBs on the number of offspring as well as on the immune system and mortality of the killer whale over a period of 100 years.

More than 50% of the populations under threat



By collecting data from around the world and loading them into population models, the researchers can see that 10 out of 19 populations of killer whales are affected by high levels of PCBs in their body.

"The findings are surprising. We see that over half of the studied killer whales populations around the globe are severely affected by PCBs." says postdoc Jean-Pierre Desforges from Aarhus University, who led the investigations.

The effects result in fewer animals over time in these populations. The situation is worst in the oceans around Brazil, the Strait of Gibraltar, the northeast Pacific and around the U.K. Here, the models show that the populations have virtually been halved during the half century where PCBs have been present.

"In these areas, we rarely observe newborn killer whales." says Ailsa Hall, who together with Bernie McConnell developed the models used by Sea Mammal Research Unit in Scotland. *"As the effects have been recognized for more than 50 years, it is frightening to see that the models predict a high risk of population collapse in these areas within a period of 30-40 years."* says Jean-Pierre Desforges.

A female killer whale may live for 60-70 years, and although the world took its first steps to phase out PCBs more than 40 years ago, killer whales still have high levels of PCBs in their bodies.

"This suggests that the efforts have not been effective enough to avoid the accumulation of PCBs in high trophic level species that live as long as the killer whale does. There is therefore an urgent need for further initiatives than those under the Stockholm Convention." concludes Paul D. Jepson, Institute of Zoology, Zoological Society of London, England, another killer whale expert and co-author of the article.

In the oceans around the Faroe Islands, Iceland, Norway, Alaska and the Antarctic, the prospects are not so gloomy. Here, killer whale populations grow and the models predict that they will continue to do so throughout the next century."

- **Reference - Article / Paper / Fact Sheet 11:**

Further evidence of the **impact of toxic algae on marine fauna** is detailed in the following article.

https://www.miamiherald.com/news/local/environment/article228126094.html

"Toxins produced by blue-green algae that have increasingly polluted Florida waters have been found in dead dolphins that also showed signs of Alzheimer's-like brain disease, according to a new study led by University of Miami researchers.

The study, published Wednesday in the peer-reviewed journal PLOS One, is the first to show detectable levels of the toxin, commonly called BMAA, in dolphin brains that also displayed degenerative damage similar to Alzheimer's, Lou Gehrig's disease and Parkinson's in humans. While more work needs to be done to determine whether the toxins cause the disease, the study concludes that dolphins and their complex brains could provide a key sentinel for the potential threat from toxic algae blooms to humans.

"Not to be too political, but it goes to show the health of marine animals and water quality." said David Davis, lead author and a University of Miami Miller School of Medicine neuropathologist. *"Everything's directly related."*

The findings add to a growing body of research that focuses on the health threat from harmful algae blooms, which climate scientists warn could worsen as the planet warms. South Florida is particularly vulnerable, with miles of coast, a lake that is a third of the size of Rhode Island, rivers and estuaries, and an agricultural industry and swelling population that continue to feed blooms with pollution from fertilizer and sewage. This past year, nearly 150 dead dolphins turned up in Florida waters after a widespread red tide along the Gulf Coast coincided with freshwater blue-green algae washing down the Caloosahatchee River. The carnage prompted the state's new governor, Ron DeSantis, to order a task force assembled to tackle damaging blue-green algae blooms just after he took office."

Dead fish clog a canal in Coral Shores in Southwest Florida in August.

Tiffany Tompkins *Bradenton Herald*

"Two years ago, UM researchers confirmed high levels of toxin from algae in sharks, concluding that the ocean's big, long-living predators accumulate the toxin in their brains over time, and they warned against eating shark. The connection between the toxin and brain disease is still relatively new and not without controversy. Scientists first discovered the link after a botanist visiting Guam to research cancer took another look at a decades-old mystery surrounding a degenerative brain disease, Discover Magazine reported in 2011. The disease hit nearly every household in a small village, leading researchers to focus on the seed from cycads, a plant often confused with palms and a staple of villagers' diet.

The seeds contain BMAA, but researchers concluded that villagers could never consume enough to make them sick. The botanist, Paul Cox, found the connection when he discovered that the villagers also ate fruit bats, which feasted on the seeds and had a much higher concentration of BMAA because it accumulated in their bodies over time, according to a 2012 Environmental Health Perspectives account.

A decade later, UM's Miami Brain Endowment Bank repeated Cox's brain study and found BMAA in the brains of people suffering from the degenerative diseases.

"BMAA is more of a long-term toxin," said Davis, a member of Cox's Brain Chemistry Lab that investigates environmental triggers for brain diseases. *"It integrates and causes proteins for misfold and that's when you get chronic inflammation and that leads to degenerations."*

Since then, more studies have looked at higher incidences of Lou Gehrig's disease in people who live near lakes with frequent blooms, Wednesday's study noted. For this study, researchers looked at brains from 14 dead dolphins, including seven Florida bottlenose dolphins that beached themselves in 2005 along the Atlantic, the Indian River Lagoon, the Banana River and Gulf of Mexico where algae blooms frequently occur. They also looked at seven common dolphins that were found dead in Cape Cod Bay off Massachusetts in 2012. All but one dolphin, which died from a boat strike, had BMAA in their brains as well as signs of degenerative disease. Notably, the Florida dolphins had three times the amount of toxins. That's likely because they swim closer to shore and into estuaries where blooms occur, Davis said, and eat smaller marine life, like shrimp, crabs and prey fish, that consume the algae.

Making the connection in dolphins is significant because it provides a window into a more complex brain than a shark's, he said, and one with higher functions like a human's. Researchers also focused on the part of the dolphin brain used for acoustic navigation because they believed problems would be more apparent.

"It's one of those regions where if you want to find something wrong with a dolphin, you would look there." Davis said. *"We thought it would be highly sensitive and vulnerable to a toxin."* Looking at dolphins in the wild also gives scientists a more realistic model of how the toxin accumulates and may cause damage, he said.

"This isn't animals being fed a certain dose over a certain amount of time. It's naturalistic exposure." he said. *"If you have these ... dolphins feeding in the same marine food web as humans, potentially eating the same things as humans, that's why we say it serves as a sentinel."*

Because this study involved such a small number of dolphins, the team was not able to definitively link a cause and effect. For that, the researchers have begun a second study using dolphins that died during last year's prolonged algae blooms. Nearly 150 were found in Gulf waters, which prompted the National Oceanic and Atmospheric Administration to launch an investigation. So far nothing suggests the toxins caused the beachings, which can be a complex event. But Davis said the larger sample will allow researchers to look at more brains. They also plan to examine more parts of the dolphins' brains. Davis said they expect to complete the next study in a year. In the meantime, he said the team hopes to draw attention to the health risk posed by algae blooms, especially in Florida.

"The BMAA topic is a relatively new one and a lot of people don't know about it." he said. *"We're trying to find out what the long-term effects are. We hypothesize at least neurological degeneration and we have pretty good models that suggest that. But we just want to let people know of this toxin."*

Toxins produced by blue-green algae have been found in dolphins that turned up dead in Florida waters after a 2018 red tide that coincided with a blue green algae bloom.

Communications with KIPT and their forest managers P F Olsen on matters related to chemical usage have proved essentially fruitless due to the fact they are not able to say what chemicals have been used in the past but can categorically state what hasn't been used - a very strange but convenient position for them to adopt!

These communications are detailed in **"Personal Commmunications"** - emails from Mr Sergeant and David Bennett, PF Olsen (Aust) Pty Ltd dated November and December 2018.

Contact was made with agents who had provided chemicals to the early plantation management at the time of their planting and resulted in the following information:

Facebook "Messenger" Messages from Vic Lodge regarding Plantation sprays

Feb 7th 2019

"Hi Phyll & Tony, just talking to someone who did a small amount of spraying for Great Southern & he said he used Clomac (active ingredient is Clopyralid). Cheers Vic

They have been using Glyphosate, Atrazine & Aly on their fire breaks."

The following information about **Clopyralid** is cause for concern.

- **Reference - Article / Paper / Fact Sheet 12:**

Signal: Danger
GHS Hazard Statements
Aggregated GHS information provided by 192 companies from 5 notifications to the ECHA C&L Inventory. Each notification may be associated with multiple companies.

H318 (99.48%): Causes serious eye damage [Danger Serious eye damage/eye irritation]
H410 (24.48%): Very toxic to aquatic life with long lasting effects [Warning Hazardous to the aquatic environment, long-term hazard]
H411 (15.62%): Toxic to aquatic life with long lasting effects [Hazardous to the aquatic environment, long-term hazard]

Information may vary between notifications depending on impurities, additives, and other factors. The percentage value in parenthesis indicates the notified classification ratio from companies that provide hazard codes. Only hazard codes with percentage values above 10% are shown.

Precautionary Statement Codes
P273, P280, P305+P351+P338, P310, P391, and P501
(The corresponding statement to each P-code can be found here.) *from European Chemicals Agency (ECHA)*

Clopyralid

PubChem CID:	15553
Chemical Names:	1702-17-6; 3,6-Dichloropicolinic acid; CLOPYRALID; 3,6-Dichloropyridine-2-carboxylic acid; 3,6-Dichloro-2-pyridinecarboxylic acid; Lontrel More...
Molecular Formula:	$C_6H_3Cl_2NO_2$ or $(C_5H_2N)Cl_2COOH$
Molecular Weight:	191.995 g/mol
InChI Key:	HUBANNPOLNYSAD-UHFFFAOYSA-N
Substance Registry:	FDA UNII
Safety Summary:	Laboratory Chemical Safety Summary (LCSS)

Clopyralid is an organochlorine pesticide having a 3,6-dichlorinated picolinic acid structure. It has a role as a herbicide. It is a member of pyridines and an organochlorine pesticide. It derives from a picolinic acid.

NSW Government SafeWork NSW

- **Reference - Article / Paper / Fact Sheet 13:**

"Be aware: Glyphosate and organophosphates - fact sheet"

"Based on a review of current research evidence, the International Agency for Research on Cancer (IARC), an agency under WHO, upgraded the carcinogenic status of the herbicide glyphosate and the pesticides malathion and diazinon.

The World Health Organisation (WHO) in March 2015 found sufficient evidence to re-classify the carcinogenicity of glyphosate (commonly known as Roundup) and four organophosphate pesticides (malathion, diazionon, tetrachlorvinphos and parathion).

New findings

Based on a review of current research evidence, the International Agency for Research on Cancer (IARC), an agency under WHO, upgraded the carcinogenic status of the herbicide **glyphosate** and the **pesticides malathion and diazinon** from 2B carcinogens (a possible carcinogen) to 2A carcinogens (a probable carcinogen). The pesticides tetrachlorvinphos and parathion were classified as possibly carcinogenic to humans (Group 2B).The IARC findings are reported on its Monograph 112 available on www.monographs.iarc.fr/ENG/Monographs/vol112

Regulator response

In November 2015 the Australian Pesticides and Veterinary Medicines Authority (APVMA), the registering authority for agricultural chemicals and veterinary medicines, explained the IARC assessment on its web site. The APVMA is now examining the IARC's full monograph in collaboration with the federal Department of Health's Office of Chemical Safety to determine any necessary regulatory action including whether glyphosate should be formally reviewed in Australia. The APVMA advises glyphosate products users to follow label instructions and that based on current risk assessments provides adequate protection for users.

Industry response

Manufacturers and importers should update the carcinogen information on the safety data sheets (SDS) as a precautionary approach to convey delayed health effects and provide any additional health and safety information required.

What you should do

If you use these chemicals, obtain the latest information and conduct a risk assessment on their use. Use the hierarchy of control to develop safe work methods and avoid exposure.

Before purchase and use, ask yourself

- Can I eliminate these hazardous chemicals with other methods of pest control, for example integrated pest management approaches like mechanical slashing or hand weeding?
- Can I substitute with safer chemicals for example, substituting non-biodegradable with biodegradable pesticides? (Organophosphates can be substituted with available pyrethroids.)
- Are my pesticides registered in Australia for approved purposes?
- Have I read the labels and followed instructions, and am I using pesticides at approved doses?
- Have I read the Safety Data Sheets (SDS) for health and safety information and stored my chemicals according to SDS advice?
- Am I using the right personal protective equipment (PPE) as per the SDS?
- Am I using the most appropriate application system to reduce my risk of exposure?
- Have I considered possible routes of pesticide exposure and contamination and washed my hands thoroughly? For example, cross contamination can occur through air, water soil, food and clothes.
- Have I got emergency and safety equipment on hand ready to use?
- Can my workers quickly access emergency contact details?

If you are worried about any possible health effects when using these pesticides, talk to your employer or consult your doctor. Smoking and poor hygiene practice can increase your risk of exposure to pesticides.

Organophosphate pesticides and health monitoring regulatory requirements

The Work Health and Safety Regulation 2017 lists 14 chemicals for which health monitoring must be undertaken if a worker is regularly using them. This list includes organophosphate pesticides. Further information is available in Safe Work Australia's Health Monitoring for Exposure to Hazardous Chemicals Guide for Workers. **https://www.safework.nsw.gov.au/home**

New findings

Based on a review of current research evidence, the International Agency for Research on Cancer (IARC), an agency under WHO, upgraded the carcinogenic status of the herbicide glyphosate and the pesticides malathion and diazinon from 2B carcinogens (a possible carcinogen) to 2A carcinogens (a probable carcinogen). The pesticides tetrachlorvinphos and parathion were classified as possibly carcinogenic to humans (Group 2B).The IARC findings are reported on its Monograph 112 available on www.monographs.iarc.fr/ENG/Monographs/vol112

Similarly **Pyridine** as a component of other sprays used.

"Pyridine is a clear liquid with an odor that is sour, putrid, and fish-like. It is a relatively simple heterocyclic aromatic organic compound that is structurally related to benzene, with one CH group in the six-membered ring replaced by a nitrogen atom. Pyridine is obtained from crude coal tar or is synthesized from acetaldehyde, formaldehyde and ammonia. Pyridine is often used as a denaturant for antifreeze mixtures, for ethyl alcohol, for fungicides, and as a dyeing aid for textiles. It is a harmful substance if inhaled, ingested or absorbed through the skin. In particular, it is known to reduce male fertility and is considered carcinogenic. Common symptoms of acute exposure to pyridine include: headache, coughing, asthmatic breathing, laryngitis, nausea and vomiting. -- Wikipedia.

Metabolite Description from Human Metabolome Database (HMDB)

Pyridine is a colorless liquid with an unpleasant smell. It can be made from crude coal tar or from other chemicals. Pyridine is used to dissolve other substances. It is also used to make many different products such as medicines, vitamins, food flavorings, paints, dyes, rubber products, adhesives, insecticides, and herbicides. Pyridine can also be formed from the breakdown of many natural materials in the environment.

Hazards Summary from CDC-ATSDR Toxic Substances Portal

- **Reference - Article / Paper / Fact Sheet 14:**

Atrazine is another of the chemicals in question as part of the regime.

"Atrazine in Water Tied to Hormonal Irregularities."
https://www.scientificamerican.com/article/atrazine-water-tied-hormonal-irregularities/
Nov 28, 2011

"Women who drink **water** contaminated with low levels of the weed-killer **atrazine** may be more likely to have irregular menstrual cycles and low estrogen levels, scientists concluded in a new study."

These are chemicals we are aware have been used, all of which have **impacts on aquatic environments.**

Their potential impacts upon marine flora and fauna are unknown but given they are basically anti proliferative growth inhibitors it is difficult to believe they won't have negative impacts.

The residual nature of any chemicals used is totally unknown and needs further exploration.

- **Reference - Article / Paper / Fact Sheet 15:**

"Herbicide Residues in Soil and Water"

SMARTtrain Chemical Note   Mark Scott NSW DPI.

***"Some herbicides have long residual*.**

The residual is NOT the same as the half-life. Although the amount of chemical in the soil may break down to half the original amount rapidly, what remains can be persistent for long periods."

Other documents talk in terms of possible **residual characteristics of 20 years+.**

This is of major concern!

There is also **concern regarding the early life of the plantations.**

Tasmanian blue gum *Eucalyptus globulus* is known for undergoing foliage change early in its lifecycle. When in a juvenile form it has ovate glaucous leaves which are attractive to insects and require spraying with pesticides to ensure they can survive until they grow their adult phase long green lanceolate leaves.

We have no way of knowing what happened in the KIPT plantations so many years ago, but realising some of the possible chemicals used are now known to be incredibly toxic, **extreme caution is required**.

In actual point of fact the eucalypts used in the KIPT plantations *E globulus* and *E nitens* are known to be **toxic in their own right**.

This given their exotic nature on KI this is cause for alarm.

- **Reference - Article / Paper / Fact Sheet 16:**

"Eucalyptus Globulus"   Bugwoodwiki

ALLELOCHEMICALS

“Most mature, undisturbed stands of *E. globulus* are virtually devoid of herbaceous annual species in the forest understory. This may be due to the inhibiting effects of Eucalyptus toxins present in the thick accumulation of Eucalyptus leaf litter underneath these stands. This assertion is supported by the fact that annual herbs gradually begin to appear and increase in height and density with increasing distance from the stand, in inverse correlation with the density of Eucalyptus leaf litter. However, there is also a paucity of herbs under mature trees which are well trimmed and cleared from litter periodically, suggesting that "while litter is an important source of toxins in some Eucalyptus species, it is not necessary to the development or maintenance of herb inhibition in the case of *E. globulus*".

Del Moral and Muller (1969) also investigated the transfer of the Eucalyptus herb-inhibiting toxins to the soil by fog drip. The evidence presented in their report indicates that *"natural fog drip from E. globulus inhibits the growth of annual grass seedlings in bioassays both on sponges and in soil and suggests that inhibition occurs under natural conditions."* The fog drip is known to contain several physiologically active components in significant concentration, including P-consiaryfumic chlorogenic and gentisic acids. The authors conclude that in *Eucalyptus globulus "toxin transfer by fog drip alone is capable of severely inhibiting the growth of annual herbs."*

The authors emphasized, however, that *"toxic fog drip is only one of several mechanisms present in Eucalyptus species capable of producing herb growth inhibition."*

Other mechanisms mentioned include:

(1) the leaching out in quantity of toxic phenolic acids from leaf litter by rain and

(2) volatilization of terpenes from leaves and subsequent re-adsorption of the terpenes by soil colloids (soil in this condition is highly inhibitory to germinating seedlings).”

- **Reference - Article / Paper / Fact Sheet 17:**

Further information with respect to **E Nitens and its toxicity** is included in the following report by GHD environmental consultants for Forico Pty Ltd.

“Overview of Report into Eucalyptus nitens - Impacts on River Health”

GHD Environmental Consultants

“A report has been prepared for Forico Pty Limited by GHD environmental consultants to support the Company’s commitment to sustainable forest management principles. This information is a brief summary of that report to provide a high level overview of the outcomes. The report focused on the George River Catchment and addressed the following areas:

• A review of the likelihood of toxins from Eucalyptus nitens (E nitens) leaf extracts being present in the George River in concentrations sufficient to cause adverse environmental impacts; and

• Comparison of catchments with similar properties to that of the George River in Tasmania to identify any evident correlations between plantations and river health.

Leaf Extract Toxicity and Pathways

The likelihood of toxins from E.nitens plantations being present in the George River in concentrations sufficiently high to cause adverse environmental harm was investigated in the report. The presence of toxic metabolites in eucalypt leaves was found to be well documented; however, their ability to enter waterways and cause adverse environmental harm was deemed unlikely due to their lipophilic nature and method of natural degradation during transport pathways."

- **Reference - Article / Paper / Fact Sheet 18:**

"Possible toxicity *Eucalyptus nitens*"

Wikipedia

"Extracts from *Eucalyptus nitens* leaves have been found to be toxic to mollusc larvae. However, this study did not compare the toxicity of *Eucalyptus nitens* with other species and it is not known if it is any more or less toxic than other eucalypts. Eucalyptus oil, which is extracted from the leaves of eucalypts, is known to be toxic and have antiseptic properties."

This study goes on to conclude there is no impact upon human health in the St George situation but it is dealing with aquatic systems. The possible impacts on molluscs in a marine environment is completely unknown but given research now shows toxicity adheres to the ubiquitous plastics known to be in all marine environments the **likelihood of negative impacts is high**.

As molluscs are a prey species for dolphins **bioaccumulation issues are paramount**.

Introduction to the water column of such toxicity is problematic in that it will be constant, accumulative and invasive in its impacts.

The actual **possible impacts of the dust generated** as part of the unloading of the woodchips to the conveyor belt and its **potential to introduce toxicity and pathogens to the marine environment**, and indeed to the **terrestrial environment** with consequent **human impacts** is extremely high.

This aspect is **inadequately dealt with in the EIS** and no real forms of mitigation suggested.

The potential impacts are clearly demonstrated in the extract from the following report.

- **Reference - Article / Paper / Fact Sheet 19:**

"Weatherwax Golf Course"

National Institute for Occupational Safety and Health. Gary M. Liss, M.D., M.S. MIDDLETOWN, OHIO Clifford Moseley, C.I.H 1984 I~

“On June 23, 1983, the National Institute for Occupational Safety and ·Health (NIOSH} received a request from the Middletown, Ohio Health Department to investigate an outbreak of acute respiratory illness among workers ·who had unloaded a truck filled with wood chips at the Weatherwax Golf Course near Middletown. NIOSH investigators commenced an environmental/medical survey later in the same day. The NIOSH investigators inspected the unloading site and collected samples of wood chips and dust for culture of organisms. They also interviewed all 11 employees (5 ill; 6 well) who had contact with the chips; reviewed records of medical examinations and laboratory tests; and obtained serum samples for determination of precipitating antibodies against fungal anti gens, including any organisms grown from the wood samples.

The chips at the back of the 'truck had appeared (to the workers) fresh and loose while those at the front had been older and were clumped together. Conditions 'were reported to have been very dusty in the truck during the shovelling. The NIOSH investigators observed strands of fungi at the front of the truck. Moderate quantities of a large number of fungi grew from the wood chips, including species of Thermoactinoll\Yces, Aspergillus, Mucor, and Candida but there did not appear to be qualitative differences in types of organisms or in amount of growth between samples from the back and those from the front of the truck.

Five employees (the ones already known to have been ill) reported experiencing five or more of the following six symptoms: weakness, cough, difficulty breathing, fever, chest tightness and headache. All five had worked directly unloading the front part of the truck on the afternoon of June 21 while none of the other six workers had performed the unloading during that time period (p=0.002, Fisher's exact test, one-tailed). The median interval to onset of 'symptoms after performing the unloading was approximately 13 hours. All five workers recovered within three days. The precipitating antibody studies showed that there were no diagnostically meaningful serological responses. Although the history was superficially compatible with hypersensitivity pneumonitis, the time, course of onset, ' the duration of symptoms, the fact that this was probably the first major exposure of these workers to mouldy dust, and the lack of antibody responses, argue against this diagnosis. This outbreak may represent an episode of pulmonary mycotoxicosis, a toxic reaction due to inhalation of large amounts of fungi.

Based on the results of this evaluation, NlOSH concluded that **a 'health hazard existed at the time of unloading the wood chips at Weatherwax Golf Course in June 1983.”**

- **Reference - Article / Paper / Fact Sheet 20 :**

“Tassal blasts Dover woodchip mill proposal as potential 'health risk' to farmed salmon”

Ellen Coulter and Stephen Pigram 24 May 2018

Tassal has said it is "reaching out to the developer to work through our concerns".
(Facebook: Tassal Our Community)

“Plans for a controversial woodchip export facility in southern Tasmania have hit a major snag, with the state's biggest salmon producer declaring the plant cannot operate so close to its fish farms.

A map, released by Far South Future, purportedly showing the proximity of the loading facility to Tassal's salmon leases. (Facebook: Far South Future)

Tassal's head of engagement Barbara McGregor said the company had been meeting with the proponent Southwood Fibre since last year, but was adamant the two operations could "simply not co-exist" within the proposed footprint at Port Esperance — with Tassal having no intentions to relinquish the site.

"The health of our fish is paramount, and we would have concerns from a biosecurity perspective with the proposed development operating so close to our lease," Ms McGregor said.

The $42 million Strathblane project by Southwood Fibre parent company Neville-Smith Group includes an onshore loading facility and amenities, woodchip pile site, access roads and a ship loading conveyor belt to transport the woodchips to waiting bulk carrier ships, which would dock between the shore and Tassal's lease areas. Southwood Fibre have said it expects the completed Strathblane facility would be host to 11 ships per year, or one approximately every four-and-a-half weeks.

Ms McGregor said Tassal required further information about the project and said *"we are reaching out to the developer to work through our concerns in person".*

She said Tassal was *"deeply committed"* to Dover and would pass any new information it received from Southwood Fibre to the local community, some of who have voiced serious concerns about the woodchip facility, which was given Crown consent by the Department of Primary Industries, Parks, Water and Environment this month, which allows it to lodge a development application with Huon Valley Council. The proposal also has to be approved by the Environment Protection Authority and will go through a public consultation process.

GREENS CONCERN OVER FOREIGN BALLAST DISCHARGE

Tasmanian Greens marine environment spokeswoman Rosalie Woodruff said she was pleased to see Tassal coming out in support of its 427 workers in the Dover region.

"These are existing jobs in Dover that are essential to the livelihoods of those families and to the whole community in the far south," Ms Woodruff said. *"The proposal for the woodchip export port does involve spraying woodchips on to the back of ships and is right next to, or on top of, the lease area of Tassal."*

She said that during the loading procedure, the bulk carriers would need to discharge ballast waters, which would have been brought to southern Tasmania from foreign waterways.

"There's no way that this proposal cannot have an impact on biosecurity."

She said Southwood Fibre had held a public meeting in Dover and made much of being open to consultation, but *"after that, they slammed the door shut".*

"They clearly realised that there were so many questions, that the community was so well informed ... I think they just bolted."

On their website, Southwood Fibre lists a number of what it describes as "key concerns" of residents, including the impact on local property prices, tourism and traffic, as well as questions over employment, biosecurity and the effects of the project on aquaculture and local species, including the endangered swift parrot. Southwood Fibre has said 117 jobs would be created at the loading facility during construction and 18 jobs at the timber processing plant during the two-year construction period. It said once operational, 145 jobs would be "supported by the project and contribute some $55.18 million in additional value to the local economy"."

CONCLUSION

In the Commitments Section of the EIS Pg.27 16.5.2 KIPT comment *"there will be no discharge of leachate to surface water or groundwater"*. They talk about impermeable bases but then go on to talk about settling ponds etc.

They have not detailed how they will prevent seepage into groundwater which will **deliver toxic leachate into the marine environment**. This, together with airborne toxicity discussed elsewhere, shows clearly that toxicity will be introduced to the marine environment and will impact at all trophic levels.

It will accumulate and as a result bioaccumulate in marine organisms.

The effects of dredging and the resultant silt plumage will not only directly impact upon the seagrass actively destroyed. The ongoing smothering of further seagrass via maintenance dredging and vessel movements together with the toxicity introduced will lead inevitably to situations of anoxia with resultant algal bloom impacts.

The potential impacts are devastating as detailed in the Toxicity section above.

Kangaroo Island / Victor Harbor Dolphin Watch

in partnership with

Whale and Dolphin Conservation

www.kangarooislanddolphinwatch.com.au www.islandmind.com
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May 27th 2019

Kangaroo Island Plantation Timbers Environmental Impact Statement Response

WHALES and DOLPHINS

On page 247 of the EIS it is stated:

"Genetic studies suggest that the south-western population includes WA and SA, and the south eastern population encompasses Victoria, Tasmania and NSW, and that there may be some level of inter-breeding between the two groups (Carroll et al. 2011). The work by Carroll et al. (2011) specifically includes samples from Encounter Bay, near Victor Harbor, in its South-western population. It is possible therefore that the SA population of southern right whales may to at least some degree be part of the faster-growing south-western population, the implication being that the loss of a single whale would be a less significant issue at a population level."

This is quite simply wrong.

The concerns raised by the DoEE regarding the situation facing Southern Right whales are very real given the following expert advice:

"Scientists understand that Eyre Peninsula is roughly the boundary between the south-eastern and south- western populations. We would expect the Smith Bay whales to be predominantly from the south-eastern population." Dr Cath Kemper – SA Museum Curator of Mammals (Pers. Comm.).

Dr. Kemper is considered the leading expert in the field of Cetacean research in SA and her understandings were supported by other luminaries including Dr. Claire Charlton, head of the Great Australian Bight Right Whale Study and Dr Rebecca Pirzl CSIRO, a lead author on the Conservation Management Plan for the Southern Right Whale 2011-2021.

The proponents further state:

"There is no evidence that Smith Bay is an important site for southern right whales."

A failure to report sightings by local residents does not mean there has not been long term occupation of the site.

The following evidence refutes this.

- **Reference –Appendix 1:**

"Cetacean Sightings MASTER Summary Smith Bay KI May 25th 2019"

Kangaroo Island / Victor Harbor Dolphin Watch May 25th 2019

There are also other sources of information not referenced including:

Marine Mammals of Gulf St Vincent, Investigator Strait and Backstairs Passage by Kemper, Bossley and Shaughnessy 2008 which could have produced further information with respect to a proposal such as this. Although dated, it provides valuable information especially with respect to the limitations on observations and greatly expands the number of species to be possibly affected.

The focus on a single species, while convenient for the proponents, may not tell the full story.

On Smith Bay beach there are the remains of a **Sperm whale *Physeter macrocephalus***

and given a number of Sperm whales stranded and died at Ardrossan in 2014, it is reasonable to assume they have passed through Investigator Strait not too distant from Smith Bay. As a deep diving, rarely seen species, they are quite likely to be impacted upon by the construction and shipping noises associated with this port. They are listed as rare in SA waters and vulnerable under IUCN listing. The same could be said for **Beaked whales *Ziphiidae*** yet no mitigation on possible impacts to these species has been proffered.

Four species are classified by the IUCN as "lower risk, conservation dependent":

- **Arnoux's and Baird's** Beaked whales
- **Northern and Southern Bottlenose** whales

The **status** of the remaining species is unknown, preventing classification.

In line with best global practice one would look to the use of **Passive Acoustic Monitoring technologies** to ensure safety for the marine mammals likely to be affected. The potential effects of anthropogenic noise are at least partially explained in the following article on recent research.

- **Reference - Article / Paper / Fact Sheet 1:**

"Heart monitors on wild narwhals reveal alarming responses to stress"
Tim Stephens December 2017
https://news.ucsc.edu/index.html

"As sea ice melts, new findings add to concerns about **the effects of ocean noise and increased human activity on deep-diving Arctic whales.**

Terrie Williams, a professor of ecology and evolutionary biology at UC Santa Cruz who has studied exercise physiology in a wide range of marine and terrestrial mammals. Williams is first author of a paper on the new findings published December 8 in Science.

The extremely low heart rates that Williams observed in fleeing narwhals are similar to those seen in animals with a *"freeze reaction"*, one of two mutually exclusive responses animals can have to perceived threats, the other being a *"fight or flight"* response that revs up heart rate and metabolism. The narwhals, in their response to a stressful situation, seem to combine elements of a physiological freeze reaction with a behavioral flight reaction, with potentially harmful consequences.

"For terrestrial mammals, these opposing signals to the heart can be problematic," Williams said. *"Escaping marine mammals are trying to integrate **a dive response** on top of **an exercise response** on top of **a fear response**. This is a lot of physiological balancing, and I wonder if deep-diving marine mammals are designed to deal with three different signals coming to the heart at the same time."*

The same phenomenon may occur in other deep-diving whales when they are disturbed by human-generated noise in the oceans, which has been associated with strandings of deep-diving cetaceans such as beaked whales, she said.

"The disorientation often reported during strandings of deep-diving whales makes me think something has gone wrong with their cognitive centers," Williams said. *"Could this result from a failure to maintain normal oxygenation of the brain?"*

Excerpts from the following paper demonstrate the critical nature of the Southern Right whale situation.

- **Reference - Article / Paper / Fact Sheet 2 :**

"Right whales and vessels in Canadian waters"

S.S.Elvin, C.T.Taggart   Science Direct   Marine Policy 32 (2008) 379-386

"***The World Conservation Union (IUCN) Red List of Threatened Species*** identifies 62 species of cetaceans at various levels of risk of extinction

[1]. Factors contributing to the decline of global cetacean populations include shipping, historical and continued overexploitation, fisheries by-catch and habitat destruction

[2,3]. Random events such as ship-strikes, if sufficiently frequent, or if populations are sufficiently small, can lead to species extinction if left unabated

[4]. Special attention must be paid to the immediate population state and dynamic if extinction or other deleterious effects to a dwindling population are considered either irrational or simply undesirable. An examination of large whale population trends reveals that right whales (genus Eubalaena) are considered to be at the highest risk of extinction of all the large baleen whales

[5]. Although receiving partial international protection in 1935 by the League of Nations, the right whale has yet to fully recover from overexploitation

[6]. Three distinct species of right whales exist [7,8]: Eubalaena japonica (North Pacific right whale), Eubalaena australis (Southern right whale) and E. glacialis (North Atlantic right whale) with different ''populations'' ranging from a few to several hundred individuals

[7,9]. The International Whaling Commission (IWC) estimates nearly 300 E. glacialis individuals remain and recognizes that species recovery has been close to non-existent."

In the ***"Spencer Gulf Ecosystem and Development Initiative"*** research scientists Christopher Izzo and Bronwyn Gillanders estimated the numbers of the south-eastern Southern Right whale population to be 500.

In the 6-7 years since those numbers have decreased to less than 300 as reported in Equinor's EP currently under consideration by NOPSEMA.

We are therefore looking at a situation akin to that in Canada and possibly more dire.

It is fair to say the South-Eastern population of the Southern Right whale is the most endangered species of baleen whale in the world and bordering on extinction.

The Canadian situation gives fair warning as to where we are headed and the urgency of the situation. The comment, *"even one death a year is too much for the population to recover"*, questions KIPT's attempts to suggest it is not an issue because of their reframing of the south-western, south-eastern population scenario.

- **Reference - Article / Paper / Fact Sheet 3:**

"Time is Running Out to Save Right Whales"

Peter Baker & Katharine Deuel   April 25, 2019

"Key group expected to recommend rule changes to NOAA.

With a right whale population estimated at only 411, scientists calculate that even **one death a year is too many for the population to recover**. Unfortunately, experts recorded 17 deaths of right whales in 2017 alone. But scientists also have concluded that the species can recover if human-caused deaths are reduced.

This week, the Atlantic Large Whale Take Reduction Team, an advisory body of experts convened under the Marine Mammal Protection Act, is meeting in Providence, Rhode Island, to discuss what the National Oceanic and Atmospheric Administration (NOAA) should do to reduce right whale deaths.

Existing rules haven't sufficiently reduced serious injuries and deaths of right whales, prompting disagreement among representatives from industry, government, and the conservation community over how to update protections for the species. But the situation has grown critical, and **the time for debates and delay is over**."

Any government which approves a development which effectively removes or compromises a potentially Biologically Important Area and site of future colonisation would be foolish in the extreme.

To become complicit in an extinction event would not augur well at either a State or Federal level. The international opprobrium would be enormous especially given recent statements concerning an extinction crisis.

- **Reference - Article / Paper / Fact Sheet 4:**

"Maternal body size and condition determine calf growth rates in southern right whales"

F. Christiansen, F. Vivier, C. Charlton, R. Ward, A. Amerson, S. Burnell, L. Bejder 2018
https://doi.org/10.3354/meps12522

ABSTRACT:

"The cost of reproduction is a key parameter determining a species' life history strategy.

Despite exhibiting some of the fastest offspring growth rates among mammals, the cost of reproduction in baleen whales is largely unknown since standard field metabolic techniques cannot be applied. We quantified the cost of reproduction for southern right whales ***Eubalaena australis*** over a 3 mo breeding season. We did this by determining the relationship between calf growth rate and maternal rate of loss in energy reserves, using repeated measurements of body volume obtained from unmanned aerial vehicle photogrammetry. We recorded 1118 body volume estimates from 40 female and calf pairs over 40 to 89 d. Calves grew at a rate of 3.2 cm d^{-1} (SD = 0.45) in body length and 0.081 m^3 d^{-1} (SD = 0.011) in body volume, while females decreased in volume at a rate of 0.126 m^3 d^{-1} (SD = 0.036). The average volume conversion efficiency from female to calf was 68% (SD = 16.91).

Calf growth rate was positively related to the rate of loss in maternal body volume, suggesting that maternal volume loss is proportional to the energy investment into her calf. Maternal investment was determined by her body size and condition, with longer and more rotund females investing more volume into their calves compared to shorter and leaner females. Lactating females lost on average 25% of their initial body volume over the 3 mo breeding season.

This study demonstrates the **considerable energetic cost that females face during the lactation** period, and highlights the importance of sufficient maternal energy reserves for reproduction in this capital breeding species."

- **Reference - Article / Paper / Fact Sheet 5:**

"Concerns Related to Chronic Stress in Marine Mammals"

Andrew John Wright SC/61/E16. Wright et al.

ABSTRACT

"The management of marine mammals traditionally focuses on lethal takes, such as in bycatch, vessel collisions and strandings. However, we are beginning to realise that non-lethal impacts of human disturbance can also have serious conservation implications, indicating that mortality counts only reveal a fraction of the picture.

Possibly the most important of non-lethal (at least, not immediately lethal) impacts arises from the prolonged or repeated activation of the stress response. The physiological stress response is a life-saving combination of systems and events that essentially maximises the ability of an animal to kill or avoid being killed. However, "chronic stress" is linked to numerous conditions in humans, including coronary disease, immune suppression, anxiety and depression, cognitive and learning difficulties, and infertility.

How does this relate to marine mammals and their conservation? Growing human activity in the marine environment is increasing the frequency with which human disturbance triggers stress responses in cetaceans and other marine mammals and thus also the likelihood of inducing chronic stress. As noise travels further in water than air, marine mammals, like other marine fauna, will be exposed acoustically to human activity at much greater distances than terrestrial animals and may thus be particularly sensitive to chronic stress. Coastal species will be especially vulnerable due to the concentration of human activity in these areas.

Whalewatching may also be a particular concern because it specifically targets marine mammals. The possibility that endangered marine mammals might express the various conditions linked with chronic stress in humans has troubling implications for conservation efforts (especially Marine Protected Areas), demands management attention, and may explain, at least in part, why some species have not recovered after protective measures have been put into place. Keywords: stress, noise, whalewatching, sanctuaries, survivorship, reproduction

INTRODUCTION

Marine mammal management and conservation traditionally focuses on lethal takes, such as in bycatch, vessel collisions and strandings. Thus, the most widely known issue related to underwater sound is that of the plight of beaked whales exposed to military mid-frequency sonar, which are thought to react behaviourally at sound levels well below those thought to cause 'injury' (Hildebrand, 2005), in ways that ultimately cause the mortalities and mass strandings that have been highly publicised (Cox et al., 2006; Rommel et al., 2006; Tyack et al., 2006). However, there is increasing concern that non-lethal impacts of human disturbance could also have serious conservation implications, indicating that the mortality counts (which are themselves likely to be substantial underestimates: see Parsons et al., 2008) only reveal a fraction of the picture. Possibly the most important of non-lethal (at least, not immediately lethal) impacts arises from the prolonged or repeated activation of the stress response. The physiological stress response, which is highly conserved across species, is a life-saving combination of systems and events that essentially maximises the ability of an animal to kill or avoid being killed (for detailed reviews and further information see Deak, 2007 and Romero & Butler, 2007.) However, it is important to note that the goal of physiological stress responses is to survive the immediate threat, not necessarily to preserve functioning for distant periods into the future. The principle systems involved SC/61/E16. Wright et al. Concerns Related to Chronic Stress in Marine Mammals 2 are the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal (HPA) axis – both of which are activated immediately upon the perception of a threat by the animal. Within seconds, the release of adrenalin & noradrenalin (AKA epinephrine & norepinephrine) by the SNS produces numerous changes, including increases in heart rate, gas exchange and visual acuity, and a redistribution of blood to the brain and muscles and away from the stomach and other non-essential organs. Behavioural changes also result, most famously the "fight or flight" response. Meanwhile, a chain of hormones released through the HPA axis leads to the release of glucocorticoids (GCs) from adrenal cortex (e.g., cortisol, corticosterone, cortisone), usually within 3-5 minutes. These induce similar changes: an increase in blood glucose and suppression of non-essential activities, such as digestion, immune activity, growth, and reproduction, although the reproductive system can, in some reproductive contexts, become resistant to inhibition by GCs. Glucocorticoids can also alter behaviour in context-specific ways, such as inducing hiding or abandonment of an area; reproductive behaviour may also be suppressed. This suite of effects is thought to allow the animal to recover from a stressor by delaying functions that can be postponed until the danger has passed, as well as to prepare the animal for subsequent threats to survival. However, this response can become maladaptive when initiated too often or for prolonged periods. This state of "chronic stress" is linked to numerous conditions in humans, including coronary disease, immune suppression, anxiety and depression, cognitive and learning difficulties, and infertility (see Clark & Stansfeld, 2007, Romero & Butler, 2007). In addition, in utero exposure to GCs via the mother and/or through mothers milk to newborns has been shown to alter the stress response itself in these neurologically-vulnerable young, leading to life-long health and psychological problems (e.g., Kapoor et al., 2006).

STRESS RESPONSES IN MARINE MAMMALS

Marine mammals live increasingly in a world influenced by human action. We know that many marine mammals carry high levels of contaminant loads, which can have a range of consequences for them, potentially including a prolonged activation of the stress response (see reviews by Kakuschke & Prange, 2007 and Martineau, 2007). It is also highly likely that changes to habitat and prey abundance and distribution through various mechanisms ranging from both coastal and offshore development to the widespread influences of climate change will be, for certain species, detrimental and may induce stress responses as well (e.g., Stirling & Derocher, 1993). However, probably the most underestimated mechanism for inducing a (prolonged) stress response in marine mammals is that of human disturbance, of which underwater noise is likely to be an important component (e.g., Miksis-Olds et al., 2007). In addition to simply disturbing marine mammals, exposure to noise can have a range of other impacts (e.g., Nowacek et al., 2007; Weilgart, 2007) that can trigger stress responses in-and-of themselves. For example, masking – the obscuring of signal of interest to the animal by noise – can interfere with communication (including for mating), navigation and foraging as many marine animals have evolved to supplement or replace the ineffective use of vision underwater with hearing (Bradbury & Vehrencamp, 1998; Berta et al., 2006; Jensen et al., 2008). Furthermore, noise is a particular concern because it can travel large distances underwater, especially at low frequencies (Urick, 1983), which means the 'acoustic footprint' of human activities can be considerably larger than the area over which they actually occur. Shipping and Masking The classic example of an activity with an extensive acoustic footprint is that of shipping. There is increasing evidence that distant shipping, with some contribution from other human activities, has substantially increased low-frequency background noise throughout huge areas of oceans around the world – in some cases doubling in power each decade over the past 50 years (e.g., Zakarauskas et al. 1990; Andrew et al. 2002; Cato & McCauley 2002; McDonald et al. 2006). This increases the likelihood of signal masking and has unquestionably curtailed communication ranges quite dramatically in low-frequency users, such as the baleen whales (see Wright (ed.), 2008) and may also be having psychological impacts, such as causing anxiety (Bateson 2007).

Other species may also be masked nearer to shipping lanes where the higher frequency components of the noise remain above ambient, or by smaller craft that produce noise predominantly at higher frequencies (e.g., Jensen et al., 2008). SC/61/E16. Wright et al. Concerns Related to Chronic Stress in Marine Mammals 3 Seismic surveys and avoidance Another anthropogenic sound that can travel over ocean basins, at least on occasion, is that of airgun arrays, used primarily to detect oil and natural gas deposits under the ocean floor in seismic surveys (Nieukirk, et al, 2004). While less likely to mask signals of interest to marine mammals because of their short duration (although it may still occur – see Nieukirk, et al, 2004), their huge source levels and high rate of repetition (see Nieukirk, et al, 2004; Madsen et al., 2006 and references therein) does mean that exposure rates can be quite high. Marine mammals have been documented to exhibit a "startle" reaction in response to seismic surveys at reasonable distances (e.g., sperm whales at 2 km; Stone 2003), which is likely indicative of the initiation of a stress response. There have also been reports of avoidance of such surveys. For example, cetacean diversity off the coast of Brazil dropped from 1994 to 2004 during seismic survey operations, with a conspicuous decrease in 2000-2001 when there were a greater number of seismic surveys (Parente et al., 2007).

However, it is hard to determine exactly what such avoidance means to the animals concerned. It may represent a number of possible situations, ranging from the possibility that avoidance may have little cost to them (as might be expected if marine mammals slightly divert their migration routes) to an indication that the exposure is too unpleasant to remain in an area of particular importance despite their need to forage or breed there (see summary by Beale, 2007). Similarly, animals that remain in important areas may either be unaffected, or so dependent on the particular habitat, source of prey, or other resource that they remain despite the disturbance and/or acoustic assault, the latter of which may actually be the most stressful of the possibilities (Beale, 2007). Navy sonar and beaked whale strandings As mentioned above, beaked whales are thought to react behaviourally to military mid-frequency sonar at relatively low exposure levels in ways that can ultimately cause mortality and stranding (Cox et al., 2006; Rommel et al., 2006; Tyack et al., 2006). This hypothesis appears to be supported by the limited and preliminary, but direct data obtain in recent studies (Moretti et al., 2008; Tyack, 2008). This, like the startled sperm whales described above, is likely to indicate a flight reaction, allowing us to deduce that a stress response has occurred, although this response, in and of itself, is not likely to be responsible for the strandings (see Wright et al., 2007). Beaked whales might be particularly sensitive to exposure to all sorts of stressors because they are thought to be diving at their physiological limits (Tyack et al., 2006). Another possibility is that the effects of pressure on the central nervous systems of diving cetaceans may result in “hyperexcitability” of the nervous system, meaning that the extremely deep-diving beaked whales may exhibit a more intense behavioural response to sonar noise when at depth (Talpalar & Grossman, 2005). A further complication arises when the usual increase in the rate of gas exchange during a stress response is considered, as this presents a problem for an animal holding its breath, which may thus have the potential to become an additional stressor itself by inducing anxiety, hypoxia, or both.

Whalewatching and energy budgets

Concern over the possible effects of whalewatching on marine mammals has increased over recent years, especially as information about the long-term impacts are beginning to become available (see Lusseau & Bejder, 2007). Unlike the other activities discussed above, whalewatching actively targets marine mammals meaning that disturbance can, in some cases, reach quite high levels. Cetaceans may begin to avoid certain areas if the disturbance reaches a certain threshold or if there is little cost (see Lusseau & Bejder 2007). However, those that stay must contend with the consequences of the attention from whalewatching vessels, which can include, but are not limited to, feeding and resting disturbance, and masking (see SC61/WW1 for a review of recent studies). Remaining animals will often display local avoidance, which might be represented by increased travelling time and a decrease in time resting or foraging, as was observed in northern resident killer whales (Orcinus orca; Williams et al., 2006). Although this change led only to a relatively small (although not necessarily inconsequential) estimated increase in energetic demands of 3%, it also led to an estimated reduction in energetic intake of 18% (Williams et al., 2006). These figures represent minimum estimates, as they do not include any costs associated with an active stress response (physiological or psychological). For example, the increase in heart rate observed in kittiwakes (Rissa tridactyla) in association with chronic human disturbance carried metabolic costs that led to an estimated increase of 7.5 to 10% in daily energy expenditure for some individuals (e.g., Beale, 2004).

CUMULATIVE EXPOSURES AND THE CONSEQUENCES OF CHRONIC STRESS SC/61/E16. Wright et al. Concerns Related to Chronic Stress in Marine Mammals 4 The potential for noise exposure alone to lead to chronic stress and the associated array of consequences and conditions has been studied in other species. For example, adverse health consequences related to chronic stress have been reported in humans that live near airports or busy roads (see Clark & Stansfeld, 2007). It should be noted, however, that these latter examples may include a combination of noise-related disturbances as well as toxicant exposure, since jet fuel and automobile exhaust can serve as chemically-based stressors in and of themselves that adversely impact the effects of noise exposure (Fechter et al., 2007). In other studies, a modest increase in continuous background noise may have caused a significant reduction in growth and reproduction in brown shrimp (Lagardère, 1982; Régnault & Lagardère, 1983). Similarly, studies in rats have demonstrated that noise can trigger a stress response at levels of exposure below those that induce observable behavioural reactions (Baldwin, 2007). Indeed, exposure to noise in the laboratory is a commonly used method for evoking stressrelated changes in behaviour and physiology across taxonomic orders (Masini et al., 2008; Saltzman et al., in press). Thus, the above activities, along with a plethora of others, have the potential to induce a state of chronic stress in marine mammals if the exposures are of sufficient intensity, duration and frequency. This eventuality is more likely if the exposed animals are already undergoing stress responses due to one or more of the many other potential threats to cetaceans, such as persistent pollutants, habitat degradation, reduction in food availability, other noise sources, etc. (Reeves & Ragen, 2004). Generally of greatest concern to managers are those effects that detrimentally alter survivability or fecundity, such as the physiological suppression of the immune system and the behavioural and physiological suppression of the reproduction.

1 MANAGEMENT IMPLICATIONS But what does all this mean for the management of marine mammal populations? Growing human activity of any kind in the marine environment is increasing the rate at which marine mammals are exposed to disturbance and other stressors and thus also the likelihood of inducing chronic stress. As noise travels further in water than air and stress responses may be triggered at levels below those at which behavioural reactions are induced and/or observed, this may be a particular problem for marine mammals. Furthermore, the potential exists for the various conditions linked with chronic stress in humans to lead to an unobserved decline in abundance without observable fatal impacts. This has very obvious implications for area-based mitigation efforts, such as Marine Protected Areas (MPAs), which are not usually large enough to provide effective shelter from anthropogenic noise for marine mammals (see Agardy et al., 2007 and references therein). Marine human activities are concentrated in coastal regions, which means that chronic stress may be increasingly likely to occur in coastal species. Similarly, extreme breathholding and pressure-related hyperexcitability might make deeper diving species more susceptible to detrimental consequences once exposed. Many MPAs exist in coastal areas, and their effectiveness at preventing disturbance within their boundaries would be reliant upon the establishment of buffer zones around those boundaries. Management of human activities within the buffer zone would then need to consider the acoustic footprint of those activities, and not just their physical location, to prevent potentially disruptive levels of sound from entering the boundaries of the MPA itself. Likewise, activities that produce high-levels of sound or sounds with sharp rise times should be highly restricted in areas where deep-diving species, such as beaked whales, are abundant given their particular sensitivities and the potential for adverse impact. The reproductive system can become resistant to such inhibition,

such as when the benefits of maintaining the reproductive efforts outweigh the costs of not responding to the stressor in terms of fitness. One example might be when an older mother's potential for future reproductive opportunities is limited and she 'decides' to continue her reproductive efforts despite the presence of a stressor. However, in that case the total number of offspring that female may have produced in her lifetime might still have been reduced in the face of chronic stressor exposures. In any case, the susceptibility of reproduction to inhibition by the stress response is highly contextspecific and depends upon age, sex, stage of the breeding cycle, etc (Wingfield & Sapolky, 2003; Romero & Bulter, 2007). SC/61/E16. Wright et al. Concerns Related to Chronic Stress in Marine Mammals 5 population structures and abundances, which would make observing any population-level impacts near impossible.

The targeted nature of whalewatching presents a particular challenge since such exclusions will be immediately detrimental to the industry. However, they may indeed be necessary for the protection of the animals, as well as scientific inquiry and public awareness, at least in the short-term, until quieter vessels are introduced and/or operational guidelines specifically to reduce acoustic disturbance can be developed and disseminated. In any case, these measures will not eliminate the disturbance cause by the presence of the vessel itself. Land-based operations are highly recommended, but not always viable. Other options include permitting or licensing systems and zones of temporal or spatial exclusion where animals may at least get some respite from vessels.

CONCLUSIONS

Much uncertainty exists on the issue of noise-induced stress responses (and even in our understanding of how sound propagates underwater; e.g., Madsen et al., 2006), but the potential for serious and possibly multigenerational impacts in marine mammals merits immediate and appropriate management action. In this regard, the International Maritime Organisation should be commended for recently taking steps to address the contribution of shipping to low-frequency ambient noise because of concerns over the impacts on cetaceans, especially baleen whales. We recommend that other management regimes and organisations consider similar actions with regards to reducing the introduction of human-generated sound from other activities into the ocean whenever possible and suggest that MPA managers consider acoustic buffer zones to limit the potential for chronic stress within their boundaries. Most studies investigating the impacts of noise on cetaceans (e.g., whalewatching disturbance) tend to investigate behavioural changes (e.g., see SC61/WW1; SC60/WW1; SC59/WW1). Many of these studies give little enlightenment as to the life history impacts of noise on cetaceans. Due to the potential for chronic stress to detrimentally alter critical life history parameters (e.g., disease susceptibility, reproductive rates, mortality rates), we suggest that the IWC highlights the importance of investigating stress responses, chronic stress and their effects in cetaceans. We also suggest that the IWC highlights the need for investigations of the cumulative and synergistic impacts of multiple stressors (e.g., noise, prey depletion, chemical pollution) upon the demographic rates of cetacean stocks and populations.

Considerations of the Effects of Noise on Marine Mammals and other Animals – Special issue of the International Journal of Comparative Psychology, volume 20(2-3), that resulted from the 2007 Stress Workshop – is available for download free of charge at: http://www.comparativepsychology.org/."

Why then do Southern Right whales favour Smith Bay?

Is it because of the favourable conditions, the somewhat sheltered nature, the shallow waters, the rocky shore, the safety offered, or is it even more complex and indicative of the part to be played by genetic memory – going back to the place where they were born?

Perhaps there are also other factors in play as demonstrated in the following paper by Roni Dengler which concerns **Bowhead whales** "rubbing" on rocky ledges and shores.

Given information provided by David Connell concerning whale behaviours at Smith Bay, perhaps we are seeing a parallel situation.

- **Reference – Appendix 2:**

"Whales of Smith Bay Kangaroo Island" David Connell January 8th 2019

Only further research will show whether this is the case but for now it is a question which begs asking. Why?

- **Reference - Article / Paper / Fact Sheet 6:**

"Watch these whales exfoliate their way to healthy skin—by rubbing on rocks"

Roni Dengler Science Magazine November 22, 2017

"When marine biologist Sarah Fortune spotted **bowhead whales** rolling onto their backs in coastal waters near Canada's Baffin Island several summers ago, she was baffled.

The Ph.D. student at the University of British Columbia in Vancouver, Canada, knew that these arctic mammals rarely hang out in warm, shallow waters. And with few zooplankton around, they couldn't have been in the bay to eat. So a few years later, Fortune and colleagues returned with a camera-equipped aerial drone to find out more.

Their first clue was the whales' unusual mottled skin and scratches along the length of their bodies. When the drone returned, they had their answer: Video recordings had captured the whales engaging in an impromptu exfoliation session, rubbing their chins, heads, backs, and sides against the large rocks. One bowhead was rubbing away for at least 8 minutes.

Together with still images and a skin biopsy, the researchers conclude that these bowhead whales **use rocks to rub away sloughing and molting skin**, they report today in *PLOS ONE*. Though this is the first time scientists have seen this behavior in bowheads, other arctic whales—such as belugas—have been seen grooming themselves along abrasive bottom surfaces in Hudson Bay estuaries.

One benefit to this annual skin cleansing? It might help the long-lived animals rid themselves of sun-damaged skin and parasites, the researchers say."

CONCLUSION

The situation facing the South-Eastern population of the Southern Right whale is the most critical facet to be dealt with in relation to MNES under the EPBC Act 1999.

The proponents have chosen to try to rewrite scientific understandings of the status of these mammals to minimise their responsibilities for appropriate consideration and development of mitigation strategies. This does them no credit.

The possible impacts of the loss of a single member of this population cascading into an extinction event are very real given there are estimated to be less than 300 left (Equinor EP 2019 Page 304).

The underwritten attitude to almost all matters regarding the marine environment in the EIS is the same in almost all instances..... *there's plenty of similar habitat nearby*.

<u>This is not a reality as our submission clearly shows.</u>

Attendance to the Conservation Management Plan for the Southern Right Whale 2011-2021, is necessary as Smith Bay is an area of consistent visitation, breeding and resting during the whale season. It is emerging as a site of possible recolonisation following the decimation of the population as a result of whaling and as such is emerging as a Biologically Important Area for Southern right whales.

All this has been explained to the proponents but has fallen upon deaf ears. One can only surmise why.

The impacts of changes to water quality will be detrimental to marine mammals, particularly given their susceptibility to matters of bioaccumulation and consequent health impacts. The only mitigations by way of use of observers and soft start procedures are totally inadequate and the soft start is likely to be detrimental in its own right, in that it will **actively displace the whales from habitat critical to their welfare and projected recovery.**

<u>Such is the importance of Kangaroo Island's North Coast, and Smith Bay in particular, the area has been nominated to the IUCN as an **Important Marine Mammal Area** for designation in 2020.</u>

Communications from co-chairs of the IMMA'S task force, Erich Hoyt and Giuseppe Notarbartolo di Sciara, indicate this designation is under consideration and given the importance of the habitat to dolphins and whales, this status is highly likely to be conferred.

<u>**The possibilities for economic capitalisation** upon this are huge and will only be realised if Smith Bay and its adjoining habitats remain intact and unsullied.</u>

Kangaroo Island / Victor Harbor Dolphin Watch

in partnership with

Whale and Dolphin Conservation

www.kangarooislanddolphinwatch.com.au   www.islandmind.com
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May 27th 2019

Kangaroo Island Plantation Timbers Environmental Impact Statement Response

NOISE and STRESS

Ever since the Rolland study in the Bay of Fundy following 9/11 and the cessation of shipping caused a marked decline in the stress levels of whales as shown by stress hormones in their faeces, **scientists have understood the impacts of anthropogenic noise in the marine environment.**

- **Reference - Article / Paper / Fact Sheet 1:**

"Evidence that ship noise increases stress in right whales"

Rosalind M. Rolland

https://doi.org/10.1098/rspb.2011.2429

Abstract

"Baleen whales (*Mysticeti*) communicate using low-frequency acoustic signals. These long-wavelength sounds can be detected over hundreds of kilometres, potentially allowing contact over large distances. Low-frequency noise from large ships (20–200 Hz) overlaps acoustic signals used by baleen whales, and increased levels of underwater noise have been documented in areas with high shipping traffic. Reported responses of whales to increased noise include: habitat displacement, behavioural changes and alterations in the intensity, frequency and intervals of calls. However, it has been unclear whether exposure to noise results in physiological responses that may lead to significant consequences for individuals or populations. Here, we show that reduced ship traffic in the Bay of Fundy, Canada, following the events of 11 September 2001, resulted in a 6 dB decrease in underwater noise with a significant reduction below 150 Hz. This noise reduction was associated with decreased baseline levels of stress-related faecal hormone metabolites (glucocorticoids) in North Atlantic right whales (*Eubalaena glacialis*). This is the first evidence that exposure to low-frequency ship noise may be associated with chronic stress in whales, and has implications for all baleen whales in heavy ship traffic areas, and for recovery of this endangered right whale population."

- **Reference - Article / Paper / Fact Sheet 2:**

"Shipping causes 'chronic stress' to whales"
https://www.theguardian.com/environment/.../shipping-noises-chronic-stress-whales
Feb 8, 2012

"*We showed* ***whales*** *occupying oceans with high levels of ship noise have a chronic* ***stress*** *response,"* said **Rolland**, who led the **study**."

An area of intensive study for many years, now we know that **the impacts of manmade sound in its many forms have disastrous consequences for cetaceans and indeed for all forms of marine life.**

Any unwarranted noise production and its supposed benefits must be weighed up against potentially fatal consequences and the potential to trigger extinction events.

In the Appendices we have included our full submission to the EPBC as it details many of these impacts.

- **Reference - Appendix 3:**

KI Plantation Timbers - Kangaroo Island / Victor Harbor Dolphin Watch EPBC Response
November 22nd 2016

Much of this information was provided to KIPT in the Stakeholders Reference Group meeting in November 2017 and was followed with further communication with Environmental Projects over the following months.

Their responses to this information as exemplified in their EIS have been woefully inadequate.

In the EIS the proponents talk in terms of a **PTS for Southern Right whales** at a distance of 900 metres from the pile driving source and have suggested mitigation measures, largely determined by cost factors rather than effectiveness, and have suggested use of soft start procedures.

This in effect is active participation in **driving an endangered species away from critical habitat**, essentially an emerging BIA. There is no discussion about impacts upon dolphins, which have protection as a migratory species under the EPBC Act. Smith Bay is known to be part of the migratory pathway of the local dolphin population and to interfere and fragment the important habitats for these animals is covered under the Act.

- **Reference - Article / Paper / Fact Sheet 3:**

When one reads the relevant Conservation Management Plan with respect to the following two points it is hard to reconcile this Port proposal with the provisions in that plan.

"Conservation Management Plan for the Southern Right Whale 2011-2021"

E. "**Noise Interference** - Loud noises or long exposure may lead to avoidance of important habitat areas, interruption to communication and, in some situations, physical damage, including permanent or temporary hearing loss. Potential forms of harmful noise interference in Australian waters include seismic surveys, other industrial activities such as drilling, pile driving, blasting and dredging, defence activities, vessel noise, and aircraft operating at low altitude.

F. **Habitat Modification** - Habitat modification through the development of infrastructure such as ports, marinas, aquaculture facilities, and ocean/marine energy production facilities could lead to the physical displacement of southern right whales from their preferred habitats or disruption to normal behaviour. Animals may also encounter chemical pollution in the form of sewage and industrial discharges, run off from onshore activities, and accidental spills. In their feeding grounds they are most at risk from bioaccumulation of human-made chemicals such as organochlorines."

With respect to dolphins the impact of noise is less well researched but there is still substantial literature which outlines the **dire consequences of exposure to anthropogenic sound impacts.**

- **Reference - Article / Paper / Fact Sheet 4:**

"Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea"

Miriam J. Brandt, Ansgar Diederichs, Klaus Betke, Georg Nehls

ABSTRACT:

"Pile driving during offshore windfarm construction goes along with considerable noise emissions that potentially harm marine mammals in the vicinity and may cause large scale disturbances. Information on the scale of such disturbances is limited. Therefore, assessment and evaluation of the effects of offshore construction on marine mammals is difficult. During summer 2008, 91 monopile foundations were driven into the seabed during construction of the offshore wind farm Horns Rev II in the Danish North Sea.

We investigated the spatial and temporal scale of behavioural responses of harbour porpoises Phocoena phocoena to construction noise using passive acoustic monitoring devices (T-PODs) deployed in a gradient sampling design. Porpoise acoustic activity was reduced by 100% during 1 h after pile driving and stayed below normal levels for 24 to 72 h at a distance of 2.6 km from the construction site. This period gradually decreased with increasing distance. A negative effect was detectable out to a mean distance of 17.8 km. At 22 km it was no longer apparent, instead, porpoise activity temporarily increased. Out to a distance of 4.7 km, the recovery time was longer than most pauses between pile driving events. Consequently, porpoise activity and possibly abundance were reduced over the entire 5 mo construction period. The behavioural response of harbour porpoises to pile driving lasted much longer than previously reported.

This information should be considered when planning future wind farm construction."

DISCUSSION

"We found a clear negative effect of pile driving during wind farm construction on porpoise acoustic activity that was detectable out to a distance of 17.8 km. At the closest distance studied (2.5 km), porpoise activity was reduced between 24 to 72 h after pile driving activity, and the duration of this effect gradually declined with distance. At the furthest distance studied (21.2 km), we no longer found a negative effect of pile driving on porpoise activity; instead, activity was higher than the overall average for about 30 h after pile driving. This might indicate that porpoises at this distance showed no behavioural reaction to pile driving. Animals moving away from the construction site might have caused porpoise abundance and thus porpoise acoustic activity to temporarily increase as animals aggregated there. The lower limit we report for the duration of the effect was based on the time when porpoise activity reached the overall average."

CONCLUSIONS

"Using passive acoustic monitoring, this study revealed a marked negative influence of pile driving on the acoustic activity of harbour porpoises. At 24 to 72 h in close proximity to the construction site, the temporal scale of this effect lasted much longer than found in previous studies. The duration of the effect declined with increasing distance, and no negative effect was found at a mean distance of 22 km. This information should be considered during future scheduling of pile driving activities within and between wind farms in European waters. Furthermore, sound measurements conducted during pile driving indicate that hearing impairment could potentially have occurred close to the construction site. Both the risk of hearing impairment in harbour porpoises and the far reaching disturbance effect highlight the necessity to develop suitable mitigation procedures. Here attention should especially be given to the development of measures that aim to reduce noise emission into the water."

- **Reference - Article / Paper / Fact Sheet 5:**

"Porpoises Flee from Noise Pollution"

Amorina Kingdon   May 23rd, 2018

https://www.hakaimagazine.com/news/porpoises-flee-from-noise-pollution/

“Toothed whales, which communicate at higher frequencies than their baleen brethren, are also disrupted by artificial noise.

When pioneering whale biologist Roger Payne released the album Songs of the Humpback Whale in 1970, it was a big hit. People found the cetaceans’ haunting moans beautiful and relaxing. Unfortunately, whales can’t say the same about the sounds we produce—the low rumblings of a cargo ship are decidedly less soothing.

Artificial noise disrupts whales’ ability to communicate through sound, affecting their feeding and navigation. To date, most research and regulations have been aimed at understanding and preventing the disruption of big baleen whales (such as humpbacks, bowheads, and right whales) by big ships. But a new study on harbor porpoises suggests that toothed whales, such as killer whales and dolphins, may be getting an earful, too. Toothed whales use higher-frequency sounds to communicate than baleen whales do, so they can hear high-pitched anthropogenic noises such as those produced by ferries, pleasure craft, and sonar. And they may be finding them disruptive as well.

Marine biologist Danuta Wisniewska, who works at Aarhus University in Denmark, had heard tales of porpoises, dolphins, and killer whales visibly reacting to a single passing ship, but she wanted reliable data. Using satellite tags and underwater microphones, Wisniewska and her team tracked seven porpoises as they moved around the Inner Danish Waters for several days. The combination of location tracking and underwater recordings let them calculate how much noise each porpoise encountered and how it reacted.

The noise caused a lot of problems for the diminutive cetaceans. The porpoise that spent the most time in the loudest area of the harbor, near a shipping channel, was exposed to potentially disruptive noise in its hearing range 89 percent of the time. The porpoise in the quietest part of the harbor was still exposed to noise about 17 percent of the time. On average, the seven porpoises made shorter and fewer dives, caught significantly less prey, and stopped echolocating when loud or fast boats passed nearby.

“It’s the most serious reaction,” Wisniewska says of this silence. *“When porpoises aren’t echolocating they’re basically blind.”*

This kind of data is the key to improving regulations, says marine biologist Nathan Merchant at the Centre for Environment, Fisheries and Aquaculture Science in England. Merchant studies how noise pollution regulations can make life easier for whales. He says little data exists on how harmful noise can be, a gap he says this study helps fill. Merchant offers as an example one metric measured by the study—the amount of time the porpoises spent swimming away from noise instead of feeding.

"They're quite small cetaceans in a cold environment," Merchant says, and they need to be hunting most of the day to sustain their metabolism. Knowing how much noise translates into how much hunting time lost, for example, can help him discover where noise limits should be set. Wisniewska is now working on quantifying the less obvious ways noise affects porpoises. "We have a team working on how much more energy they expend when they're exposed to noise," she says. She also wants to study how high-frequency noises may be hurting more vulnerable species of toothed whales, such as the endangered southern resident killer whales in British Columbia's Strait of Georgia.

It's likely impossible to eliminate all of our noise pollution, but with better data, perhaps we can be better neighbors. After all, whales have made it perfectly clear that they do not enjoy our latest release, Songs of the Motorboat."

- **Reference - Article / Paper / Fact Sheet 6:**

"Changes in the behavioural complexity of bottlenose dolphins along a gradient of anthropogenically-impacted environments in South Australian coastal waters: Implications for conservation and management strategies"

Nardi Cribb, Laurent Seuront

https://www.researchgate.net/publication/303715858_Changes_in_the_behavioural_complexity_of_bottlenose_dolphins_along_a_gradient_of_anthropogenically-impacted_environments_in_South_Australian_coastal_waters_Implications_for_conservation_and_management

"The susceptibility of bottlenose dolphins (Tursiops sp.) to disturbance within South Australian coastal waters is of particular importance due to both the ever increasing impact of anthropogenic activities on these waters and their semi-enclosed nature. Currently, little is known about the ecology of dolphins in this region, in particular in relation to anthropogenically-driven disturbances. This study investigates the level of stress experienced by bottlenose dolphins from the complexity of their temporal patterns of dive durations recorded along a gradient of environment types defined as a function of the intensity of anthropogenically-driven pollution and disturbances, including urban development and recreational boating. Dive durations were opportunistically recorded from land-based stations scattered across South Australian coastal waters both in the absence of boat traffic, and the potential for boat-related disturbance was investigated when a motorized vessel was within 100 m from a traveling individual to infer the effect of indirect exposure to boat disturbance. This approach fundamentally differs from more standard assessments of the behavioural effect of direct exposure to boat disturbance, for instance when dolphins chase fishing vessels, flee from motorboats or bow ride. Subsequent analyses were based on nearly 12,000 behavioural observations. No significant differences were found in dive durations measured in the absence of boats and when boats were present. In contrast, fractal analysis consistently identified significant differences in the complexity of dive duration patterns as a function of environment and exposure to disturbance.

Specifically, bottlenose dolphins occurring in environments with less anthropogenic pressure exhibit a higher behavioural complexity. This complexity consistently and significantly decreases both within each environment and between environments with increasing anthropogenic pressure. These results further show that the relative changes in bottlenose dolphins' behavioural complexity increase in environments less impacted by anthropogenic activities. These results are discussed in the general context of the adaptive value of fractal behaviour, the susceptibility of bottlenose dolphins occurring in distinct environments to anthropogenic disturbance, and how behavioural properties identified with our fractal methods can be used to establish baseline information that can be used for the design and implementation of conservation and management strategies. © 2016 Elsevier B.V. All rights reserved. Keywords: Anthropogenic stress Disturbance Behaviour Boat traffic Habitat Fractals Conservation Management Tursiops sp.

4.6. On the importance of assessing pernicious stress for dolphin conservation Chronic exposure to even low levels of stress has implications for energy balance, physiological conditions and vital rates (New et al., 2013), and is likely to induce long-term consequences at the population level (Lusseau, 2004; Bejder et al., 2006). This is a critical issue for dolphin welfare as well as the related development and implementation of effective mitigation and management strategies because the habituation to boat traffic reported for bottlenose dolphins (Sini et al., 2005) did not imply the absence of stress, hence may be thought as a pernicious threat as suggested in a preliminary study (Seuront and Cribb, 2011). As such, it is stressed that the assessment of the potential impacts of boat traffic, hence the identification of potential long-term ramifications, may require more efficient ways to infer the behavioural stress of dolphins inhabiting anthropogenically-impacted coastal areas. Specifically, bottlenose dolphins occurring in environments with less anthropogenic pressure exhibited a higher behavioural complexity. This complexity consistently decreased both within and between environments with increasing anthropogenic pressure.

Our results further showed that the behaviour of Tursiops sp. occurring along the metropolitan coast of Adelaide and in Boston Bay was more affected to the boat presence than those living in the Adelaide Dolphin Sanctuary (ADS). This observation may indicate that bottlenose dolphins are more susceptible to be affected by the development of human activities than in Boston Bay and the ADS. In turn, this also suggests that their baseline behavioural repertoire is richer, hence allow them more behavioural flexibility to respond to disturbances, than in dolphins living in less pristine habitats. Similarly, the relatively moderate differences in behavioural complexity observed in the ADS in the absence of boat and when boats were present does not necessarily imply a habituation to boats as observed elsewhere (Sini et al., 2005). This may indicate instead that these dolphins have a limited ability to modify their behaviour in response to boat traffic in particular and to anthropogenic disturbance in general.

5. Conclusion This work illustrates how standard behavioural metrics failed to identify changes in the patterns of dive durations of bottlenose dolphins occurring in distinct environments under different

levels of exposure to anthropogenic chronic and acute disturbances. In contrast, the fractal methods used here, beyond being very easy to implement, provides an objective, quantitative and non-intrusive way to quantify subtle behavioural changes. This method is then suggested as a potential powerful tool to assess both absolute and relative behavioural changes in bottlenose dolphins. It may hence provide baseline information on the actual level of stress and related behavioural flexibility bottlenose dolphins — and ultimately any marine mammal — might have to respond to anthropogenic disturbance, an absolute prerequisite to the development of conservation and management strategies."

The importance of habitat is raised in the following paper:

- **Reference - Article / Paper / Fact Sheet 7:**

"Habitat use Patterns and Ranges of the Bottlenose Dolphin in the Gulf of California Mexico."

Lisa Taylor Ballance

"Habitats are generally composed of a mosaic of patches which differ from each other physically and biologically. Some patches offer more protection from the elements or from predation; others offer less. Some patches support large concentrations of food; others are barren. Because of such heterogeneity we expect to see specific patterns in the way animals are distributed and in the way they use patches within a given habitat.

Habitat heterogeneity and the biological requirements of a species interact not only to produce these patterns in distribution and in habitat use, but also to influence the size of an animal's home range (McNab 1963). Specifically, the body size and energy requirements of an animal dictate the amount of energy necessary to maintain this individual. The abundance, distribution and availability of resources within the habitat determines the size of an area which will fulfil these energy requirements. The result of the interactions between these factors is manifested in the size of the home range."

- **Reference - Article / Paper / Fact Sheet 8:**

"Dolphins need to eat up to 25 kilograms of fish every day"

Matt Warren Jan. 19, 2018
Royal Open Science.

https://www.sciencemag.org/news/2018/01/dolphins-need-eat-25-kilograms-fish-every-day

Scientists in Florida determined:

"Bottlenose dolphins burn as many as 33,000 calories – equivalent to 25 kilograms of fish every day." as reported in a BBC News report on January 19th, 2018.

In view of these reflections on **the importance of habitat in meeting the needs of the dolphins** in Smith Bay and surrounds, and the possible impacts upon prey species, the lack of detail in KIPT's EIS is simply staggering.

If they wish to speak only in economic terms, as appears to be the case, the impact upon ecotourism operations on the North Coast has received scant attention.

- **Reference - Article / Paper / Fact Sheet 9:**

"High intensity anthropogenic sound damages fish ears"
Robert D McCauley, Jane Fewtrell 2012
https://www.researchgate.net/

- **Reference - Article / Paper / Fact Sheet 10:**

"Impact of air gun noise on the behaviour of marine behaviour of marine fish and squid"
Fewtrell, J. and McCauley, R. 2012
https://espace.curtin.edu.au/handle/20.500.11937/49460

The proponents and their supporters simply suggest the dolphins in the area can **deviate around the end of their proposed infrastructure**, but this is problematic given the situations explored in Heithaus et al and the hypotheses developed.

This research suggests the further offshore the coastal dolphin populations travel, the greater is the chance of predation.

With dolphins in the wild experiencing a **50% loss of calves** under normal circumstances this added imposte could have devastating consequences.

- **Reference - Article / Paper / Fact Sheet 11:**

"Spatial variations of shark-inflicted injuries to insular Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) of the SW Indian Ocean."

Heithaus et al

Marine Mammal Science 33(1) January 2017.

"Predation risk can be critical in shaping the behavior and population dynamics of prey taxa (e.g., Lima and Dill 1990) that, in turn, may have cascading consequences for communities (Heithaus et al. 2008). Although often considered top predators, many populations of small delphinids are at risk from predators. Killer whales (Orcinus orca) are a threat primarily in temperate waters, while risk from large sharks dominates in tropical ecosystems (see Heithaus 2001a, Weller 2009 for reviews). Although often overlooked, these predators may influence small cetacean (Delphinidae and Phocoenidae) behavior—including daily movements (e.g., spinner dolphins Stenella longirostris, Norris and Dohl 1980), group size (Gygax 2002), and habitat use at multiple spatial scales (Heithaus and Dill 2006, Srinivasan et al. 2010) —as well as body condition (MacLeod et al. 2007).

Of key importance to identifying areas where predation risk might be important in shaping behaviors and population dynamics is understanding spatial and temporal variation in predation risk. For most populations of small cetaceans such as delphinids, however, there is no information on the relative risk of predation they face. Because predation events are uncommon enough to preclude direct estimates of mortality risk, evidence of unsuccessful predation attempts (e.g., scars and injuries) have been used to gain insights into predation risk to many taxa, including dolphins (e.g., Corkeron et al. 1987, Heithaus 2001b). The use of scars, however, has many 1 Corresponding author: (e-mail: heithaus@fiu.edu). 1 limitations because the probability of an individual surviving an attack to display a wound will vary with numerous factors including the relative size of predator and prey, relative prey escape ability and predator efficiency, as well as wound healing rates (see Heithaus 2001a for discussion). Still, in the absence of other data, the proportion of individuals with predator-inflicted injuries provides an important first step in elucidating predator-prey interactions."

The importance of not interfering with migratory pathways is well known and is outlined in the following article.

- **Reference - Article / Paper / Fact Sheet 12:**

"Migration critical to survival of dolphin populations, genetic study shows"

November 14, 2018, University of New South Wales

https://newsroom.unsw.edu.au/news/science-tech/migration-critical-survival-dolphin-populations-genetic-study-shows

Bottlenose dolphins of Bunbury, Western Australia. Credit: Delphine Chabanne, Murdoch University

"An analysis of dolphin genes has revealed information about their past migrations, showing just **how crucial migrants might be for other populations.**

A new study by an international team of researchers found that one Western Australian dolphin population was once an important source of migrants – that is, dolphins that support nearby populations. The researchers analysed the genetic variants in bottlenose dolphins (*Tursiops aduncus*) to find out about past dolphin migration.

"These dolphin migrants from Bunbury were likely important in supporting the stability of nearby populations," says lead author Dr. Oliver Manlik, Conjoint Associate Lecturer at UNSW Sydney, who is also an assistant professor at the United Arab Emirates University.

"Dolphins have no borders, and persistence of animal populations often depends on a ***'rescue effect',*** *a scenario in which a declining population is 'rescued' from extinction by immigrants from other populations,"* he explains.

That's why it is important for scientists to identify **'source' populations,** populations from which individuals emigrate, and **'sink'** populations who receive the migrants.

"These coastal dolphins do not go on any migration 'journeys', like some whales and offshore dolphins do," Dr. Manlik says. *"Rather, they disperse, which means that some dolphins move from one population to another and reproduce with individuals of the other population, and leave their offspring and genes behind—that's how we detected this pattern."*

Worryingly, a previous study had shown that the Bunbury dolphin population may decline because they were not producing enough offspring.

"If that is now true, then the Bunbury dolphins may no longer be able to continue supplying emigrants to support other populations, putting these other dolphin populations at risk as well," explains Dr. Manlik.

The previous study also showed that reproduction is key to the persistence of the Bunbury population, and, if undisturbed, it is possible that the Bunbury dolphins produce more offspring again.

"In that case, the Bunbury population might be OK, and will be able to support its neighbouring populations again," Dr. Manlik says.

Dr. Delphine Chabanne of Murdoch University, a co-author on the study, has been studying these dolphins in Australia for more than a decade.

"For the conservation of these dolphin populations, it is important to monitor them closely, and in particular, to keep a close eye on the reproduction of the Bunbury dolphins," she says.

Co-author Professor Bill Sherwin from UNSW adds: *"Genes are information. They can tell us whether populations are isolated or connected, and shed light on migration patterns of the past – important information for wildlife conservation. We now know that we need to focus on the Bunbury dolphins, and especially on their reproductive rates, to protect several dolphin populations."*

The new study, published in the journal *Marine Mammal Science*, is an illustration of how modern genetics can use information from genes to gain a glimpse into the past, unravelling past migration patterns of animals, and therefore help inform the future."

Given the greatly **increased recruitment rate at bays adjoining Smith Bay** and being cognisant of the transience between it is reasonable to suggest that these areas, including Smith Bay, perform a vital function as habitat for a **"rescue" population** for other dolphin populations around Southern Australian coastlines.

We do know that movement between Kangaroo Island and the mainland has been established as described in the paper published in the Open Journal of Marine Science, Jan 2018.

- **Reference – Appendix 4:**

"New Evidence for Bottlenose Dolphin (Tursiops spp.) Population Connectivity between Kangaroo Island and South Australian Mainland Waters."

N.Cribb, P.Bartram, T.Bartram, L.Seuront.

http://www.scirp.org/Journal/PaperInformation.aspx?PaperID=81655

https://www.theislanderonline.com.au/story/5186950/local-dolphins-on-the-world-stage/

Numbers at both Dashwood Bay to the immediate west and North Cape to the east increase by approximately 300% and 100% respectively at certain times of the year.

While the reasons for this are currently little understood, further research is likely to show the **importance of the local population on a state wide basis**.

- **Reference - Article / Paper / Fact Sheet 13:**

"Decline in Relative Abundance of Bottlenose Dolphins Exposed to Long-Term Disturbance"

Lars Bejder, Amy Samuels et al

ABSTRACT:

"Studies evaluating effects of human activity on wildlife typically emphasize short-term behavioral responses from which it is difficult to infer biological significance or formulate plans to mitigate harmful impacts. Based on decades of detailed behavioral records, we evaluated long-term impacts of vessel activity on bottlenose dolphins (Tursiops sp.) in Shark Bay, Australia.

We compared dolphin abundance within adjacent 36- km2 tourism and control sites, over three consecutive 4.5-year periods wherein research activity was relatively constant but tourism levels increased from zero, to one, to two dolphin-watching operators. A nonlinear logistic model demonstrated that there was no difference in dolphin abundance between periods with no tourism and periods in which one operator offered tours.

As the number of tour operators increased to two, there was a significant average decline in dolphin abundance (14.9%; 95% CI = −20.8 to −8.23), approximating a decline of one per seven individuals. Concurrently, within the control site, the average increase in dolphin abundance was not significant (8.5%; 95% CI = −4.0 to +16.7). Given the substantially greater presence and proximity of tour vessels to dolphins relative to research vessels, tour-vessel activity contributed more to declining dolphin numbers within the tourism site than research vessels.

Although this trend may not jeopardize the large, genetically diverse dolphin population of Shark Bay, the decline is unlikely to be sustainable for local dolphin tourism. A similar decline would be devastating for small, closed, resident, or endangered cetacean populations."

<u>This is the crux issue.</u>

A highly endangered species will be displaced from a habitat which is critical for the survival of the species.

The proponents then follow with:

"It is noted that the policy is intended to minimise the likelihood of injury, rather than prevent behavioural changes in whales" and this clearly demonstrates their minimist approach.

Throughout the whole of this document we have outlined consistently the true impacts of behavioural change and their implications at an individual and population level.

In Table 18-11 in the EIS it shows a Permanent Threshold Shift (PTS) at 900 metres for a Southern right whale and a Temporary Threshold Shift (TTS) at 6500 metres.

This effectively means any Southern Right whale travelling through the middle of Investigator Strait will be affected. It is worth noting an old adage from Marine Mammalogy "lore" .....

…"a deaf whale is a dead whale."

That is before any consideration of associated stressors and accompanying behavioural responses.

<u>CONCLUSION</u>

The potential impacts of stressors upon the cetaceans in Smith Bay, and indeed elsewhere along KI's North Coast, have been clearly outlined in this section of our submission.

Not all impacts will be clearly observed, but they will still exist, and their potential ramifications could be absolutely disastrous.

Given the situation existing in relation to the **South-Eastern population of the Southern Right whales** this is particularly of concern.

Simply put ...... extinction is forever.

<u>To contemplate the international reaction to overseeing such an event is quite chilling.</u>

Kangaroo Island / Victor Harbor Dolphin Watch

in partnership with

Whale and Dolphin Conservation

www.kangarooislanddolphinwatch.com.au www.islandmind.com
www.twitter.com/KIDolphinWatch www.instagram/kivhdolphinwatch
www.facebook/kangarooislandvictorharbordolphinwatch

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May 27th 2019

Kangaroo Island Plantation Timbers Environmental Impact Statement Response

VESSEL IMPACTS

Apart from noise impacts discussed elsewhere in this document and the potential for vessel strike, there is also cause for alarm which comes from the proposed use of tugboats as outlined in the EIS.

The following information regarding **ducted propellers and the impacts upon marine mammals** is extremely concerning, in light of not only dolphin habitation but visitation by Longnosed fur seals and Australian sealions, both endangered species, particularly the sealions which are highly endangered.

The following links indicate clearly the danger to marine fauna and mammals in particular.

- **Reference - Article / Paper / Fact Sheet 1 / Website 1:**

Ducted propeller from Wikipedia

https://en.wikipedia.org/wiki/Ducted_propeller

The next link details an abstract referred to in the Wikipedia article above.

"Unusual Mortality of Pinnipeds in the United Kingdom Associated with Helical (Corkscrew) Injuries of Anthropogenic Origin."

Bexton, Steve et al.

Aquatic Mammals Sep2012

https://web.a.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=01675427&AN=82513290&h=g5lIerRZXCg407RTmb1w98gq7cAW%2bmG1YAy6KZxIR6WByDf%2bIpSyzHv1Yxc8mgKgFsoaqxmtk4wUVv91prJZdA%3d%3d&crl=c&resultNs=AdminWebAuth&resultLocal=ErrCrlNotAuth&crlhashurl=login.aspx%3fdirect%3dtrue%26profile%3dehost%26scope%3dsite%26authtype%3dcrawler%26jrnl%3d01675427%26AN%3d82513290

The following article from the UK Guardian provides further information:

- **Reference - Article / Paper / Fact Sheet 2**

"Seal deaths caused by propellers break environmental law, ministers warned"

The Guardian

https://www.theguardian.com/environment/2014/feb/26/sea-deaths-ship-propellers-corkscrew

The next paper is the most damning for ducted propellers and extremely concerning.

http://www.smru.st-andrews.ac.uk/files/2015/10/USD2_hypothetical_link_VF2-0.pdf

Although these are international studies anecdotal evidence indicates there are **issues regarding this situation in Australian waters** and a marked desire for the implications not to reach the public arena. The reasons are obvious.

VESSEL STRIKE POSSIBILITY

Complex formulae were utilised by BMT WBM Pty Ltd on behalf of the proponents to create a scenario of possible vessel strikes on Southern right whales as one in 300 years.

When simple probability and ratios are employed a different, more disturbing picture is formed:

- 1 ship provides a 1 in 300 chance of a vessel strike fatality event.
- 2 ships therefore provide a 1 in 150 chance of a vessel strike fatality event
- 3 ships therefore provide a 1 in 75 chance of a vessel strike fatality event
- 4 ships therefore provide a 1 in 37.5 chance of a vessel strike fatality event.

As there are up to 3 tugboats to be employed for the freighters in Smith Bay, this is a more realistic interpretation of possible whale/vessel congruence.

And this is based on a single whale being present! On a number occasions two or more whales have been seen in Smith Bay, often females with calves, changing the probabilities greatly and altering the figures even more markedly.

By continuing to utilise a **risk enhancement strategy** rather than the **threat abatement strategy** employed by the proponents and their contractors we begin to see a more realistic situation emerge.

- 2 whales therefore provide a 1 in 18.7 chance of a vessel strike fatality event
- 3 whales therefore provide a 1 in 9.35 chance of a vessel strike fatality event
- 4 whales therefore provide a 1 in 4.67 chance of a vessel strike fatality event.

As detailed in discussion points elsewhere in this document and as raised by DoEE responses to EPBC Referral Number 2016/7814, 14/12/16"

"The loss of a single animal from the south-eastern group would have a significant impact on the population of southern right whales".

Even at one death the situation is critical and can be easily avoided by having whales and no vessel - the chance is then zero.

This is a perfect example of **true spatial mitigation** as prescribed by the EPBC Act 1999 – elimination of threat.

- **Reference - Article / Paper / Fact Sheet 3:**

"Spencer Gulf Ecosystem & Development Initiative; Interactions between whales and vessels: causes and mitigation options – with reference to southern Australia"

Christopher Izzo and Bronwyn Gillanders

The following excerpt provides greater clarity regarding potential shipstrike situations:

"When data are available, it may be possible to estimate annual ship strike rates.

Using mortality data reported in Kemper et al. (2008b) for southern right whales in Australia and South Africa as well as for North Atlantic right whales, annual rates of **whale-vessel interactions** were calculated at 0.09 year1 , 0.34 year-1 and 0.76 year-1 , respectively.

These differences are likely due to there being lower densities of both whales and shipping traffic in Australia relative to the other regions (Fig. 5) and/or due to lower reporting rates of ship strikes (Van Waerebeek et al., 2007; Kemper et al., 2008b; Moore, 2009).

Using the same data presented in Kemper et al. (2008b), it is also possible to approximate total mortality rates of the Australian southern right whale (i.e. by combining natural and anthropogenic attributed mortalities) allowing for comparisons between ship strike mortality rates (0.09 year-1) with total mortality rates (0.79 year-1). Thus, ship strike mortality rates are a fraction of total mortality rates."

Also from the same source the following tract outlines further relevant information regarding **potentially fatal interactions**.

"**The direct outcome of a ship strike for the whale is generally death or serious injury**, including fractured bones, haemorrhaging, or propeller lacerations (Knowlton and Kraus, 2001; Campbell Malone et al., 2008; Conn and Silber, 2013). Non-fatal collisions likely have long-term negative effects on the survival of individuals (Silber et al., 2009) and the injuries sustained may ultimately result in the death of the cetacean, even several years after the collision (Campbell-Malone et al., 2008).

Even passive interactions between whales and vessels (i.e. whale watching) elicit short-term changes in whale behaviour, including changes to pod composition (Ribeiro et al., 2005), surfacing and diving patterns (Blane and Jaakson, 1994; Gulesserian et al., 2011), as well as movement patterns and habitat use (Williams et al., 2002; Bejder et al., 2006).

Collisions with whales can also pose a threat to human safety, with reports of ship strikes resulting in serious injury (including two fatalities) of passengers and crew members (Laist et al., 2001; de Stephanis and Urquiola, 2006; Carrillo and Ritter, 2010). In addition, the vessel itself may sustain considerable damage, potentially leading to economic losses for shipping companies as well as damage to the public image of the company in terms of environmental impacts (Laist et al., 2001; Couvat and Gambaiani, 2013).

With increasing numbers of humpback and southern right whales wintering in Australian coastal waters, interactions with vessels involving these two species are likely to become more frequent.

The effects of ship strikes on cetacean populations will be exacerbated where shipping and recreational boating overlap with critical habitats, such as calving and nursing sites, and along migration routes."

- **Reference - Article / Paper / Fact Sheet 4:**

"As Global Shipping Grows, Prepare for a Surge of Invasive Species"

Charles Q. Choi

May 1, 2019

"Scientists are predicting a dramatic uptick in the rate of species introductions as economies grow and the climate changes."

"**Invasive species have long spread across the world by ship, often with disastrous effects**. Now Anthony Sardain, an invasion ecologist at McGill University in Montreal, Quebec, expects the risk of marine invasions to rise three- **to 20-fold in the next 30 years**.

The idea came to Sardain in the summer of 2015 as he sailed with his father, a commodity market analyst, off the coast of Brittany, France. As they discussed how China's emergence as a superpower might impact global trade, Sardain realized that previous research on marine invasive species typically assumed global trade would remain constant. But **shipping is expected to change on a global scale**. Sardain and his colleagues set out to forecast how this might affect where marine species are being introduced.

The researchers first developed a model to predict **future global maritime traffic**. This incorporated data on more than 50 million voyages taken by more than 81,000 ships worldwide between 2006 and 2014, as well as factors such as the population sizes and gross domestic product (GDP) of nations. They combined this model with projections of climate change, which will open new shipping routes, as well as expected population growth and GDP forecasts.

They also looked at existing models of ship-linked marine invasions—for instance, how invasive species attached to ships' hulls or in ballast water might spread.

The scientists projected that global maritime traffic may increase by 240 percent, up to as much as 1,209 percent, by 2050, leading the risk of marine invasions to surge in nations with large, fast-growing economies, such as those in northeast Asia.

"Even if the increase in shipping is only 200 percent, this still has ***a huge potential to distinctly increase marine invasion dynamics in the future****. And this is very likely going to happen,"* says biodiversity modeler Hanno Seebens of the Senckenberg Biodiversity and Climate Research Centre in Frankfurt, Germany, who did not take part in this research.

"Unless appropriate action is taken, we could anticipate an ***exponential increase in such invasions,*** *which conceivably could have unprecedented economic and ecological consequences,"* says study coauthor Brian Leung.

The good news, Sardain says, *"is that there are currently measures being undertaken to tackle this problem."* For example, the International Maritime Organization's international ballast water management convention that entered into force in 2017 aims to reduce marine invasions by having ships discharge ballast water taken on near coasts in the middle of their voyages and replace it with ocean water. The logic is that potentially invasive organisms that evolved to survive in coastal environments would die in the open ocean, and vice versa. Such ballast exchange *"has been effective at reducing invasion rates in the … Great Lakes,"* Sardain says.

"*The most important implication of these findings is that* ***tackling the human-mediated spread of alien species should be a priority for all governments****,"* Seebens says.

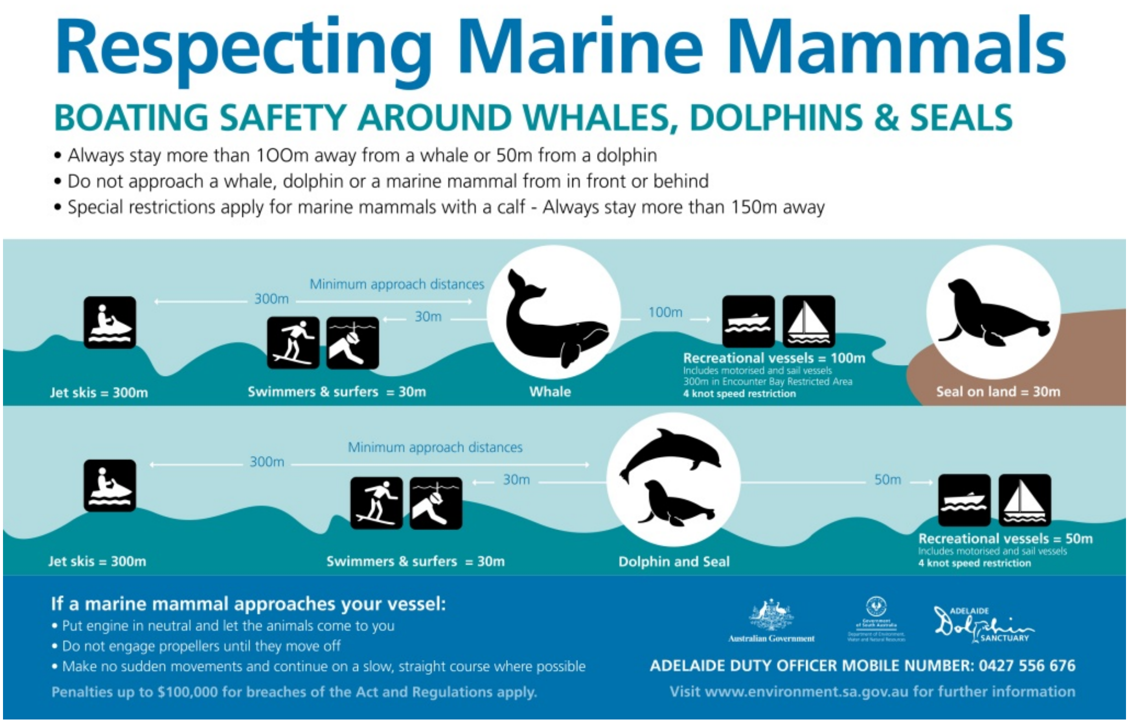
"This is a ***global phenomenon****, which affects all countries worldwide, which could only be tackled by joint efforts."*

- **Reference - Article / Paper / Fact Sheet 5:**

"Respecting Marine Mammals – Boating Safety Around Whales, Dolphins and Seals"

www.environment.sa.gov.au

Drawn from State and Federal Legislation this document specifies distances of approach for vessels to marine mammals as shown below.



This acts in direct conflict to shipping movements given the stopping distances required by vessels like Panamax freighters or similar.

The actual distances at which whales may appear make it impossible for these vessels to respond in a timely manner.

- **Reference - Article / Paper / Fact Sheet 6:**

"The Determination of a Minimum Critical Distance for Avoiding Action by a Stand-on Vessel as Permitted by Rule 17a) ii)"

International Journal on Marine Navigation
and Safety of Sea Transportation
E.W. Rymarz March 2007

The following tables clearly demonstrate the problem.

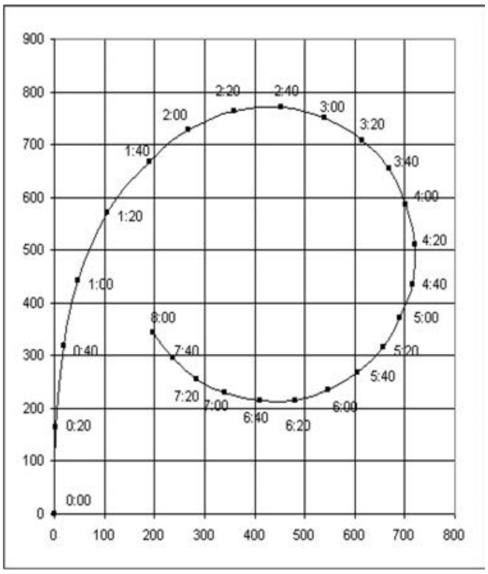


Fig. 3 PANAMAX Turning circle to stbrd.

-full sea speed ahead

Fig. 4. PANAMAX - crash stop.

From full ahead to stop the vessel by full astern

CRASH STOP

PANAMAX

Czas	y	x
00:00	0	0
00:20	160	0
00:40	320	0
01:00	460	0
01:20	590	0
01:40	720	0
02:00	860	0
02:20	975	0
02:40	1090	0
03:00	1200	0
03:20	1300	0
03:40	1400	5
04:00	1483	10
04:20	1560	15
04:40	1630	21
05:00	1692	30
05:20	1750	40
05:40	1805	52
06:00	1860	70
06:20	1910	90
06:40	1950	110
07:00	1981	127
07:20	2005	145
07:40	2017	154
08:00	2030	165

These diagrams show the full danger proffered by vessel movements. If a Panamax ship takes 8 minutes and over 2 km. to come to a crash stop it is almost impossible to avoid a collision with a whale which appears within that distance and it certainly creates a situation where the vessel is in breach of the Marine Mammal Act provisions.

As Smith Bay provides an area of congruence for vessels and whales, including vulnerable calves, the problem is insurmountable in terms of mitigation.

In light of the highly endangered nature of the south-eastern Southern right whale population and the potential impacts of even the loss of an individual as discussed elsewhere solutions are problematic.

- **Reference - Article / Paper / Fact Sheet / Website 7:**

www.nefsc.noaa.gov/psb/surveys/ and www.narwc.org

are sites which relate directly to the situation regarding North Atlantic right whales which are similarly problematic. They provide interactive mapping, shipping advice etc. and state 10 knot limits in Seasonal Management Areas and other management strategies.

They also specify no closer than 500 yards ..... shut down!

No such issues have been addressed in the EIS.

In fact the proponents have simply **minimised and obfuscated the issues** which are likely to arise, a consistent strategy throughout.

They have based their responses to any situation regarding whales on two premises:

- there has only been a single whale sighting
- the Southern Right whales are from the South-western population

Both have been thoroughly refuted in this and referenced documents.

KIPT's response in the EIS:

"It is concluded that the risk to the southern right whales from KIPT shipping operations would be negligible."

REALLY? **Extinction is NOT negligible.**

CONCLUSION

As has been clearly demonstrated in this document there is literally no way of avoiding collisions between vessels and whales.

Given the noise generated by vessels of this size, approximately 200dB, (Tyack et al 2010) any whale within the Smith Bay precinct is going to already be confused and stressed, (Rolland et al 2012).

The interference with their hearing, their major sense will be enormous, and potentially catastrophic. Even the potential displacement from critical habitat will have diabolical consequences. It will simply become a scenario of *"see whale, hit whale"* with all the consequent impacts.

The introduction of invasive marine pest species will be unavoidable and KIPT's response of simply abiding by existing legislation and guidelines is woefully inadequate.

To create a scenario where invasive species can colonise and infect major tracts of the north coast of Kangaroo Island, which is currently pristine, and Smith Bay recognised as totally free of pest species, is irresponsible in the extreme.

Once introduced they will be impossible to eradicate. It is an open ocean environment, not a bay which can be closed off and dealt with accordingly.

<u>This should be an element of major concern for relevant authorities and not something to be glossed over and dealt with in facile ways.</u>

Kangaroo Island / Victor Harbor Dolphin Watch

in partnership with

Whale and Dolphin Conservation

www.kangarooislanddolphinwatch.com.au www.islandmind.com
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May 27th 2019

Kangaroo Island Plantation Timbers Environmental Impact Statement Response

CUMULATIVE IMPACTS

The proponents choose only to deal, as required and expected, with the cumulative impacts they create.

We however need, and choose, to consider matters more globally, morally, ethically and sustainably and it is this which is our point of difference.

They seek, in spite of protestations to the contrary, to go to the lowest levels of compliance and mitigation.

At this time, in this century, with all we know and are beginning to understand about our impacts, this is simply not enough.

- **Reference - Article / Paper / Fact Sheet 1:**

"One million species at risk of extinction, UN report warns, and we are mostly to blame"
Lexi Metherell 7 May 2019

Policies that put economic growth before environmental conservation shoulder some of the blame. Credit IPBES

"One million of the world's species are now under threat of extinction, according to the biggest-ever review of the state of nature on Earth."

KEY POINTS:

- The report, which draws on 15,000 scientific and government sources, says human use of land and sea resources are mostly to blame
- The decline in nature is happening at rates that are unprecedented in human history, the UN report reveals
- More than 40 per cent of amphibian species, almost 33 per cent of reef-forming corals and more than a third of all marine mammals are threatened

The UN-backed report was three years in the making and was based on systematic reviews of 15,000 scientific and government sources.

Among a vast number of alarming findings is that the average population size of native species in most habitats on land has fallen by at least 20 per cent, mostly since 1900. More than 40 per cent of amphibian species, almost 33 per cent of reef-forming corals and more than a third of all marine mammals are now under threat.

"We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide," said Sir Robert Watson, the chair of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), which put together the report.

The IPBES has 132 nation-members and is known as the equivalent of the Intergovernmental Panel on Climate Change (IPCC), but for biodiversity.

HUMAN EXPANSION AND EXPLOITATION OF HABITATS TO BLAME

The report says that human use of the land and sea resources are mostly to blame, followed by direct exploitation of animals, climate change, pollution and invasive species. More than a third of the world's land surface and nearly 75 per cent of freshwater resources are now devoted to crop or livestock production, while urban areas have more than doubled since 1992.

Meanwhile, 300-400 million tonnes of heavy metals, solvents, toxic sludge and other waste is dumped into the world's waters every year.

The decline in nature is happening at rates that are unprecedented in human history.

"It's like reading a paper that says the natural world is in catastrophic decline and there is a chance that this catastrophe will take us all down with it," said Tim Beshara, federal policy director of Wilderness Society.

"Humanity is causing a slow-motion apocalypse of the natural world and that's getting faster and faster as time goes on."

In Australia, part of the problem is rapid deforestation, said Professor James Watson, the director for the University of Queensland's Centre for Biodiversity and Conservation Science.

"We are world leaders in habitat clearance, vegetation clearance — we clear more land than just about every country on the planet, especially for cattle farming," he said.

The rapid losses are also evident in our cities.

"Thirty, forty years ago koalas were a common species," said Professor Watson.

"Every single suburb in Brisbane, for example, had very healthy populations of koalas. Right now, only one suburb in Brisbane has a koala population, and that's a very small one."

"Fundamentally, we're sleepwalking into an extinction crisis. We're not talking about the biosphere in the way that we need to. Nature is getting eroded in a dramatic way and a loss of natural capital means that humans will suffer in the long run."

Sir Robert Watson said there must be transformative change to human civilisation if we are to avoid the extinction crisis.

"By transformative change, we mean a fundamental, system-wide reorganisation across technological, economic and social factors," he said.

AUSTRALIA 'MISSING IN ACTION' ON CONSERVATION

Next year is a big year for global conservation. The signatories to the Convention on Biological Diversity, which is the global treaty meant to safeguard biodiversity, are scheduled to meet and sign a new post-2020 strategic plan. Professor Watson said it's an opportunity to reset the clock and design a global deal for nature and biodiversity.

"The sad thing is Australia has gone missing in these negotiations, they haven't even turned up to the last major international negotiations around this matter, and as you are seeing in the federal election, biodiversity is just not even mentioned," he said.

"That's a shame because Australia is one of the few mega-biodiverse countries around the world — we have more species than just about every other country."

KIPT do not appear to care if they make a contribution to a series of extinction events and, by dint of the approvals process, make government complicit in this.

The following articles and papers pay testimony to the larger scale issues in play and why they are worthy of consideration in the full panoply of this situation.

- **Reference - Article / Paper / Fact Sheet 2:**

"'Shocking' state of seas threatens mass extinction, say marine experts"
Fiona Harvey

21 Jun 2011

"Overfishing and pollution putting fish, sharks and whales in extreme danger – with extinction 'inevitable', study finds"

Record high temperatures during 1998 wiped out 16% of all tropical coral reefs.
Photograph: Darryl Leniuk/Radius Images/Corbis

"Fish, sharks, whales and other marine species are in imminent danger of **an "unprecedented" and catastrophic extinction event at the hands of humankind**, and are disappearing at a far faster rate than anyone had predicted, a study of the world's oceans has found.

Mass extinction of species will be "inevitable" if current trends continue, researchers said.

Overfishing, pollution, run-off of fertilisers from farming and the acidification of the seas caused by increasing carbon dioxide emissions are combining to put marine creatures in extreme danger, according to the report from the International Programme on the State of the Ocean (Ipso), prepared at the first international workshop to consider all of the cumulative stresses affecting the oceans at Oxford University.

The international panel of marine experts said there was a *"high risk of entering a phase of extinction of marine species unprecedented in human history"*. They said the challenges facing the oceans created *"the conditions associated with every previous major extinction of species in Earth's history"*.

"The findings are shocking," said Alex Rogers, scientific director of Ipso. *"As we considered the cumulative effect of what humankind does to the ocean, the implications became far worse than we had individually realised. This is a very serious situation demanding unequivocal action at every level. We are looking at consequences for humankind that will impact in our lifetime, and worse, our children's and generations beyond that."*

The flow of soil nutrients into the oceans is creating huge *"dead zones"*, where anoxia - the absence of oxygen - and hypoxia - low oxygen levels - mean fish and other marine life are unable to survive there.

Hypoxia and anoxia, warming and acidification are factors present in every mass extinction event in the oceans over the Earth's history, according to scientific research. About 55m years ago, as much as half of some species of deep-sea creatures were wiped out when atmospheric changes created similar conditions.

In recent years, human effects on the oceans have increased significantly. Overfishing has cut some fish populations by more than 90%. Pollutants, including flame-retardant chemicals and detergents are absorbed into particles of plastic waste in the sea, which are then ingested by marine creatures. Millions of fish, birds and other forms of life are choked or suffer internal ruptures from ingesting plastic waste.

During 1998, record high temperatures wiped out about 16% of the world's tropical coral reefs.

The scientists called on the United Nations and governments to bring in measures to conserve marine ecosystems. Dan Laffoley, of the International Union for the Conservation of Nature, said: *"The world's leading experts on oceans are surprised by the rate and magnitude of changes we are seeing. The challenges for the future of the oceans are vast, but unlike previous generations we know what now needs to happen. The time to protect the blue heart of our planet is now, today and urgent".*

- **Reference - Article / Paper / Fact Sheet 3:**

"Marine Mammals and Multiple Stressors: Implications for Conservation and Policy"

Mark P. Simmonds

459 Marine Mammal Ecotoxicology. https://doi.org/10.1016/B978-0-12-812144-3.00017-6

INTRODUCTION

"For many centuries, in many maritime countries, human interest in marine mammals was limited to consideration of them as a resource to be exploited for human consumption and then for profit. For example, whales were regarded as having such value that King Edward II of England made a formal claim to their ownership, followed by several other heads of state (Brakes and Simmonds, 2011). Widespread commercial whaling in the 19th and 20th centuries, eventually involving diesel-driven fleets including factory vessels, led to decimation of populations. Attitudes changed in the 1960s and 1970s when the animals started to be valued and appreciated in other ways, including aesthetically and for their entertainment value in captivity. Considerable knowledge has been gained in recent decades about both the biology of the animals and the fast-evolving threats that they face, but increasing knowledge does not automatically lead to improved protection, and some species and populations are still heading toward extinction (Campagna, 2015). At the root of this is a complex and evolving array of factors that can impact on these animals. For example, the endangered North Atlantic right whale, Eubalaena glacialis, population was initially devastated by whaling. Now, as this much diminished population struggles to recover, ship strikes and entanglement in fishing gear are regarded as the primary threats (Reilly et al., 2012). Looking to the future, it seems likely that climate change will cause the species yet more problems (Greene and Pershing, 2004). Another example of populations being affected by multiple threats might be found in the case of delphinids in the Northeast Atlantic where pollution, in the form of PCBs, has recently been recognized again as a major threat 460 SECTION | III Monitoring and Conservation of Marine Mammals (see, for example, Jepson et al., 2016). These are the same populations that, in many cases, are also being affected by deaths in fishing nets and other factors. To conserve wildlife populations, we need to address not one but the multiple factors that are affecting them simultaneously, and this is not a new realization. Nor is the notion that some factors act synergistically, creating greater harm together than when acting on their own. For example, enhanced exposure to pathogens from discharges into cetacean habitat combined with enhanced exposure to immunosuppressive contaminants might be expected to create more disease and even, potentially, drive mass mortalities (Simmonds and Mayer, 1997). However, marine mammal science tends to focus on particular classes of threat, rather than trying to address their multiplicity and the consequences of the interactions between them for the species and populations being affected. There have been good reasons for this. Typically, scientists have had to specialize to be effective (and successful in their careers), and natural sciences and veterinary sciences (including animal welfare science) have tended to follow separate paths. Perhaps, as argued subsequently, the time may have come for a reunification of these specializations, as we struggle to address the realities of multiple stressors in wildlife conservation. Indeed, how to sensibly address this complexity is arguably now one of the "holy grails" of modern conservation. Inherent in this is understanding how the factors interact to cause outcomes for the animals concerned and also how multiple exposures to stressors over a lifetime might best be considered. None of this is easy. Indeed it has recently been suggested that assessing "cumulative effects" is "a problem that has proven nearly impossible to solve" (Tyack, 2016). Nonetheless, it is also argued that to discern the factors contributing to population trends, scientists must consider the full complement of threats faced by marine mammals (NAS, 2016). Only with such knowledge can effective decisions be made about which stressors to reduce, to bring the population back to a more favorable state, and this kind of assessment can also provide the environmental context for evaluating whether an additional activity could threaten it. However, this view of science driving policy, while eminently logical, may not be fully realistic.

AN INVENTORY OF THREATS

There is a wide and growing range of potential stressors that affect marine mammals, and Table 17.1 provides a list. These stressors are not static over time, as new ones continue to be created by human activities (take, for example, the evolution of marine noise pollution as a threat, as described in Simmonds et al., 2014) and populations may be exposed to new stressors as conditions change. In fact, novel technologies (combined with retreating ice at the poles) now allow us to access even the deepest and previously most inaccessible regions. In the Arctic, in particular, we are witnessing an influx of activities new to the region, including large-scale fishing, fossil fuel exploration, and shipping, all presenting new threats to wildlife (Simmonds, 2016). Marine Mammals and Multiple Stressors

Chapter | 17 461 TABLE 17.1 Factors That May Adversely Affect Cetacean and Other Marine Mammal Populations and Their Habitats Climate change Storm intensity changes Sea ice changes Changes in runoff water circulations Ozone depletion Climate change–driven changes in human activities, e.g., l increased shipping and fishing in Arctic waters l increased directed take of marine mammals Pollution Nutrient pollution/eutrophication Harmful algal blooms Oil spills Persistent organic pollutants, especially PCBs (but also potentially including brominated flame retardants and perfluorinated compounds) Heavy metals Nonfishery-derived marine debris, including microdebris Fisheries/ related activities Overfishing and prey-culling and depletion Mariculture Marine debris, including ghost nets Bycatch Noise pollution Seismic surveys Boat traffic (also causing ship strikes) Military sonar Construction Pathogen emergent disease Physical habitat degradation Bottom trawling Dredging Other destructive fishing techniques Reclamation Coastal construction Wind farms Dams and barrages Marine fossil fuel exploration/extraction Continued 462 SECTION | III Monitoring and

Conservation of Marine Mammals Simmonds and Brakes (2011) compared a review of threats to cetaceans made in 1996, with their understanding in 2011, and suggested the following key developments: l There had been a general acceptance of noise pollution as a substantive threat and some movement to address this. l Climate change had also become an accepted phenomenon, with implications for cetaceans. l Levels of some of the more infamous pollutants had fallen. l There was much recent new research into marine mammal diseases and a growing awareness of the vulnerability of marine mammal populations to disease events and the potential of human activities to contribute to them. A few years further on (I am now writing in mid-2017), it is now possible to recognize the reemergence of the threat posed by PCBs as a significant issue for the survival of some populations. Likewise, the growing number of harmful algal blooms (e.g., Anderson, 2009), possibly boosted by nutrient discharges, combined with changing climate, seems to be coming more clearly to the fore as a pressing issue (IWC, 2017). It is also now much more clearly recognized that intense sounds from human activities—such as seismic air guns—can have direct physiologic effects on marine mammals and that naval sonar triggers behavioral reactions that can lead to death by stranding (NAS, 2016). Emerging threats at this time include the growing amounts of macro- and microdebris in the seas and oceans and, as noted before, rapidly changing human activities in the Arctic. Factors impacting marine mammals populations can be lethal (e.g., a ship strike or a launched harpoon) or sublethal, and when describing "stressors" here, it is a sublethal impact that is being primarily considered. For example, while loud noise can be lethal, the most common effect of noise on marine Tourism Whale watching "Swim with" programs War-related activities Mines Munitions dumps Introduced species Intentional takes Commercial whaling Other marine mammal takes for profit or food. After International Whaling Commission (2006), with additional factors from Brakes and Simmonds (2011). TABLE 17.1 Factors That May Adversely Affect Cetacean and Other Marine Mammal Populations and Their Habitats–cont'd Marine Mammals and Multiple Stressors Chapter | 17 463 mammals is behavioral disturbance. From a population perspective, rather subtle behavioral changes affecting very large numbers of marine mammals may have greater consequences than occasional lethal events affecting a few (NAS, 2016).

AN EXAMPLE OF A COMPLEXITY: CLIMATE CHANGE

To help more fully comprehend the complex natures of the situations that marine mammal populations are facing, it may be worth considering further the various mechanisms through which climate change may come to impact them. Simmonds (2016) reviewed this, and it is apparent from the scientific literature that the primary concerns are not so much about a direct effect upon the individual marine mammals themselves (e.g., thermal stress) but more focused upon changes in prey and, to some extent, on changes in human activities (including their changing locations as highlighted for the Arctic earlier and discussed more broadly in Alter et al., 2010). This is not to say that there might not be direct responses from marine mammal populations to changing physical conditions in the sea. For example, cetacean population distribution is closely related to temperature, and it has long been theorized that there will be a general movement toward the poles as waters warm. There is already evidence that this is starting to happen. Prey may also change and shift distribution, so trying to separate out one effect from another in the future may be difficult. Fig. 17.1 illustrates the various ways in which climate change–driven factors may come to affect marine mammals. It also highlights potential interactions with other factors. For example, access to prey might also be affected by competition with species that have changed distribution. And the fitness of the marine mammals (both as individuals and populations) might also be undermined by exposure to new pathogens, chemical and noise pollution, and so forth.

ENGAGING WITH MULTIPLE STRESSORS

The first serious attempt to try to address the issue of the multiple factors affecting marine mammals may have come from the International Whaling Commission (IWC). By the early 2000s, the member nations of the IWC had become concerned about the broad range of factors then known to be affecting cetaceans. It initiated an ambitious piece of work to look at this via a "Workshop on Habitat Degradation." While the workshop title indicates a focus on habitat, it was ultimately concerned with how to take an integrated approach to stressors/threats. The workshop was informed by an earlier smaller "scoping group" meeting of experts, and it is worth noting that this identified several potential ways forward, including consideration of individual health and body condition, "vital rates" (i.e., survival and fecundity and other life history parameters), population changes, and community-level changes (IWC, 2006). The scoping group suggested that the principal tools for linking habitat changes to these response variables were (1) correlative analyses comparing response variables across habitats with very different levels and patterns of impact; (2) "analogy 464 SECTION | III Monitoring and Conservation of Marine Mammals from more detailed mechanistic studies on model species"; and (3) modeling of population responses to changes in vital rates as a result of habitat degradation. The IWC Workshop on Habitat Degradation met in 2004 and noted in its report that the IWC has been concerned about the influence of environmental changes on cetacean populations for many years, signified by various resolutions requesting that its Scientific Committee progress understanding of this issue (IWC, 2006). In response, the Scientific Committee had identified eight environmental priority topics: l climate/environment change; l physical and biologic habitat degradation; l chemical pollution; l direct and indirect effects of fisheries; l impact of noise; l disease and mortality events; l ozone and UV-B radiation; l Arctic issues. The workshop's general conclusions stressed the importance of undertaking research relating habitat condition to cetacean status in the context of FIGURE 17.1 Climate change–driven factors and associated stressors and linkages. (Modified from Simmonds, M.P., 2016. Impacts and effects of ocean warming on marine mammals. In: Laffoley, D., Baxter, J.M. (Eds.), Explaining Ocean Warming: Causes, Scale, Effects and Consequences. IUCN, pp. 305–322.) Marine Mammals and Multiple Stressors Chapter | 17 465 conservation and management. However, it also commented that "this is a particularly complex area of study, requiring both theoretical developments in modelling approaches and a commitment to long-term interdisciplinary data collection programmes." To help make progress, the workshop produced and strongly recommended a new framework for further investigation, which is shown in Fig. 17.2. The workshop also commented that any general application of the framework would require that management and research bodies take a longer-term view and described the present ad hoc processes (giving "Environmental Impact Assessments," based on short-term limited datasets as an example) as unsatisfactory. In terms of further research, the workshop identified several cetacean populations with sufficiently broad sampling programs, covering sufficiently long time frames, which could be the focus of studies: Florida bottlenose dolphins; European harbor porpoises; and resident killer whales from the northwest coast of North America. The workshop also proposed a workplan to develop the framework (as shown in Fig. 17.2) and that this should include: 1. application to specific case studies; 2. further development of approaches to distinguish the relative effects of different stressors via population and spatial modeling approaches; FIGURE 17.2 Framework for modeling the links between environmental stressors that degrade habitat and population effects. (After IWC, 2006. Report of the IWC scientific committee workshop on habitat degradation. Journal of Cetacean Research and Management 8 (Suppl.), 313–335.) 466 SECTION | III Monitoring and Conservation of Marine Mammals 3. application of the framework to one area and then using the results to make predictions for the same species in a different area and comparing this with the actual situation as a type of “validation”; 4. a follow-up workshop to review the progress of this workplan. Sadly, this comprehensive start to unraveling such a complex issue has not obviously positively resonated down the intervening years in terms of research either under the jurisdiction of the IWC or, as far as can be judged from the scientific literature, anywhere else! Perhaps the inherent problems were just too complicated, or perhaps, there was still too much to be done in terms of understanding the various stressors or developing the necessary models. However, most recently, at its 2017 meeting, the Scientific Committee of the IWC agreed to prepare for a workshop on cumulative threats, and it took note of the relevance of the outputs of the 2004 Habitat Degradation workshop to this (IWC, 2017). So, it may be hoped that there may yet be some further development and elaboration of the approaches and recommendations made by the 2004 workshop. Certainly, there has been a lot of work on the factors affecting marine mammals and their habitats in the intervening years, and increasingly, this considers interactions with more than one stressor. The relevant scientific literature is too voluminous to review here, but examples include the copious amount of recent research on marine noise (Simmonds et al., 2014) and also on the effects of whale watching on cetacean populations (see, for example, New et al., 2015; Higham et al., 2014). Effort has also gone into modeling approaches, leading, for example, to the Population Consequences of Disturbance model (New et al., 2014).

THE LATEST WORK ON CUMULATIVE EFFECTS

Animals and populations of animals may be exposed to particular stressors once or many times. A good example is exposure to a loud noise, and multiple, frequent exposures might be more significant than rare exposures over a longer time. “Cumulative effect” has been defined as the combined effect of exposures to multiple stressors integrated over a defined relevant period: a day, a season, year, or lifetime (NAS, 2016). In the United States, the National Academies of Sciences, Engineering, and Medicine has been looking at cumulative effects on marine mammals. The results of its deliberations were delivered in a substantive and substantial (250-page) report published in 2016 (NAS, 2016). The topic of cumulative effects was chosen by the federal agency sponsors because assessing cumulative effects has been an important part of US regulations protecting marine mammals since the 1970s, but “the approaches used have little predictive value.” If cumulative effects cannot be accounted for, “then unexpected adverse impacts from interactions between stressors pose a risk to marine mammal populations and the marine ecosystems on which people and marine mammals depend” (Tyack, 2016). Because quantitative prediction of cumulative effects of stressors on marine mammals is not currently possible, the authors of the NAS report have developed Marine Mammals and Multiple Stressors Chapter | 17 467 a conceptual framework for assessing the population consequences of multiple stressors (NAS, 2016). They call this the “Population Consequences of Multiple Stressors” model, and it uses indicators of health that integrate the short-term effects of different stressors that affect survival and reproduction, and the report explores a variety of methods to estimate health, stressor exposure, and responses to stressors. (For a full explanation of this approach and the study’s full and detailed recommendations, readers are directed to the full report.) Importantly, the authors concluded that scientific knowledge is not up to the task of predicting the cumulative effects of different combinations of stressors on marine mammal populations (NAS, 2016) and comment that “even though exposure to multiple stressors is an unquestioned reality for marine mammals, the best current approach for management and conservation is to identify which stressor combinations cause the greatest risk.”

CONCLUSIONS AND RECOMMENDATIONS

This short review cannot do justice to the investigations that have been made into the effects of stressors on marine mammals and their habitats, alone, in combination, or cumulatively. However, what is emerging from these studies is that this is a very complex sphere of endeavor. Clearly, much research is ongoing, and inherent in this is information that will help to inform those seeking to conserve marine mammal populations. However, the integration of research into effective conservation policy is itself far from being straightforward. Claudio Campagna, in an inspiring keynote address at the 2015 Conference of the Society for Marine Mammalogy, challenged his audience with a bleak but well-informed view of modern conservation (Campagna, 2015). He opined that the continuing crisis of imminent extinctions is being driven by a paradigm that he summarized as "„,provide me with a good economic reason or I do nothing… or I will make small adjustments of no consequence". He argued that the current approach to species conservation is flawed as it is based on the notion that science informs policy and policy informs conservation and sustainable economic growth. However, in practice, he argued new information is used to intervene only when it is no more costly than doing nothing! Valuing nature only in economic terms avoids recognizing the disastrous consequences of what Campagna called "the species crisis." Sadly, my own experience of conservation work aligns closely with this, and while scientists may work hard to understand matters and give advice, including in the complex context of the multiple stressors now affecting marine mammals, this does not necessarily mean that any effective action will follow. Related to this is that many conservation approaches require a good understanding and ongoing monitoring of the populations concerned. This is rare for many marine mammal populations (which is why many remain "data deficient" on the International Union for Conservation of Nature Red List). What is clear, 468 SECTION | III Monitoring and Conservation of Marine Mammals however, is that chemical pollution, noise pollution, disturbance (leading, for example, to displacement from important habitats), and other factors can substantially impact populations, and there are some instances where we know or can reasonably deduce which populations are being impacted to such an extent that their future is imperiled (for example, in the case of PCBs, certain populations in the Northeast Atlantic, including the Mediterranean and Black Sea areas). This then provides a case for action. Pollution by PCBs and climate change are clearly difficult issues to address. There is no simple "off-tap" for either. However, it should be noted that various actions are being promoted, especially in a European context, to address PCBs (see Law and Jepson, 2017; Stuart-Smith and Jepson, 2017). However, in situations where we believe such intransigent stressors as these may be the primary cause of problems, addressing other more easily resolvable factors likely to be adversely affecting the population would seem at least precautionary and, indeed, sensible (e.g., taking action to stop or lessen incidental removals in fishing nets or death by ship strikes). Such precautionary action— reducing stressors where this is possible— should not wait on perfect proof of impact or be inhibited by the knowledge that these stressors are not the primary causal factors in declines, but it should proceed to make populations as robust as possible to the multiple stressors they are facing. Sanctuaries or marine protected areas, wherein stressors are reduced or removed, will play an important role in this, and there is an ambitious program of work on this going forward at this time led by the Marine Mammal Protected Areas Task Force. The Task Force was created in 2013 and has been setting up regional workshops to identify Important Marine Mammal Areas, beginning with the Mediterranean in 2016, followed by the South Pacific, the Northeast Indian, the Northwest Indian and the Southeast Pacific oceans, and the waters of Oceania surrounding Australia and New Zealand (ICMMPA, 2017). Another innovation (as hinted at in the introduction) is the use of animal health considerations to help pinpoint and better understand problems. Monitoring marine mammal population trends may not always be practical, and a measurable decline in a population should not necessarily be taken as the only possible cue for action. Welfare science and health assessments offer another set of tools. This idea is not entirely novel. While the 2004 IWC workshop did not formally include health assessments in its guiding framework (Fig. 17.2), the possible development and use of health parameters was certainly discussed there (IWC, 2006). Thirteen years later, the National Academies of Sciences, Engineering, and Medicine puts monitoring health at the center of its approach and recommendations. More generally, monitoring the health of wild populations offers a new way to identify when significant problems are developing; perhaps providing a kind of early warning system. This relationship between welfare science and conservation now deserves to be further developed from the perspective Marine Mammals and Multiple Stressors Chapter | 17 469 of improving both conservation and welfare responses, and interestingly, the IWC, with its growing interest in whale welfare outside of the hunting context (IWC, 2016), may prove to be the crucible in which such things productively come to mix. Finally, one of the biggest problems faced by those who want to conserve and protect marine mammals (or for that matter address pressing threats, including climate change) is convincing those in power and the public more generally that this actually matters: specifically that the survival of marine mammals has relevance to our own species. Somehow, it appears that the human race has become detached from the natural environment that supports it by maintaining functioning ecosystems of which wild animals (including marine mammals) are components. This detachment is so profound that we do not recognize the threat to ourselves as our activities disrupt and damage ecosystems. Part of the response to this has to be in education (in the broadest sense) and explaining how we inherently fit into—and are supported by—something much bigger than ourselves. Without a better informed and sympathetic public, and policy makers, we have little hope of effectively addressing the complex issues besetting marine and other ecosystems."

The following paper, quoted in part, shows clearly the **range of complex issues which can beset species of fauna,** in this case dolphins, which are so much a part of the biodiversity which inhabits Smith Bay.

<u>In these days of uncertainty and biodiversity loss it seems irresponsible to contribute unnecessarily to factors which affect survival of species.</u>

- **Reference - Article / Paper / Fact Sheet 4:**

"Long-term decline in survival and reproduction of dolphins following a marine heatwave"

Sonja Wild, Michael Krützen, Robert W. Rankin, William J.E. Hoppitt, Livia Gerber, Simon J. Allen

"The study area in the western gulf of Shark Bay, Western Australia, encompasses approximately 1,500 km2. Over 5,000 dolphin group encounters have been documented between 2007 and 2017 (all points). To account for unequal survey effort in each field season, the study area was overlaid with a grid of 2 x 2 km cells. Capture-recapture analyses were run on data sets with two different levels of inclusiveness:

(A) the core study area consisting of grid cells that had been covered in all seasons; and

(B) a more inclusive area of mainly the Northern part of the study area where seagrass die-off had been most severe.

A set of Pollock's Closed Robust Design (PCRD) models considered to assess apparent survival rates in the bottlenose dolphin population in the western gulf of Shark Bay, while controlling for temporary emigration and differences in capture and recapture probabilities. The notation (.) indicates that a parameter was kept constant; (heat) indicates that the parameter was allowed to vary with a binary heatwave variable ('pre' for the years 2007–2010 and 'post' for years 2011– 2017); (time) indicates that the parameter was allowed to vary with the primary period (years); (forage) indicates that the parameter was allowed to vary with an individual's foraging technique ('sponger' or 'non-sponger'); (depth) allowed a parameter to vary with a binary variable describing habitat preferences ('deep' or 'shallow'); (composite) allowed the parameter to vary with a variable grouping individuals into habitat and foraging preferences ('shallow all'; 'deep sponger'; 'deep non-sponger'); (ts) indicates that capture (p) and recapture (c) probabilities were allowed to vary by both primary (years) and secondary periods (months); (het) allowed for individual heterogeneity in capture and recapture probabilities (when pi◌̆1), while (het2) allowed for individual heterogeneity in capture and recapture probabilities, plus allowed for them to vary by primary and secondary periods (when pi◌̆1). Supplemental Experimental Procedures Field methods Boat-based surveys were conducted between April and October from 2007 to 2017 in the western gulf of Shark Bay, Western Australia, based at our long-term research site at the township of Useless Loop. The broader study area stretches over approximately 1,500 km2 (Figure S1A). Weather-dependent sampling (daylight hours, low wind, no rain, Beaufort sea state ≤3) was carried out on either predetermined, systematic transects or on a less structured basis within the boundaries of the study area (see below). On sighting, each dolphin group was approached for the purposes of recording GPS location and water depth, conducting individual photoidentification and observing behaviour over a minimum of five mins (hereafter termed a 'survey'). Individuals were identified based on the markings on and shape of their dorsal fins using standard photo-ID techniques. Group composition was recorded based on the 10 m chain rule. Foraging behaviour was recorded (as sponging or otherwise), and an individual was considered a 'sponger' after having been seen foraging with a sponge on at least two different occasions. Date of birth for 266 calves was estimated based on body size, presence of foetal lines and time since the last encounter of the mother in the absence of a calf. For 118 calves, birth dates were estimated within two years, and for 148 calves accuracy was one year or less. Demographic analyses Photographic capture–recapture data was used to estimate apparent survival (the product of true survival and permanent emigration), while controlling for temporary migration patterns and capture and recapture probabilities, using Pollock's closed robust design (PCRD). The PCRD is a hierarchical sampling strategy that includes repeated sampling of a population under 'closure' (i.e., no births or deaths, called 'secondary periods'), which are nested within broadly spaced 'primary periods'. The sampling structure increases the effective capture probability of animals that are difficult to detect and facilitates estimation of temporary emigration processes. The population is assumed 'closed' within primary periods and open between primary periods. Consideration of temporary migration is especially important for populations with wide-ranging individuals, such as dolphins.

In the case of Shark Bay dolphins, temporary migration can be viewed as movements in and out of the study area, given the well documented, strong philopatric tendencies of both sexes in this population. Ideally, capture-recapture analyses are based on data collected along systematic transects designed to ensure consistent coverage of the study area. Since the Dolphin Innovation Project is long-term and multi-strategy, with foci on behaviour, social structure, genetics, ecology, and communication, systematic transects have not been conducted in all field seasons. In seasons in which transect-based sampling was not conducted, either particular areas or subsets of dolphins were targeted according to specific scientific questions, or broad coverage of the study area was attempted in order to continue contributing to the long-term demographic data. To account for unequal survey effort across field seasons, we overlaid the study area with a 2 x 2 km grid and only included surveys within grid cells that had been covered in all field seasons (core study area). To test for robustness of the model estimates, analyses were repeated with a more inclusive data set, with more grid cells included in the Northern (shallower) part of the study area, where seagrass loss has been most severe and survey effort had been intensified after 2008 (results on robustness follow the main results).

For application of PCRD, several assumptions have to be fulfilled. First, individuals have to possess unique markings and be correctly identified. Hence, many previous studies on the demographic characteristics of marine mammals, including survival or abundance, have excluded individuals with insufficient markings. This is usually the case for calves and juveniles, as they are born with ‘clean’ fins and only acquire marks throughout their lifetimes. However, we were interested primarily in survival rates across the population. We elected to keep all individuals in our data set, regardless of the distinctiveness of the fin, because calves and recently weaned juveniles are expected to be most vulnerable to environmental stressors. For identification, we also relied on more subtle features, such as small nicks, fin shape or scarring patterns for less distinctive individuals. Most individuals in the study population are very well known and have been photographed on numerous occasions, allowing matching based on more subtle marks, including temporary scarring. To verify correct identification of individuals, all photo-identification data were double checked by a second observer. We also repeated our analysis on a reduced data set including only well marked individuals to ensure robustness of our results. We first graded all photographs according to fin distinctiveness (categories 1–3) and then re-ran our models (see below) on a data set that excluded category 1 fins (clean fins; i.e., with small marks not visible at an angle or in blurred photographs.Second, populations are assumed to be closed within primary periods (i.e., no births, deaths or permanent emigration), but open between primary periods. We chose years as primary periods, assuming population closure over the duration of one field season (two-four months), because reproduction is moderately seasonal in Shark Bay, with most births occurring between September and January (Austral summer). Third, individuals are supposed to have equal probability of being captured within sampling periods. Unequal capture probability primarily influences abundance estimates, but is less likely to influence survival rates, the main inference of our study. Nevertheless, we accounted for unequal capture probabilities by fitting full heterogeneity models, which allow for individual heterogeneity in both capture and recapture probabilities. Fourth, all individuals have equal probability of survival. This assumption is likely to be violated in our data, given we included all individuals regardless of age, and calf mortality in the Shark Bay dolphins is known to be high (at 44% by three years of age. However, we were primarily interested in survival estimates as a whole-population index, and documenting changes over time (especially pre- and post-heatwave). This is somewhat confounded with changes in the demographic composition of the marked population over time (e.g. if the proportion of low-survival juveniles changes versus the proportion of high-survival adults). Nevertheless, we assumed such changes were essentially random and exhibited no trend over the study. Fifth, secondary period sampling occasions are supposed to be instantaneous. To ensure coverage of the entire core study area described above, we used calendar months as secondary periods, resulting in eleven primary periods (2007–2017) and two to five secondary periods per primary period, depending on the duration of the field seasons. Since calendar months as secondary periods are relatively large, the assumption of instantaneous sampling is violated. This places downward pressure on capture probabilities (animals assumed to be in the study area during all secondary periods, but who have left, are scored as 'missed-captures'), and potentially larger survival estimates. So long as the magnitude of the violation is constant over the study period, then the relative change in survival will be unbiased.

Alternatively, we deemed it more plausible that periods of intense changes in survival may result in more intense in-and-out movement of animals between secondary periods (and, therefore, more downward bias in capture probabilities and more upward bias in point-survival efforts). Therefore, this bias works to reduce our power to detect changes in survival. Models were created fitting the parameters apparent survival rate (S), temporary migration rates (Gamma', Gamma''), capture probability (p), recapture probability (c), and the parameter pi, which controls individual capture and recapture heterogeneity. Gamma'' is defined as the probability of an individual becoming a temporary emigrant, given it was alive and observed in the study area during the previous primary period. Gamma' describes the probability of an individual being a temporary emigrant given it was already a temporary emigrant in the previous primary sampling period. The models assumed that either survival was constant over time (denoted (.)), varied from year to year (denoted (time)), or varied only between the periods 'pre' (2007–2010) and 'post' (2011–2017) heatwave (denoted (heat)). We also included individual-level variables to investigate potential differences in survival among dolphins: forage allowed for a difference between spongers and non-spongers, depth for a difference between habitat types. For depth, we averaged the water depth of all sightings for each individual and assigned each individual to either shallow (10 m), since dolphins in the western gulf show strong natal habitat preferences for either shallow or deep water habitat. Seagrass almost exclusively occupies depths of less than 12m in western Shark Bay, which is why the two habitats may have been differentially affected by the heatwave. Where both forage and depth occurred in a model together, they were replaced with a single composite variable (composite) with three levels ('shallow all'; 'deep sponger'; 'deep non-sponger'), since, in our entire data set, only one sponger was found in shallow water. The variable 'composite' served for avoiding three-way interactions and, hence, over-complexity of models.

We also allowed for interactions between each individual-level variable (forage/depth/composite) and time variables (time/heat). Three emigration patterns were considered: i) no emigration (Gamma' and Gamma'' = 0); ii) random temporary emigration, where the probability of an individual being present within a primary period is independent of its presence in the previous sampling period (Gamma' = Gamma''); and iii) Markovian emigration, where the presence of an individual within a primary period is dependent on whether it was present during the previous primary sampling period (Gamma' and Gamma'' independently estimated). Both Gamma parameters were either i) set to be constant (.), ii) allowed to vary with years (time), the heatwave covariate (heat), foraging strategy (forage), habitat preference (depth) or the variable grouping individuals into habitat/forage categories (composite), or iii) were set to 0 (for no emigration). We did not specify any interaction terms among the Gamma parameters, in order to avoid over-complexity for the Gamma' parameter that is not easily identifiable. In a first set of models, both capture (p) and recapture (c) probabilities were either set to be constant (.), or varying with years (t = time) or both with years and months (ts = time.session). As such, setting pi = 1 enforced no heterogeneity in individual capture or recapture probabilities. We further fitted full heterogeneity models, which allowed for individual heterogeneity in both capture as well as recapture probabilities (het, het2) while varying pi either with foraging strategy (forage), depth (depth), the composite variable (composite) or setting it to be constant (.). Thereby, 'het' only allowed for individual heterogeneity in capture and recapture probability, while 'het2' also allowed for variation between primary and secondary periods. Models were fitted using R package Rmark in all possible combinations of the parameters, resulting in 7,548 different models.

The Akaike's Information Criterion corrected for sample size (AICc) was used to estimate relative model support, the model with the lowest AICc having the most evidential support. Eleven models that did not result in parameter estimates were refitted with new initial parameters from similar models. To assess changes in female reproductive rates, we used a Poisson Generalised Linear Model (GLM) to test for the number of calves born each year pre- and post-heatwave, while correcting (as an offset) for the number of females seen each season that were known to have had at least one calf between 2007 and 2017. To investigate differences in reproduction between dolphins from different habitat types and/or with different foraging techniques, we ran the models i) on all females pooled together; ii) with depth as a covariate (shallow, deep); iii) with foraging technique as a covariate (non-sponger, sponger); and iv) with the composite variable as a covariate with levels as described above (shallow all, deep non-sponger, deep sponger). Supplemental Results Between 2007 and 2017, over 5,000 dolphin groups were encountered in the western gulf of Shark Bay and 1,013 different individuals identified. After removal of surveys outside the core study area (see Methods), 2,005 surveys including 482 different individuals remained for fitting capture-recapture models. Of these, 60 individuals were identified as spongers and 422 as non-spongers. Reduced survival after the heatwave The top four models accounted for >95% of the posterior model probabilities. They shared several structural features: they included heatwave and foraging strategy as covariates for survival (either as S(heat*forage) or S(heat*composite)); they had time-varying random emigration; they included re/capture probabilities with temporal heterogeneity by primary and secondary periods, including habitat and/or foraging strategy dependent individual heterogeneity probabilities. Since S(heat*composite) and S(heat*forage) refer to slightly different groups of dolphins (see Methods), and the top two models (both with S(heat*forage)) reached a cumulative Akaike weight of >0.8, estimates for apparent survival were averaged across the first two models only. Refuting or confirming causal hypotheses is not the fundamental motivation of the AIC. Instead, the AIC provides support for estimates that are (approximately) best at minimizing expected estimation error.

Therefore, best approximation of the shape of the survival time series is one in which there is a sudden break following the heatwave. Our model averaged time series is a parsimonious approximation of reality, which could of course have a more complex shape (such as a drop in survival at the heatwave, followed by gradual recovery). Such contrary hypothetical forms were not favoured as evidenced by the low Akaike weights of models with fully time-varying survival. Note that a very large sample size would increase power sufficiently to reliably estimate year-to-year changes in survival. The AICc, however, suggests that, given the current sample size, more complex forms could not be reliably estimated. If we take the position that Akaike weights are approximate model probabilities, then there is evidence of a persistent effect of the heatwave and subsequent habitat degradation. Model averaged estimates indicate that apparent survival of spongers was less negatively affected than that of non-spongers (5.9% versus 12.2% decline in survival from pre- to post-heatwave, respectively). The difference in the effect of the heatwave on spongers and non-spongers was estimated to be 6.3%. Apparent survival, normally encompassing both true survival and permanent emigration, is here assumed to be a good approximation of true survival, because both sexes are highly philopatric and permanent emigration has not been documented in Shark Bay dolphins. The demarcation of the 'core study area' has an element of reasoned arbitrariness to it. Therefore, to ensure robustness of our results, we repeated all sets of models with a more inclusive data set, as well as shorter secondary periods for the core study area. For half months, all encounters on the 1st until the 15th of each month were considered to be in the first half, while encounters between the 16th until the end of each month were considered to be in the second half of the month. With calendar months, the number of secondary periods varied between two and five for each primary period, whereas for half months the number of secondary periods within each primary period ranged between five and 10. Eight models not resulting in parameter estimates (inclusive data set) were re-run using initial parameters of similar models.

Furthermore, we repeated our analysis on a restricted data set, which included only well-marked individuals (with months as secondary periods, core area), resulting in the inclusion of 344 individuals, while 138 unmarked or poorly marked individuals were excluded from the analysis. Five models that did not result in parameter estimates were re-run using initial parameters of similar models. The top 95% of models of each of the data sets described above (based on their Akaike weights) were considered in the results below. For both the core (main results) and inclusive data set, the top 95% of models showed most support for survival varying with the heatwave covariate, as well as individual foraging strategy (Akaike weight core: 0.806; Akaike weight inclusive: 0.896). Model averaged parameter estimates for apparent survival of the more inclusive data set confirmed findings of the core study area: estimates for apparent survival were within 0.3% of estimates presented in the main results, and reductions in survival from pre- to post-heatwave for non-spongers were 11.7% (from 92.6% to 80.9%) and 6.3% for spongers (from 97.4% to 91.1%). For smaller secondary periods (half months), models with survival varying with the composite variable received most support (Akaike weight: 0.991), which further confirmed differential impacts of the heatwave depending on an individual's foraging strategy. Reductions from pre- to post-heatwave were lowest for spongers in deep water (6.0% reduction from 97.4% to 91.4%), followed by non-spongers in deep water (10.8% reduction from 92.6% to 81.8%) and all shallow water individuals (13.4% reduction from 92.4% to 79.0%). Finally, analyses including only well-marked individuals showed most support for survival varying with heatwave and individual foraging strategy (Akaike weight: 0.70), followed by models with survival varying with the composite variable (Akaike weight: 0.16). Model averaged estimates for the top two models revealed 4.0% reduction in survival for spongers (from 95.7% to 91.7%) and 11.2 % reduction in survival for non-spongers (from 93.7% to 82.5%). These results suggest that, despite unequal survey effort across different field seasons, the ad libitum data collection in some field seasons, as well as the inclusion of all individuals regardless of fin distinctiveness, results on differential impacts on spongers versus non-spongers are reliable. While models with half months as secondary period show differential survival for non-spongers from shallow and deep habitat, they confirm our main results, that i) survival estimates for all individuals declined post-heatwave, and ii) that spongers were less affected than non-spongers from both shallow and deep habitat. Lower survival of shallow water individuals compared to deep water individuals (both spongers and non-spongers) further indicates that reductions in vital rates are most likely driven by losses, and a lack of recovery, of seagrass."

- **Reference - Article / Paper / Fact Sheet 5:**

"El Niño Southern Oscillation influences the abundance and movements of a marine top predator in coastal waters"

Kate R. Sprogis, Fredrik Christiansen, Moritz Wandres, Lars Bejder 8 October 2017

Abstract

"Large-scale climate modes such as El Niño Southern Oscillation (ENSO) influence population dynamics in many species, including marine top predators. However, few quantitative studies have investigated the influence of large-scale variability on resident marine top predator populations. We examined the effect of climate variability on the abundance and temporary emigration of a resident bottlenose dolphin (*Tursiops aduncus*) population off Bunbury, Western Australia (WA). This population has been studied intensively over six consecutive years (2007–2013), yielding a robust dataset that captures seasonal variations in both abundance and movement patterns.

In WA, ENSO affects the strength of the Leeuwin Current (LC), the dominant oceanographic feature in the region. The strength and variability of the LC affects marine ecosystems and distribution of top predator prey. We investigated the relationship between dolphin abundance and ENSO, Southern Annular Mode, austral season, rainfall, sea surface salinity and sea surface temperature (SST). Linear models indicated that dolphin abundance was significantly affected by ENSO, and that the magnitude of the effect was dependent upon season. Dolphin abundance was lowest during winter 2009, when dolphins had high temporary emigration rates out of the study area. This coincided with the single El Niño event that occurred throughout the study period. Coupled with this event, there was a negative anomaly in SST and an above average rainfall. These conditions may have affected the distribution of dolphin prey, resulting in the temporary emigration of dolphins out of the study area in search of adequate prey.

This study demonstrated the local effects of large-scale climatic variations on the short-term response of a resident, coastal delphinid species. With a projected global increase in frequency and intensity of extreme climatic events, resident marine top predators may not only have to contend with increasing coastal anthropogenic activities, but also have to adapt to large-scale climatic changes."

- **Reference - Article / Paper / Fact Sheet 6:**

"Warming oceans are killing dolphins, study shows"

Jen Christensen April 1, 2019

What life looks like at 'Day Zero'

"**Dolphins may be in serious trouble as temperatures rise with global warming.**
After a heat wave struck the waters of Western Australia in 2011, scientists noticed that warmer ocean temperatures caused fewer dolphin births and decreased the animal's survival rate.

The heat wave caused the water temperature of an area called Shark Bay to rise about 4 degrees above the annual average. After the heat wave, the survival rate for some species of dolphins fell by 12%, according to a study published Monday in the journal Current Biology.

The dolphins also gave birth to fewer calves. What worries the researchers is that this change in birth rate wasn't only observed immediately after the year of the heat wave. They studied the dolphins that lived in Shark Bay between 2007 and 2017, and the decline in births lasted at least until 2017.

"It was serendipity really. We have been working in that part of Shark Bay since 2007, now as part of a large study," Michael Krützen, an author of the study and director of the Department of Anthropology at the University of Zurich, wrote in an email.

Researchers had noticed that the warmer waters killed a lot of seagrass, which drives the bay's entire ecosystem. It provides food and protection for animals that live there.

"Once we realized that the 2011 warm water event had such devastating consequences on the seagrass beds in Shark Bay, we wondered whether [animals] on top of the food chain might also be affected," Krützen said.

What was a surprise, he said, was that even six or seven years after the heat wave, there was still *"no clear sign that things were back to normal -- survival and reproduction were still lower, so these short term effects have long-term consequences on marine megafauna."*

It's unclear what is causing the change in dolphin survival and birth rate. It may be because fewer newborns survived the higher temperatures. Dolphin parents may have been neglecting their offspring due to the environmental change. Or the heat could have delayed the animal's sexual maturity. The team hopes to do more research to find out.

Not all dolphin groups were affected. Some of those in Shark Bay use sponges as tools to hunt, and those dolphins weren't as negatively impacted, at least not in the time period the researchers observed. Long-term, however, they don't know whether those animals would be similarly affected.

Scientists have long known that a warmer ocean is bad news for animals. The warmth stresses the entire ocean food web, studies show. Warmer oceans hold less oxygen, which can cause massive fish kills. Corals, home to many fish and other sea creatures, are also extremely temperature-sensitive. Heat waves between 2016 and 2017 killed half the corals at the Great Barrier Reef, for instance.

It's likely there will be many more ocean heat waves. Climate change is particularly hard on the oceans, which absorb 93% of the Earth's energy imbalance. The oceans have been warming at an accelerated rate since the 1960s, studies have found.

"Survival and reproduction are important parameters that inform us about the health of a population," Krützen said. *"It seems that extreme weather events appear to threaten marine mammal populations in their existence. If we want to conserve these populations, we have to think how the frequency of such events can be kept at a minimum."*

What can stop it? "Stop using fossil fuels," Krützen said. Increased fossil fuel use is directly causing climate change, studies have shown.

"Seriously," he said. *"[I'm] not sure these effects with the very large destruction of seagrass cannot be undone or repaired by humans. Nature will do it, but it takes time in the case of Shark Bay."*

CONCLUSION

It is almost impossible to predict with any great accuracy what the effect of cumulative impacts might be in many circumstances.

In the section above by Mark Simmonds and Phillipa Brakes many potentially damaging issues are explored but there is an area of considerable certainty which emerges from scientific literature, that of **possible extinction**.

<u>With an estimated decline of 40% in the South-Eastern population of Southern Right whales there is a high likelihood of extinction unless careful management is employed.</u>

The Conservation Management plan for the species is unambiguous about **the need to avoid development in areas of important habitat**. The whales cannot simply relocate from habitat which is preferred or critical for them, and speaking morally and ethically why should they?

The effects of **diminished water quality** due to dredging and consequent **sea grass loss**, the impacts of **toxicity**, the **stress created by noise** during construction and operations, the potential for **vessel strike** ..... the list goes on, and it is all unnecessary.

<u>The impacts upon a highly endangered species, the most highly endangered Baleen whale species in the world at this time, under the protection of the EPBC Act 1999 as a Matter of National Environmental Significance are simply too great to ignore.</u>

The potential international embarrassment for Australia, especially in light of our stance on Japanese whaling etc., is of major concern.

For our country to join the race to extinction together with New Zealand with the Mauis/Hectors, Mexico with the Vaquita, China with the Finless River Porpoise and Canada with the North Atlantic Right Whale is highly unpalatable. The hypocrisy would not go unnoticed and Australia's international reputation would be damaged accordingly.

This scenario is also completely unnecessary and the solution is extremely simple

..... **move the proposed port elsewhere**.

<u>As a Citizen Science organisation researching the dolphins in our regional waters we have enormous concerns regarding potential impacts upon them also.</u>

As Smith Bay forms part of the **migratory pathway between two known nursery sites,** we are extremely concerned about the potential disruptions which will occur to their lives, especially in light of recent research indicating successful breeding is an indicator of the health of a population.

Interference which causes higher mortality rates coupled with the uncertain impacts of warming oceans, disease, climate change factors, effects upon prey species etc. are causes of great concern.

Again, as mentioned previously, the solution is obvious.

Perhaps the following needs to be revisited in light of the above:

The criteria to be considered when determining whether an action will have a significant impact on a listed threatened species of National Environmental Significance are as follows.

The action must not:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species; • disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- introduce disease that may cause the species to decline
- interfere with the recovery of the species.

Kangaroo Island / Victor Harbor Dolphin Watch

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May 27th 2019

Kangaroo Island Plantation Timbers Environmental Impact Statement Response

ALTERNATIVE ECONOMICS

The emergence of Smith Bay as a BIA for Southern Right whales may be seen as an impediment by the proponents of KIPT's Seaport proposal but it can be viewed in a completely different way.

It can provide **consistent, sustainable economic benefits** as the following excerpts from the following report very clearly demonstrate.

- **Reference - Article / Paper / Fact Sheet 1:**

"The Growth of Whale Watching Tourism in Australia – An IFAW Report"

Michael McIntyre

Asia Pacific Director, International Fund for Animal Welfare May 2004

"A global assessment produced by IFAW in 2001 (*Whale Watching 2001: World Tourism, Numbers, Expenditures and Expanding Socio-economic Benefits* by Erich Hoyt) showed that by the dawn of this millennium, whale watching had become a $1 billion industry attracting more than 9 million participants in 87 countries and territories around the world.

Since that time whale watching in Australia has continued to expand. This report documents the continuing growth in whale watching in Australia – where we now have more than 1.5 million whale watchers contributing close to $300 million to the Australian economy.

This is a massive increase of 15% per annum over the past five years.

IFAW has long believed whales and people both do better when these magnificent animals are seen and not hurt. And this report on whale watching in Australia validates that belief.

We look forward to the continued development of this industry and to the growing benefits it brings to both animals and people."

This is an old report but gives some idea of the **potential being offered by an initiative of this nature** which is comparatively benign in comparison to the port proposal.

Organic growth of such an industry on Kangaroo Island is perfectly achievable.

SA Tourism Commission figures for the Southern Fleurieu show 400,000 visitors and a $9,000,000 input to the regional economy from south coast whale watching based around Victor Harbor, Goolwa and Port Elliott in recent years.

If and when the whale numbers recover, the North Coast of Kangaroo Island can provide similar benefits.

This fledgling industry is not conducive to the KI seaport proposal because of the siting at Smith Bay, the proverbial **"Hot Spot" for the whales**, their preferred habitat.

Kangaroo Island sits on the Great Southern Reef and provides some of the greatest access to its myriad wonders.

With great interest being shown by scientific researchers, research tourists, eco-tourism operators, temperate water divers and the like in the 85% endemism which Kangaroo Island's relatively pristine waters offer, it seems much more beneficial in both the short and long term to consider carefully when and where development should be undertaken, particularly in such a case as this where there are other options available.

Kangaroo Island / Victor Harbor Dolphin Watch

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May 27th 2019

Kangaroo Island Plantation Timbers Environmental Impact Statement Response

APPENDICES

1. **Cetacean Sightings MASTER Summary Smith Bay KI** May 25th 2019
   Kangaroo Island / Victor Harbor Dolphin Watch
   Focus Area 3."Whales and Dolphins" Page 2

2. **"Whales of Smith Bay Kangaroo Island"** David Connell January 8th 2019
   Focus Area 3."Whales and Dolphins" Page 12

3. **KI Plantation Timbers - Kangaroo Island / Victor Harbor Dolphin Watch EPBC Response** November 22nd 2016
   Focus Area 4. "Noise and Stress" Page 2

4. **"New Evidence for Bottlenose Dolphin (Tursiops spp.) Population Connectivity between Kangaroo Island and South Australian Mainland Waters"** January 10th 2018
   Nardi Cribb, Phyll Bartram, Tony Bartram, Laurent Seuront
   (1) School of Biological Sciences, Flinders University, Adeiaide, Australia
   (2) Kangaroo Island/Victor Harbor Dolphin Watch, Kangaroo Island, Australia
   Focus Area 4. "Noise and Stress" Page 11

Cetacean Sightings - Smith Bay, Kangaroo Island

MASTER SUMMARY May 25th 2019

Year	***Date & Time***	***Position***	***Species & No.*** *Humpback Whale	*Southern Right Whale	*Bottlenose Dolphin	*Shortbeaked Common Dolphin	***Behaviours & Details***	***Observer***
Historical								
1928	December	Smith Bay https://trove.nla.gov.au/newspaper/article/191549371	1 Large Whale - species unconfirmed				***"In a playful mood"*** – swam alongside the cutter for some time	**Charlie Dermander** - Fisherman
1950's	Mid to late 1950's	Smith Bay & Dashwood Bay	**Regular sightings** of whales spouting offshore - species unconfirmed			Bottlenose & Common Dolphins	**"Cruising the shore line" -** ***"herding mullet and tommies"***	**Ian Turner and Family** - Residents
KIMA >	**2006 - 19**							
2006	14th August 28th Sept.	Tumblers / Smith Bay Jamo's Reef & Smith Bay		2 SR Whales		 ***2 Orcas***		***KI Marine Adventures** ***KI Marine Adventures**
2007	10th July 29th July	West of Smith Bay Smith Bay		3 SR Whales 2 SR Whales - 1 Female 1 Calf		12 - 15 Shortbeaked Common Dolphins	Dolphins feeding	***KI Marine Adventures** ***KI Marine Adventures**
2008	**No Data**							
2009	18th June 26th July	West of Tumblers / Smith Bay Smith Bay	1 Humpback Whale	 2 SR Whales -	8 - 12 *2 groups Bottlenose Dolphins		Whale in close to shore	***KI Marine Adventures**

	2nd August	East of Smith Bay		1 Female 1 Calf 2 SR Whales	30 Bottlenose Dolphins - Abalone Farm			***KI Marine Adventures** ***KI Marine Adventures**
2010	21st July 22nd August	Smith Bay Smith Bay	1 Humpback OR SRW whale - unconfirmed	3 SR Whales - 2 Adults 1 Calf				***KI Marine Adventures** ***KI Marine Adventures**
2011	From 2011 > 2019 30th August 10th September	Smith Bay Smith Bay Smith Bay	**Annual whale sightings** -species unconfirmed	2 SR Whales - 1 Female 1 Calf 2 SR Whales - 1 Female 1 Calf			***"Whales observed in Smith Bay every year since 2011."*** Charmaine Zealand & Paul Lunn – Molly's Run	***Molly's Run** ***Yumbah Aquaculture** ***Yumbah Aquaculture**
2012	1st July ….August	North Cape > Smith Bay Just East of Smith Bay		2 SR Whales 1 SR Whale	15 - 18 Bottlenose dolphins		First sighted off North Cape - later in Smith Bay Dolphins sighted with the whale	***KI Marine Adventures** ***KI Marine Adventures**

2013	5th September ….August 25th October Date TBC *Video Footage*	Smith Bay - eastern end Smith Bay Smith Bay	 1 Humpback Whale	3 SR Whales 5 SR Whales - 3 Adults 2 Calves 4 SR Whales - 2 Female 2 Calves			 Travelling to the East Whales remained in Smith Bay for several months in close to shore.	***KI Marine Adventures** ***KI Marine Adventures** ***KI Marine Adventures** **Walter & Karen Florance - Farmers**
2014	27th July ….August ….August	Tumblers / Smith Bay Smith Bay		2 SR Whales 2 SR Whales - 1 Female 1 Calf 4 SR Whales - 2 Female 2 Calves	6 Bottlenose dolphins	Shortbeaked Common Dolphins	Dolphins out from the whales feeding on tuna. ***2 Females confirmed as giving birth in Smith Bay during 2014** – possibly includes previous confirmed sighting	***KI Marine Adventures** ***Yumbah Aquaculture** ***Molly's Run**
2015	3rd July 22nd July	Jamo's Reef & Smith Bay Smith Bay	 1 Humpback Whale	2 SR Whales		 Large group – Shortbeaked	First sighted Jamo's Reef - later in Smith Bay	***KI Marine Adventures** ***KI Marine Adventures**

						Common Dolphins	Dolphins sighted with the whale	
2016	21st May	Smith Bay	1 Whale - unspecified				*** SATC Film Crew**	***KI Marine Adventures**
	….August	North Cape > Smith Bay		2 Adult SR Whales			First sighted off North Cape > later Smith Bay heading West - 800m offshore	***KI Marine Adventures**
	23rd August	Emu Bay	1 Humpback Whale - Juvenile					
	9th October	Cassini > Smith Bay	1 Humpback Whale			Large group of Shortbeaked Common Dolphins 100 - 150	Breaching 3 – 4 times	***KI Marine Adventures**
2017	11th July	Tumblers > Smith Bay		2 SR Whales			No breach - pectoral & tail visible	***KI Marine Adventures**
	8th September	Smith Bay		2 SR Whales - 1 Female 1 Calf			KPT vessel testing substrate near whales	***Yumbah Aquaculture**
	9th September	North Cape	1 Whale - unspecified		2 large groups of Bottlenose Dolphins		2 – 5 miles offshore	***KI Marine Adventures**
	29th September	Smith Bay		2 SR Whales - 1 Female 1 Calf				***Yumbah Aquaculture**

2018	18th August	Smith Bay		3 SR Whales - 1 Female 1 Juvenile 1 Calf				***KI Marine Adventures** *Confirmed by ***Molly's Run**
	19th August	Smith Bay	2 Humpback Whales					***Yumbah Aquaculture**
	27th August	Smith Bay		3 SR Whales - 2 Adults 1 Calf				***Yumbah Aquaculture**
	17th November	Smith Bay	1 Humpback Whale			Small group of Shortbeaked Common Dolphins		***KI Marine Adventures**
	5th December	Smith Bay > Emu Bay	1 Humpback Whale - Juvenile		1 Large group of Bottlenose Dolphins			***KI Marine Adventures** ***Close to Yumbah Aquaculture**

Data Summary: 1928 > 2012

- Southern Right Whales - **57** **79.2%** ***12** **Females** confirmed **21.05%** ***17** **Calves / Juveniles** confirmed **29.82%**
  ***28** Gender unconfirmed **49.12%**
  NB Some *"Adults with calves"* NOT confirmed as Female
- Humpback Whales - **9** **12.5%** ***2** **Juveniles** confirmed **22.22%**
- Unconfirmed / unspecified species - **4** included in data sets and **Multiples** in anecdotal / personal communications records
- Orcas - **2**
- Dolphins - **Bottlenose Dolphins*: 7 groups – several large numbers **Shortbeaked Common Dolphins:* 5 groups – several large

TOTALS: *72 Whales & 2 Orcas 1928 > 2018*

Data Analysis: 2006 > 2018

69 Large Whale Sightings: 57 SR Whales 82.61% 9 Humpback Whales 13.04% 3 Unconfirmed Species 4.35%

SR Whales: *12 Females confirmed 21.05% *17 Calves / Juveniles confirmed 29.82% *28 unconfirmed gender 45.61%

Humpback Whales: *2 Juveniles confirmed **22.22%**

Data Sources:

- *Current Data Contributors:*
  1. Kangaroo Island Marine Adventures - Eco Tourism Marine Tour Operator: Kingscote, Emu Bay, Smith Bay, Dashwood Bay Operating Ecotourism tours and KI / VH Dolphin Watch surveys in the region since from 2006 > present day
  2. Yumbah Aquaculture - Abalone Farm, Smith Bay
  3. **Molly's Run** - Bed and Breakfast Accommodation - Smith Bay
  4. Walter and Karen Florance - Landholders / Farmers - Smith Bay
  5. Residents and community members

- *Whale Spotters / Observers:*

Yumbah personnel and community members / residents who have provided sightings / information via personal communication (Pers Comm.) – all are credible, experienced observers

1. David Connell - Yumbah Aquaculture *Lodged with SAWC
2. Christopher Smith - Yumbah Aquaculture *Lodged with SAWC
3. Luke Barrett - Yumbah Aquaculture *Lodged with SAWC
4. Sam Horjus - Yumbah Aquaculture *Lodged with SAWC
5. Kirsty Buick - Yumbah Aquaculture
6. Simon Buick - Yumbah Aquaculture
7. Sam Florance - Yumbah Aquaculture
8. Sam Woolley - Yumbah Aquaculture
9. Hannah Nasesi - Yumbah Aquaculture

10. Quinton Anderson - Yumbah Aquaculture
11. Steve Betheras and wife Karen Betheras - residents
12. Frank Berden and Helen Berden - residents
13. Damien Berden and wife Ali Berden - residents
14. Howard Forster, Greg Forster and Jack Forster - local professional fishermen
15. Grant Flanagan and Sharlene Noble - residents
16. Walter Florance, Karin Florance and family (two houses on property) – resident farmers
17. Mayor Michael Pengilly and wife Jan Pengilly - resident farmers
18. Paul Lunn and Charmaine Zealand - residents / Molly's Run
19. Andrew Neighbour, Nina Maurovic - KI Marine Adventures
20. Michael Fooks - professional fisherman

- *Historical:*

1. Charlie Dermander - Fisherman TROVE https://trove.nla.gov.au/newspaper/article/191549371 Smith Bay
2. Ian Turner and Family - Landholders / Farmers - Smith Bay

- *Unrecorded / Unconfirmed:*

1. Multiple personal communications with Landholders / Farmers / Fishermen / Residents report regular and increasing whale sightings for long periods of time in Smith Bay over many years.
2. Reports of a number of whale sightings reported to the SA Whale Centre but not recorded for various reasons
3. Contributors, particularly local residents, had been reluctant to make the observations public over the years for fear of attracting attention and resultant disturbance to the whales resting in the area.
   ***** "A locals' best kept secret - Smith Bay"*****

- *Kangaroo Island / Victor Harbor Dolphin Watch:*

1. Surveys commenced in Nov. 2005 with the 1st Dashwood Bay survey in May 2007
2. 49 Surveys have been conducted at Dashwood Bay to date – each survey covers adjacent Smith Bay – 97.96% Bottlenose Dolphin sightings in Dashwood Bay and regularly on the edge or in Smith Bay. ie 1 survey with no sightings in 2009
3. Sightings numbers: 1 - no sightings, 14 – 25 or less, 23 - 26 > 50, 11 – 51 >
4. Numbers are increasing with 6 surveys recordings 70 > 100+ dolphins!
5. High number of calf / juveniles sightings in this monitoring area with new calves regularly sighted.

6. High levels of residency and transience along the North Coast between North Cape and Dashwood Bay.

Discussion Points:

Variables / Variations

- Possibly some overlap in sightings eg 2014 Female & Calf Southern Right Whale sightings, and sightings with months only and not dates specified. (marked in red)
- Degree of certainty of species identification:
  ***High** - KI Marine Adventures, Yumbah employees, Florance family, Molly's Run
  ***High to Variable** - community data input over the years

Conclusions:

- Smith Bay is an **Emerging Biologically Important Area** for Southern Right whales
- Endangered Southern Right whales return to the site **annually** – many are females with juveniles / calves
- **Births in Smith Bay** have been confirmed over the years
- Many Southern Right whales **remain in the area for some time**…on occasions 3 – 4 months!
- Shallow Smith Bay has **similar rocky reef and rocky shore line habitat** to other preferred SR Whale areas
- Bottlenose Dolphins are **resident** in Smith Bay and Dashwood Bay with a **high level of transience** along the North Coast

Highest levels of protection must be afforded to Smith Bay and the surrounding North Coast area.

It is an imperative to protect and conserve this critical habitat for the endangered South Eastern population of Southern Right whales, of which scientists estimate less than 300 remain, and large numbers of resident and transient Bottlenose Dolphins.

Acknowledgements:

KI Marine Adventures, Yumbah Aquaculture, Molly's Run and local farmers, fishermen and residents

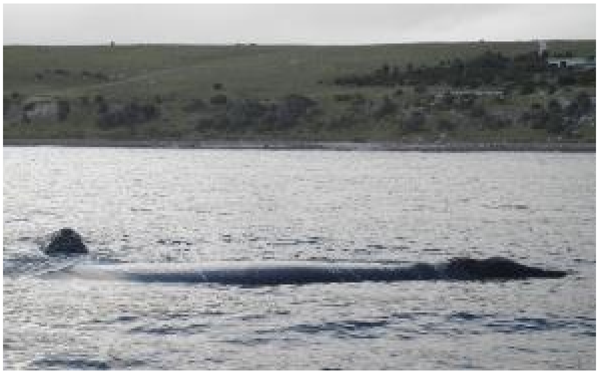
Tony and Phyll Bartram

Whales of Smith Bay, Kangaroo Island

Between 1999 and 2018 I have had the privilege of watching the Southern Right whales frolic, nurse and give birth in Smith Bay. As time has passed the visiting frequency and numbers has been on the increase.

My initial encounter was a solitary mother sheltering in the bay with her calf and over the years the numbers grew as I became accustomed to when to expect them and where to keep a look out. At first it was birthing mothers and then the addition of mothers with juveniles. In 2018 a group of three played in the waters for several days as if it was their preferred place to be.

Birthing mothers arrive and pace the bay just as any expecting mother paces her surroundings. Although I haven't witnessed a birth, you can always tell it's happened as by morning she will be very close to shore, so shallow her belly must be resting on the sea floor. It doesn't take long before you spot a little head close by her side.



Left alone without interruption, a mother will remain in the bay until their juvenile is strong enough to take on the open water. This time frame is usually around the 10 day mark, but it has taken as long as 14 days for one young one, that I did think wasn't going to make it. Total time spent for a mother has been as long as 4 weeks from arrival until departure.

I have noticed that once the juvenile begins to play openly, showing the strength to frolic around its mother and capable of making small lunges out of the water, it's only a day or so and they will be gone.

The most impressionable experience I have had was in the Spring of 2011 where a mother just following birth, lay so close to shore you could feel her breath passing through the rocks. On a dead calm evening, just sitting on the ironstone shoreline while her breath vibrated through my body, is a memory never to be forgotten.

Smith Bay has an ironstone reef that runs parallel to its shores. I believe the mothers feel this is great protection for their young. The bay has minimal sand so even in onshore wind days water clarity is very good.

It's common to see the dolphins and whales interacting. It's obvious they have respect for each other and do regularly co-exist.

I have at times had multiple mothers in the bay at the same time, all with young. Interestingly they will be close from evening to morning but generally will spend the day alone with their young. Quite the sight to see three mothers all with their heads within 10 metres of each other, as if they are up for a chat and three young, dashing around them like kids in the playground.

To date Smith Bay is a place of refuge for these whales and many other species.

Let's hope we can keep it this way.

David Connell

January 9th 2019

Emu Bay, Kangaroo Island, SA

Kangaroo Island / Victor Harbor Dolphin Watch
in partnership with
Whale and Dolphin Conservation

www.kangarooislanddolphinwatch.com.au www.islandmind.com www.wdcs.org.au

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The Hon. Josh Frydenberg MP
Minister for the Environment and Energy

John Gorton Building
King Edward Terrace,
Parkes ACT 2600
Australia

November 22nd 2016

Dear Minister,

Reference: KI Plantation Timbers Smiths Bay Port Proposal

Reference Number 2016 / 7814

Introduction

As a preamble we would like to draw your attention to the following comments from the Key Directions Statements from the IUCN Australia's "Conserving Australia's Marine Environment" Symposium as we believe they are relevant in this instance.

1. ***Avoid a short term approach to multiple threats****: All governments need to address these threats over the long term in a systematic and integrated manner and avoid short-term, politically driven decision making.*

2. ***Address cumulative impacts:*** *Appropriately scaled strategic frameworks that contain consistent environmental standards and provide a robust basis for both planning and approvals processes can be a key mechanism to avoid cumulative impacts.*

3. ***Exclude critically sensitive areas from extraction:*** *Places in our marine environment of high ecological and cultural values should be permanently off limits to damaging activities and protected under a range of mechanisms.*

4. ***Improve knowledge and ensure transparency of resource extraction industries:*** *Policy and legislation should ensure any industry operating in Australian waters meets the highest standards to avoid or reduce environmental impacts from their operations and such industries should contribute directly to marine conservation efforts.*

Reference: Conserving Australia's Marine Environment Key Directions IUCN 2013

The cetaceans which inhabit and migrate through the Smith's Bay Area of the North Coast of Kangaroo Island are entitled to much greater consideration than that currently afforded them by the Kangaroo Island Plantation Timber's Referral detailed above.

Given many of the species are accorded protected status under the EPBC Act of 1995, much greater attention to their welfare should be evident in this document.

We are aware through our association with the SA Museum and our familiarity with their data, together with data collected regarding observations by eco-tourism operator, and our associate and operational partner Kangaroo Island Marine Adventures, that there is very high likelihood of interactions with whales and dolphins in this precinct. We have attached a data summary document with respect to dolphin movements through this area which shows the importance of maintaining the migratory pathway between North Cape and Dashwood Bay, both critical sites, which lay either side of Smith's Bay.

The relevance of our position with respect to this referral is outlined below.

Kangaroo Island / Victor Harbor Dolphin Watch is a longitudinal research programme monitoring wild dolphin populations around our coastline. Beginning in March 2006 the project involves students and community members of all ages in collecting data about local dolphin population groups, their behaviours and their habitat. Using non invasive photographic identification techniques we seek to identify individual dolphins and their group structures and track their movements, with an ultimate aim of protection and conservation.

Kangaroo Island / Victor Harbor Dolphin Watch's Charter:

- Reengaging volunteers of all ages in education through their environment
- Contributing to knowledge and understandings about cetaceans in our environment
- Developing a baseline position with respect to population groups and habitat around the coastline
- Protecting dolphins, whales and their environment
- Assisting other communities to develop similar cetacean protection and study programs
- Providing personal growth and leadership opportunities for youth

Kangaroo Island / Victor Harbor Dolphin Watch works in partnership with the Whale and Dolphin Conservation. Established in 1987, Whale and Dolphin Conservation, is the world's leading charity dedicated to the conservation and welfare of all whales, dolphins and porpoises.

Issues of grave concern

Eight major issues emerge with respect to KIPT'S submission for approval to the EPBC:

1. ***The ecological importance of the area designated.*** The Smith's Bay area is of great significance to migratory species including endangered species under the EPBC Act.

   Smith's Bay is part of vitally important marine ecosystems, which support a number of different resident and migratory cetaceans including blue whale (*Balaenoptera musculus*), bottlenose dolphin (*Tursiops truncatus*), Indo Pacific bottlenose dolphins *(Tursiops aduncus)* Bryde's whale (*Balaenoptera edeni*), common dolphin (*Delphinus delphis*), southern right whale *(Eubalaena australis),* and sperm whale (*Physeter macrocephalus*). Many of these species are listed as endangered or vulnerable, and many more species are listed as migratory or as marine under the *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC).

   A number of these species are also similarly protected under South Australia's *National Parks and Wildlife Act, 1972.* All these cetaceans are also offered additional protection as 'cetaceans' under the *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales*. The activities proposed, particularly in the construction phase, are within a clearly identified biologically important habitat (feeding, migratory and resting) and there is a high likelihood of encountering cetaceans year round.

   This could be deemed to be particularly true for Humpback whales *(Megaptera novaeangliae*) which are increasing in number and are being observed much more frequently and over a much longer period of time than previously.

2. ***The possibility of displacement through avoidance is extremely high*** given the known impacts of anthropogenic noise on cetaceans which rely so heavily upon their sense of sound to maintain their lifestyle.

   Sound propagation through water has not been factored in to KIPT's submission although it is likely to have a marked detrimental effect upon many species, and cetaceans in particular. There is no sound modelling data provided in the referral, nor proposals for mitigation.

   This is a gross oversight on behalf of KIPT and its associates.

3. ***The cumulative effect of a broad range of impacts*** makes the degree of uncertainty extremely high in all matters of ecological and conservation consideration. This degree of uncertainty should obviously lead to employment of the precautionary principle, the basic precept upon which the EPBC Act rests.

4. ***The 10 kilometre radius approach employed*** might appear appropriate in the terrestrial environment but does not attract this status in the marine environment. Sound can travel, and therefore impact, over hundreds of kilometres in ocean environments.

5. ***In the supplementary documentation to the Referral proper*** *the* **"Error! Reference source not found"** message which appears consistently, is extremely confusing and would seem to denote a particular reference set which has been relied upon for much of the referral but is effectively unobtainable. The summations made are therefore questionable in the extreme.

There are many sources of information available at both State and Commonwealth level which are considerably more reliable in relation to this set of circumstances eg. information held by the SA Museum etc.

6. ***No mention is made of, or recognition of the Conservation Management Plan for the Southern Right Whale****: A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 – 2011>2021* or the *South Western Region Biodiversity Plan* in spite of the highly endangered status of the South Eastern population of Southern Right whales which migrates through the Investigator Strait/Backstairs Passage waterway.

7. ***In the Reference list attached to KIPT's Referral there is no documentation cited regarding whales and dolphins*** – a great weakness borne of oversight or ignorance.

8. ***The actual physical barrier which the jetty / pontoon provides*** will compromise the safety of dolphins and whales, particularly calves, because of energy implications with respect to distances to be travelled and because of greater possibilities of predation caused by having to travel further offshore.

   Bottlenose dolphin calves have been observed in these waters year round, and our data illustrates conclusively that this region is a vitally important migratory pathway and a feeding / resting / mating area.

Reference: Appendix 1   KI VH Dolphin Watch Analysis KI North Coast Transience October 15th 2016

KIPT's assertions regarding the likelihood of cetacean encounters based upon selective reading from limited studies chosen for the purpose of supporting their position and extremely limited data and understandings, ignores the enormous and growing body of evidence with respect to the impacts of anthropogenic sound in marine environments.

<u>In the reference documents listed in the referral there are no specific documents with respect to cetaceans</u> and particularly no reference to the *Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 – 2011> 2021*, or similar. This should be an essential element of any referral in the described waters.

This article from the Canadian Times Colonists was provided by a colleague at NSF encompassing current understandings regarding anthropogenic sound impacts like those associated with the construction phase.

"DUST-UP (AND FOLLOW UP) ON SEISMIC SURVEYS IN JUAN DE FUCA" from www.ocr.org

"There seems to be a divide between those who believe that there is no evidence that seismic surveys harm marine animals, and those who may not have the evidence but instinctively believe that repetitive seismic impulses are inherently bad for marine life.

Many comments are in the tradition of ad-homonym attacks (which I find surprising for Canadians). The comments also do not consider the new data substantiating that seismic surveys do have biological impacts on marine mammal foraging behavior at distances greater than 10 km (Jochens, et al, 2008, Southall et. al. 2007), and have been correlated with a cessation in traditional migratory behavior at distances greater *than 100km in Mediterranean Sei whales (Castellote, 2009). And of course there is the well established evidence that seismic surveys compromise fisheries."*

The potential for damage at individual and population levels is clearly outlined in Tyack 2008:

Journal of Mammalogy 89(3):549–558, 2008

IMPLICATIONS FOR MARINE MAMMALS OF LARGE-SCALE CHANGES IN THE MARINE ACOUSTIC ENVIRONMENT
PETER L. TYACK*
Biology Department, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA

Some of the most intense human sources of sound include air guns used for seismic exploration and sonar for military and commercial use. Human sources of sound in the ocean can disturb marine mammals, evoking behavioural responses that can productively be viewed as similar to predation risk, and they can trigger allostatic physiological responses to adapt to the stressor. Marine mammals have been shown to avoid some human sound sources at ranges of kilometers, raising concern about displacement from important habitats. There are few studies to guide predictions of when such changes start to lower the fitness of individuals or have negative consequences for the population. Although acute responses to intense sounds have generated considerable interest, the more significant risk to populations of marine mammals is likely to stem from less visible effects of chronic exposure.

There are a variety of ways that anthropogenic sound can affect animals. If detection of a signal is noise-limited, then elevation of noise can reduce the probability of detecting a signal, effectively reducing the range of communication. Within limits, animals may be able to compensate for noise by increasing the level of their own calls, by shifting their signals out of the noise band, by making their signals longer or more redundant, or by waiting to signal until noise is reduced. However, these changes may be costly and may not completely compensate for the noise. If an anthropogenic signal stimulates a disturbance response, then this response may cost the animal in terms of energy and lost opportunities. Sound also may trigger stress responses, which involve other physiological costs. Some sound exposures may be loud enough to make it more difficult for an animal to perform its regular functions. At high exposure levels, sound may even decrease hearing sensitivity, ultimately leading to hearing loss if the exposure is intense enough or long enough.

Those with a primary interest in animal welfare may focus on the boundaries where brief minor effects may transition to chronic ones, where annoyance turns into suffering, where disturbance prevents an animal from engaging in its normal behavior (Dawkins 2006). But from a conservation perspective, the most important changes are those that affect populations, changes which can be thought of in terms of changes in growth, reproduction, and survival of individuals. Wartzok et al. (2005) argue that science has not advanced to the point where we can predict population consequences of the effects of sound listed in the 1st paragraph. However, acoustic stimuli from human disturbance can pose clear risks when they cause animals to abandon important habitat, or when they reduce the ability of animals to use the habitat.

This kind of abandonment of habitat clearly should be avoided, especially for endangered species. It is common for a migrating baleen whale to swim more than 100 km in a day (Mate et al. 1998). This puts a premium on the capability for long-distance communication in these social oceanic animals, where sound is the only way to communicate at ranges greater than tens of meters.

.

DO MARINE MAMMALS ALTER THEIR VOCAL BEHAVIOR TO COMPENSATE FOR NOISE?

It is very difficult to test whether elevated ambient noise is preventing an animal from hearing and reacting to a communication signal. The cost of this kind of lost opportunity is not normally included in studies of behavioral disruption, and it is difficult to design ecologically valid studies of this problem. An alternative approach to get at this issue is to ask whether and when animals modify their vocal signals to compensate for changes in noise. Potential mechanisms for increasing the detectability of signals include waiting to call until noise decreases, increasing the rate of calling, increasing signal intensity, increasing signal duration, and shifting signal frequency outside of the noise band. These changes increase costs for signaling, so if animals show systematic use of compensation mechanisms, this would suggest that the noise is compromising effective communication sufficiently to incur the cost of compensation.

Frid and Dill (2002) suggest that behavioral ecological theories about how animals should balance the benefits of antipredator behavior against the costs of responding may be a useful way to view responses to anthropogenic disturbance. They point out that many sources of human disturbance involve stimuli that are approaching the animal, often with increasing and ultimately high stimulus values. Such stimuli are likely to trigger a general antipredator response. Viewing disturbance in terms of antipredator behavior is likely to be particularly useful for intense sources of sound that move in a way that might trigger responses similar to antipredator behavior. Zimmer and Tyack (2007) point out that 1 explanation for mass strandings of beaked whales that coincide with sonar exercises is that the sonars have fundamental frequencies well outside of the frequency band of the whales' own signals, but that are quite similar to the calls of killer whales. In this case it may literally be more appropriate to call the response an antipredator response rather than simple disturbance.

McEwen and Wingfield (2003) make 2 critical points about allostasis with regard to disturbance. First, although these mechanisms help an animal deal with a transient stressor, they can cause problems in the case of exposure to a chronic stressor. Romano et al. (2004) showed that the level of catecholamines in trained dolphins exposed to loud sounds increased the louder the sound was, and that the levels of aldosterone (a corticoid hormone important in marine mammals) increased after exposure to noise. This study only looked at exposures to a single pulsed sound per day. It is not known whether chronic exposure to continuous noise, such as that from ships, causes chronic allostatic stress.

However, long-term changes in relevant physiological parameters were measured over the 25-week experimental period of the study of Romano et al. (2004). Second, there are some seasons or phases of the life cycle when animals have less of a reserve and are more vulnerable to the impact of a stressor. For example, if a baleen whale is stressed at the end of the feeding season when it is just about to migrate, it may have plenty of energy reserves to deal with the stress. But if the same whale is confronted with the same stress after migrating and fasting for 9 months, it may not have sufficient reserves to deal with the stress. Similarly if a female baleen whale is stressed after several years of building up energy reserves for reproduction, she may be better able to deal with a stressor than after giving birth and lactating for half a year while fasting during migration. These observations suggest a logic for selecting the most vulnerable animals as subjects for a studies designed to understand the effects of disturbance.

Wartzok et al. (2005) argue that a major scientific effort is required to be able to predict long-term effects on marine mammal populations from behavioral and physiological effects of anthropogenic noise on individual marine mammals. The least certain element of the science required to solve this problem involves estimating the consequences of changes in behavior on survival, growth, and reproduction of individuals. This review of how noise may influence communication suggests the importance of some areas of research that have received less attention than observation of disturbance. The theories of predator risk and allostasis may help to provide a framework for progress in understanding the consequences to individuals and populations of disturbance caused by anthropogenic sound.

The Recommendations section of this paper makes compelling reading and could be a suitable minimal prerequisite for KIPT prior to any approvals being given. This comprehensive paper should form the basis for any considerations of impacts.

As Jim Cummings, Executive Director of Acoustic Ecology Institute says in his paper:

EXAMINATION – 2009 FOR THE CANADIAN SCIENCE ADVISORY SECRETARIAT
Examination of the Effectiveness of Measures Used to Mitigate Potential Impacts of Seismic Sound on Marine Mammals. DFO workshop, May 11-12, 2009.
Does moderate anthropogenic noise disrupt foraging activity in whales and dolphins?
Jim Cummings; Executive Director, Acoustic Ecology Institute cummings@acousticecology.org

Introduction:
While the primary mitigation measures associated with seismic survey sound are designed to avoid gross impacts such as TTS or physiological injury, the Statement of Canadian Practice with Respect to the Mitigation of Seismic Sound in the Marine Environment also aims to prevent significant impacts on breeding, feeding, or nursing marine mammals. Determination of "significant" impacts is an ongoing challenge in relation to ocean noise, and this paper will not attempt to address that central question. As we evaluate the effectiveness of existing or proposed mitigation measures, we must also continually assess new research results and observations. Toward that end, this paper will summarize a growing body of research published since late 2007 that raises new questions about a subtle but perhaps significant behavioral response to moderate anthropogenic noise in the marine environment: the suspension of foraging activity.

These recent papers together suggest that moderate human noise may disrupt the feeding behaviors of many different species—indeed, interruption of foraging and feeding appears to be quite common, and perhaps the most biologically significant of the common behavioral disruptions observed. Reference will be made to one older study, which assessed the energetic costs of various behavioral disruptions and highlighted the relatively high energetic cost of reduced feeding time. This consideration of reduced foraging time should be considered within the context of a growing understanding that even moderate noise intrusions (120-150dB) can trigger behavioral disruptions which are not necessarily minor (see Southall, et al, 2007, for scaled severity of responses observed).

And further in relation to anthropogenic sound impacts:

CANADIAN SCIENCE ADVISORY SECRETARIAT EXAMINATION OF THE EFFECTIVENESS OF MEASURES USED TO MITIGATE POTENTIAL IMPACTS OF SEISMIC SOUND ON MARINE MAMMALS
DFO workshop, May 11-12, 2009.

Moderate noise and suspension of foraging activity: seismic surveys
The most striking studies relating directly to anthropogenic sound include.

The 5-year Sperm Whale Seismic Study (SWSS) in the Gulf of Mexico.
This project monitored whales as they were exposed to sounds from a seismic airgun array; many were tracked via satellite tags (which remain on for days and tracked dozens of whales in large areas) and a few with D-tags (which remain on for hours and recorded the sounds heard and made by a handful of animals, as well as tracking their dive patterns).

While the "take-away" message in media reports at the time of the release of the SWSS final report was centered on the apparent lack of large-scale effects of airguns (distribution of whales on scales of 5-100km were no different when airguns were active than when they were silent), a key observation was rarely noted: the one whale that was D-tagged and that experienced sound levels of over 160dB (164dB) remained at the surface for the entire two hours that the survey vessel was nearby, then dove to feed as soon as the airguns were turned off. The whale remained at the surface for an additional hour before the airguns were activated; there is a chance it was ill or otherwise disrupted by the tagging, rather than the airguns themselves.

Another possibility is suggested by the fact that this whale's D-Tag recorded significant higher-frequency components in the airgun signals; it is possible that, at close range, these higher-frequency components would have interfered with the whale's echolocation, whereas similar sound levels at greater distances would be less bothersome. (See note in Appendix B, regarding findings from this study that sound levels of 160dB could occur up to 10km away from active airguns.) The relative lack of whales within 5km was also noted, though given the total number of observations, did not qualify as statistically significant. The authors concluded that "it is more likely than not that some decrease of foraging effort may occur" when airguns are active, at least in some individuals. Using complex statistical analysis to try to tease patterns from a limited data set, the researchers conclude that a decrease of 20% in foraging activity is likely. (Jochens, et al, 2008)

In Angola, another study done during a seismic survey came up with a similar mix of easy to report overall effect, and suspicious secondary effect: In this case, the study simply looked at the numbers of whales seen by marine mammal observers during several months on a particular vessel. There were no apparent large-scale distribution changes (i.e. the whales did not leave the area when surveys were occurring). But strangely, more whales were seen during airgun activity than when airguns were silent; again, it appears that they were more apt to remain at the surface when the noise was occurring. (Weir, 2008)

Another study by Weir, also done in West Africa, indicated that pilot whales showed a modest avoidance response to airgun ramp-up, while also observing another instance of milling on the surface at a range of just under and over a kilometer. (This paper also serves as a valuable survey of previous studies of the effectiveness of ramp-up procedures.) In the instance reported on here, a survey vessel gradually approached a pod of traveling pilot whales from behind, and initiated ramp-up when 900m away. The whales did not initially respond, but when the ship was 750m away, they suddenly veered 90 degrees and traveled until they were again about 900m away. At that point they milled for a few minutes, then gradually increased their distance to about 1.3km, continuing to mill at the surface and orient toward the ship as the it passed abeam of them (as the airguns continued their ramp-up procedure), after which they headed off in the opposite direction to the ship's continued movement.

The author notes that it is impossible to know whether the initial movement away from the vessel was triggered by the gradual increase in the sound level reaching a point at which they decided to move away, or if the group moved when they first heard the sound, and responded to it in something like a startle response. She also notes that the movement away was limited in time and space: after the initial movement away, "despite a four-fold increase in source volume...the whales exhibited behavior best described as milling." (Weir, 2008)

A paper from late 2007 looked at cetacean distributions near a seismic survey in the north Atlantic, where again, the overall number of marine mammals within 1-2km did not change significantly when the seismic source was 'on' compared to 'off', but it appeared that larger and apparently less vocal groups were observed when the seismic source was active. The researchers noted that "seismic surveying can apparently have a behavioral impact at a high level of statistical significance without visual observers reporting seeing fewer marine mammals". This study was a post-hoc statistical analysis of observations made at the time of *the survey, and the authors note that it may suffer from some confounding variables, including lack of clear separation of different species and bathymetric conditions. (Potter, et al, 2007)*

Again the uncertainty regarding the extent of possible impacts is the major consideration – **not** the absence as suggested by KIPT.

Interestingly the US National Marine Fisheries Service (NMFS) criteria defines two levels of harassment to marine mammals:

JASCO APPLIED SCIENCES UNDERWATER NOISE ASSESSMENT
Version 3.0 1

Introduction

1.3. Acoustic Impact Criteria
1.3.1. US National Marine Fisheries Service (NMFS) criteria
The US National Marine Fisheries Service (NMFS) considers two levels of harassment to marine mammals: Level A Harassment, injury; and Level B Harassment, disturbance. The Marine Mammal Protection Act of 1972 defines Level A Harassment as "any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild" (Marine … 2007). Level B Harassment is defined as "any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered" (Marine … 2007).

Particularly the work of Southall et al 2007 is noted and provides a level of necessary consideration. Again it is worth reflecting that the NMFS has established a study with respect to seismic testing with regard to the Diablo Canyon Power Plant – if they acknowledge impacts upon Marine Mammals to a significant level, what is it that KIPT doesn't understand or acknowledge?

Or is it just convenient to ignore the body of evidence which exists with respect to the effects of anthropogenic sound including seismic testing which is commensurate to the sound levels which will be generated by the port construction?

Recent happenings in Peru where hundreds of dolphin carcasses washed ashore along a 140 kilometre stretch of coastline, give cause for concern. Dr Yaipan Llanos who has been investigating the causes of death after completing 30 necropsies, claims to have seen physiological impacts that could have resulted from seismic testing for oil and gas. The dolphins showed signs of a rapid ascent to the surface: bubbles in the organs and tissues - effectively the "bends" which is known to afflict human divers. These harmful bubbles may have been caused by the disruptive impacts of an intensive sound source dislodging bubbles inside the animals or a rapid ascent to the surface. One alarming finding is that the middle ears of 30 of the dolphins had fractures, an injury which could be a result of exposure to seismic airgun blasts. None of this Science is definitive but must be considered along with other possibilities. www.oceana.org

The US Bureau of Ocean Energy Management (BOEM) is currently investigating this situation while reviewing decisions with respect to seismic testing for oil and gas off the Atlantic coast.

Given this ever growing body of evidence perhaps we should be paying heed to approaches like that suggested in Ellison et al 2012 in

CONSERVATION BIOLOGY Volume 26 Issue 1 – A New Context – based Approach to assess Marine Mammal Behavioural Responses to Anthropogenic Sounds.

A New Context-Based Approach to Assess Marine Mammal Behavioral Responses to Anthropogenic Sounds

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Abstract: *Acute effects of anthropogenic sounds on marine mammals, such as from military sonars, energy development, and offshore construction, have received considerable international attention from scientists, regulators, and industry. Moreover, there has been increasing recognition and concern about the potential chronic effects of human activities (e.g., shipping). It has been demonstrated that increases in human activity and background noise can alter habitats of marine animals and potentially mask communications for species that rely on sound to mate, feed, avoid predators, and navigate. Without exception, regulatory agencies required to assess and manage the effects of noise on marine mammals have addressed only the acute effects of noise on hearing and behavior. Furthermore, they have relied on a single exposure metric to assess acute effects: the absolute sound level received by the animal. There is compelling evidence that factors other than received sound level, including the activity state of animals exposed to different sounds, the nature and novelty of a sound, and spatial relations between sound source and receiving animals (i.e., the exposure context) strongly affect the probability of a behavioral response. A more comprehensive assessment method is needed that accounts for the fact that multiple contextual factors can affect how animals respond to both acute and chronic noise. We propose a three-part approach. The first includes measurement and evaluation of context-based behavioral responses of marine mammals exposed to various sounds. The second includes new assessment metrics that emphasize relative sound levels (i.e., ratio of signal to background noise and level above hearing threshold). The third considers the effects of chronic and acute noise exposure. All three aspects of sound exposure (context, relative sound level, and chronic noise) mediate behavioral response, and we suggest they be integrated into ecosystem-level management and the spatial planning of human offshore activities.*

Experimental and observational research on the effects of sound on hearing and behavior in marine animals has provided insights into describing responses and assessing these phenomena and their potential applications to management. There are dualities in measures of behavioral responses (e.g. acute responses versus chronic responses; absolute sound levels versus relative sound levels; attraction versus aversion; naiveté versus adaptation; and whether or not a response is biologically significant) that invalidate the use of an absolute, dose–response RL approach.

Acoustic habitats of different groups of marine mammals have profound spatial, spectral, and temporal differences. It is logical to segregate these differences on the basis of function (as has been done in terms of hearing [Southall et al. 2007]). For example, the distinction between the mysticete and odontocete cetaceans is relatively clear. In general, mysticetes can communicate over great distances (100s of kilometers) for long periods (days) in the low-frequency (<1 kHz) range. In contrast, odontocetes produce and perceive sounds over middle to short distances (10s of kilometers), over intermediate to short periods (minutes) in the mid- (1 kHz < f < 10 kHz) and high-frequency (f > 10 kHz) ranges. Among the reasons for the differences in the perceived acoustic habitats of mysticete and odontocete cetaceans are the physical principles that control the sound fields in these different frequency ranges as well as the variation in animal-hearing sensitivity as a function of frequency. Thus, the potential for physical effects from sound exposure (e.g., TTS) are greater in the frequency range of best hearing (Finneran & Schlundt 2010). As a result of frequency-dependent absorption, transmission loss (TL) for high-frequency sounds (produced by odontocetes) increases rapidly as distance from the source increases (especially above 20 kHz; Urick 1983), whereas for low-frequency sounds (typically produced by mysticetes), absorption plays virtually no role even at distances in excess of 100s of kilometers. Thus, when considering the exposure of odontocetes to high-frequency sound sources, the potential for either injury or behavioral response is likely to be constrained to short distances and to brief exposure periods, whereas for mysticetes the effects of low-frequency sources are likely chronic and occur over greater distances for longer periods.

And further:

Given the above considerations, multiple variables likely affect behavioral response to sound. It is recognized that quantification of multiple variables has not been broadly applied to the assessment of behavioral responses to sound, but there is some evidence that regulatory agencies are moving in this direction (Johnson 2012).

Further to these considerations our responsibilities under international agreements need to be factored into the decision making process with respect to any approvals resulting in anthropogenic noise, being introduced into the marine environment as outlined below.

Recently a scientific synthesis on the impact of noise on marine biodiversity was discussed by SBSTTA16 - the science body that advices Governments in the Convention on Biological Diversity. They reviewed the three major sources of marine noise - seismic exploration, shipping and military sonar**.**

Their findings have now wound their way into international decision making processes, and 196 Governments – including Australia - that are Parties to the Convention on Biological Diversity agreed the following:

10. MARINE AND COASTAL BIODIVERSITY
Impacts of anthropogenic underwater noise on marine and coastal biodiversity
1. *Welcomes the report Scientific synthesis on the impacts of underwater noise on marine and coastal biodiversity and habitats (UNEP/CBD/SBSTTA/16/INF/12), and takes note of the key messages of the report provided in annex II to the document UNEP/CBD/SBSTTA/16/6;*
2. Takes note of resolution 10.24 adopted by the Conference of the Parties to the Convention on Migratory Species at its tenth meeting, which provides guidance on further steps to abate underwater noise pollution, where necessary, for the protection of cetaceans and other migratory species;

3. Notes that anthropogenic noise may have both short- and long-term negative consequences for marine animals and other biota in the marine environment, that this issue is predicted to increase in significance, and that uncontrolled increase in anthropogenic noise could add further stress to oceanic biota;
4. Encourages Parties, other Governments and relevant organizations, according to their priorities, to:
(a) Promote research with a view to further improving our understanding of the issue;
(b) Promote awareness of the issue with relevant stakeholders both nationally and regionally;
(c) Take measures, as appropriate, to minimize the significant adverse impacts of anthropogenic underwater noise on Marine biodiversity, including best available technologies (BAT) and best environmental practices (BEP), drawing upon existing guidance; and
(d) Develop indicators and explore frameworks for the monitoring of underwater noise for the conservation and sustainable use of marine biodiversity, and report the progress to a future meeting of the Subsidiary Body prior to the 12th meeting of the Conference of the Parties;
5. Noting the need for a consistent terminology to describe underwater noise, requests the Executive Secretary to collaborate with Parties, other Governments and relevant organizations, to prepare, subject to availability of financial resources, a draft set of consistent terminology for consideration by a meeting of the Subsidiary Body prior to the twelfth meeting of the Conference of the Parties;
6. Noting the gaps and limitations in existing guidance, including the need to update it in the light of improving scientific knowledge, and recognizing a range of complementary initiatives under way, requests the Executive Secretary to collaborate with Parties, other Governments, and competent organizations, including the International Maritime Organization, the Convention on Migratory Species, the International Whaling Commission, as well as indigenous and local communities and other relevant stakeholders, to organize, subject to availability of financial resources, an expert workshop with a view to improving and sharing knowledge on underwater noise and its impacts on marine and coastal biodiversity, and developing practical guidance and toolkits for minimizing and mitigating the significant adverse impacts of anthropogenic underwater noise on marine and coastal biodiversity, which can assist Parties and other Governments in applying necessary management measures. The workshop should cover issues such as, the development of acoustic mapping of areas of interest, among others;
7. Further requests the Executive Secretary to bring this decision to the attention of the organizations referred to in paragraph 19 above at: www.cbd.int/doc/meetings/cop/cop-11/official/cop-11-01-add2-en.pdf

Di Iorio and Clark in recently published work with respect to interference with Blue Whale communication and possible impacts state:

EXPOSURE TO SEISMIC SURVEY ALTERS BLUE WHALE ACOUSTIC COMMUNICATION
Lucia Di Iorio and Christopher W. Clark
1Zoologisches Institut, Universita¨t Zu¨ rich, Winterthurerstrasse 190, 8004 Zu¨ rich, Switzerland
2Bioacoustics Research Program, Cornell Laboratory of Ornithology,
159 Sapsucker Woods Road, Ithaca, NY 14850, USA

This study suggests careful reconsideration of the potential behavioural impacts of even low source level seismic survey sounds on large whales. This is particularly relevant when the species is at high risk of extinction as is the blue whale (IUCN 2008).
Reference: www.rsbl.royalsocietypublishing.org June 9, 2012

There is also considerable evidence regarding the impacts upon prey species as clearly demonstrated by the work of Andre, McCauley and others.

SHIPPING NOISE PULPS ORGANS OF SQUID AND OCTOPUSES

Environment 11 April 2011 New Scientist by Andy Coghlan

It's not just dolphins and whales that suffer from the noise of shipping, sonar and oil prospecting. Experiments on squid, cuttlefish and octopuses show that their balancing organs are so badly damaged by sound similar to submarine noise pollution that they become practically immobile. The consequences seem permanent. "For the first time we are seeing the effects of noise pollution on species that apparently have no use for sound," says Michel André of the Technical University of Catalonia in Barcelona, Spain. "We were shocked by the magnitude of the trauma," he says. The results of the experiments, in which André's team exposed captive cuttlefish, octopuses and squid to low-frequency sound for 2 hours, seem to confirm that "ear" damage in nine giant squid that unexpectedly washed up on Spanish beaches in 2001 and 2003 was caused by low-frequency sounds from nearby seismic surveys for oil and gas.

This is particularly relevant with respect to Sperm Whales and Beaked Whales, the deep diving species.

It is worth noting the skeleton of a Sperm Whale has wrecked on Smith's Bay previously and who will forget the seven female Sperm Whales who stranded and died at Ardrossan or the Beaked Whale on the West Coast recently ...... all within the Investigator Strait region.

This information together with other relevant data is available from the SA Museum and it seems somewhat incongruous, or perhaps just convenient, that there does not seem to be any reference to this data when KIPT decided there was little likelihood of interactions with cetaceans.

Have KIPT undertaken surveys using PAM methodologies to establish the presence or absence of deep diving species?

In spite of its limitations as described in Mellinger et al (2007) at least it offers an extra level of understanding possible impacts of this proposal.

The following paper from Jim Cummings, Canadian Science Advisory Secretariat; *Examination of the Effectiveness of Measures to Mitigate Potential Impacts of Seismic Sound on Marine Mammals, Does moderate noise disrupt foraging activity*? DFO CSAS, May 2009, demonstrates clearly the need to employ this mitigation measure.

Appendix C: Passive Acoustic Detection of Beaked Whales from a Moving Platform
Beaked whales seem particularly sensitive to many types of sound; their responses to active sonar are well known; they have been involved in the only stranding events (ambiguously) associated with seismic surveys; and they have also been shown to be extremely responsive to Acoustic Harassment Devices (Caretta et al, 2008: beaked whale by-catch in gillnets equipped with pingers dropped to zero over eleven years, whereas no other species showed such an absolute change).

Detection of beaked whales as part of seismic survey mitigation is especially important, as key beaked whale habitat occurs in the Scotian Shelf region where oil and gas exploration is expected to increase. An important recent study (Zimmer, et al, 2008) should inform all plans to adopt Passive Acoustic Detection (PAD, also known as Passive Acoustic Monitoring) for beaked whales.

Beaked whales spend very little time at the surface, with foraging dives that last an hour or more, including about 30 minutes of active echolocation at the feeding depth. Visual detection is very difficult, so the *possibility of using PAD/PAM is an attractive complement to visual spotting. However, beaked whale high-frequency foraging clicks attenuate rapidly.*

According this study, acoustic modeling suggests that in "good conditions," e.g. wind speed of 2 m/s, a hydrophone close to the surface should detect beaked whales with a high probability within .7km. At the other end of the detection range, no whales would be detected at distances greater than 4km, except in very low ambient noise or unusually good propagation conditions.

The detection curve generated by the models suggests roughly 50% detection when whales are 1.5-3.5km distant. When the researchers substituted some actual dive profile data obtained in D-Tag studies, detection probability may rise somewhat, with 80% detection being possible at distances of 1.5-2.5 km. Detection is complicated by the fact that the sound of the clicks is highly directional; only clicks directed nearly directly toward the receiver will be heard at the modeled distances, but echolocating whales do scan in many directions, so at least some clicks from any whale should be detected.

Finally, the relatively quiet interval between deep foraging dives can be as long as 110 minutes, meaning that listening time should be roughly 140 minutes to have a high probability of detection if beaked whales are present. This, in turn, suggests that a slow-moving vessel (such as gliders or drifting buoys) will be more successful than a faster-moving active sonar or seismic survey vessel. (That is, if detections are only going to occur within roughly 4km, the listening platform should remain in a relatively similar area during the 2-hour-plus PAD session.)

References

Carretta, Barlow, Enriquez. Acoustic pingers eliminate beaked whale bycatch in a gill net fishery. Marine Mammal Science, 24(4):956-961 (October 2008).
Zimmer, Harwood, Tyack, Johnson, Madsen. Passive acoustic detection of deepdiving beaked whales. The Journal of the Acoustical Society of America, November 2008, Volume 124, Issue low ambient noise or unusually good propagation conditions.

Recently conducted research undertaken by IFAW in the GAB collecting acoustic and visual data shows clearly the presence of deep diving species like Sperm whales and beaked whales on a much larger scale than purely visual observations would attest.

A minimum requirement therefore for any proposal on the North Coast of Kangaroo Island, Investigator Strait and Backstairs Passage should be a full investigation of potential anthropogenic sound impacts.

Final report for a survey of cetaceans in the eastern Great Australian Bight 26th April – 8th May 2013
The International Fund for Animal Welfare and Marine Conservation Research Limited
Report prepared by: Marine Conservation Research Limited 1 High Street Kelvedon, Essex CO5 9AG, UK July 2013

In recent times significant information has become available which impacts considerably on this proposal. This has particular relevance to the species of Cetaceans and possible impacts upon their welfare.

KIPT have shown no consideration for the usage of PAM technologies in their environmental survey work in spite of the known presence of deep diving species in the area to be effected by their proposal. It is possible they have no understanding at all of the likely impacts of the noise they will generate.

We believe this referral constitutes the need for controlled action status being considered.

The proposal does represent a significant impact to Threatened Species for the following reasons:

- It could lead to a long term decrease in the size of a species population
- It will reduce the area of occupancy of a species population, particularly with respect to crucial habitat
- It will adversely affect habitat critical to the survival of a species
- It will cause disruption to the breeding cycle of a species population
- It will modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline
- It is likely to interfere substantially with the recovery of species

There will be avoidance behaviours and consequent effects of allostatic responses, displacement from foraging and feeding habitat, (Di Iorio and Clark 2012) and loss of energy efficiencies for many species including those registered as endangered (Tyack 2008) (McCauley 1994) etc and as such, the action is likely to:

- Substantially modify, destroy or isolate an area of important habitat for a migratory species
- Seriously disrupt the lifecycle of an ecologically significant proportion of migratory species

Environmental impacts on the Commonwealth Marine Environment are expected to be significant for the following reasons:

- The activity will modify, destroy, fragment, isolate or disturb an important area of habitat such that the functioning of the marine ecosystem suffers from adverse impacts
- The activity is likely to have adverse impacts on marine species or cetaceans during their lifecycle or impact on their spatial distribution
- The activity will substantially change air quality or water quality which may impact on biodiversity, ecological integrity, social amenity or human health

5.3 Proposed action IS a controlled action.

Matters likely to be impacted:

- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Commonwealth marine environment (sections 23 and 24A)

Regarding economic impact with respect to tourism and ecotourism as mentioned by KIPT, any activity which impacts upon the recreational fishery impacts upon tourism, as the debate surrounding Marine Parks attests.

Similarly any activity which interrupts migration and feeding of whales and dolphins effects the ecotourism industry.

<u>Southern Right Whales</u>

With particular reference to the endangered Southern right whales the *Conservation Management Plan for the Southern Right Whale; A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 – 2011>2021* seems to have been ignored totally.

Its objectives make salutary reading given this proposal and its potential impacts.

Introduction

Southern right whales (Eubalaena australis) are currently listed as endangered under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act) because they have undergone a severe reduction in numbers as a result of commercial whaling. An initial recovery plan for southern right whales was developed for the period 2005 to 2010.

A review of that plan found that despite progress on many recovery actions and evidence of some population increase in south-west Australian waters, southern right whale habitat occupancy is still constrained in comparison to historical occupancy, and current abundance is still well below estimated historic abundance.

The review recommended an updated recovery plan for the southern right whale be developed to reflect new knowledge and prioritise research needed to monitor population recovery and better predict the impacts of threats such as climate change. This plan conforms to the International Whaling Commission's (IWC) 'Conservation Management Plan' format, while meeting the requirements of a recovery plan under the EPBC Act.

Recovery Objective

The long-term recovery objective is to minimise anthropogenic threats to allow the conservation status of the southern right whale to improve so that it can be removed from the threatened species list under the EPBC Act.
A.2: Assessing and addressing anthropogenic noise a framework to minimise risk of biological consequences from acoustic disturbance from seismic survey sources to whales in biologically important habitat areas or during critical behaviours.

Reference: Conservation Management Plan for the Southern Right Whale; A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 - 2011>2021

With respect to possible disruptions to mothers and calves likely to be impacted upon, the following from the Management Plan is of consideration:

Southern right whales' low and slow reproductive rate has resulted in only a gradual recovery from whaling and affect the species' capacity to withstand impacts.

Female southern right whales show calving site fidelity, generally returning to the same location to give birth and nurse offspring. This trait impacts on the whales' ability to respond to external threats, including their ability to tolerate and respond to habitat changes.

Site fidelity limits their capacity to occupy new areas, even where suitable habitat is available and abundance is increasing. Site fidelity, combined with an average three-year calving interval, causes habitat occupation and coastal visitation to vary between years.

Reference: Conservation Management Plan for the Southern Right Whale; A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 - 2011>2021

The degree of uncertainty which this suggests makes assertions of temporal reliability somewhat facile, particularly given impacting factors of sea surface temperature changes and climate variability in face of climate change.

Temporal: The presence of animals during March through to October in 2013 compromises any "temporal mitigation" factor suggested.

In Australia, calving/nursery grounds are occupied from May to October (occasionally as early as April and as late as November), but not at other times. Female-calf pairs generally stay within the calving ground for 2–3 months. Other population classes stay for shorter and variable periods, moving about more from place to place on the coast and generally departing the coast earlier than female-calf pairs (most have left by September).

Coastal visitation varies between years probably due to cohort structured breeding and environmental variability. Substantial changes in the number of whales recorded on the coast from year to year and the absence of reproductively mature females in virtually all years between calving events, indicates that not all whales migrate to the coast each year. The winter distribution of whales not appearing on the Australian coast is unknown, and the absence of reproductively mature females indicates that this winter distribution may include offshore breeding (conception) habitat.

A number of additional areas for southern right whales are emerging which might be of importance, particularly to the south-eastern population. In these areas, small, but growing numbers of non-calving whales regularly aggregate for short periods of time. These areas include coastal waters off Peterborough, Port Campbell, Port Fairy and Portland in Victoria; Great Oyster Bay and Frederick Henry Bay in Tasmania; Storm Bay and Sleaford Bay in South Australia; and Twofold Bay and Jervis Bay in NSW.

Calving aggregations occur over a wide environmental range, but habitat providing some degree of protection from prevailing weather conditions is generally preferred. Southern right whales vary their habitat use according to local environmental conditions, optimising their distribution within aggregation areas on high energy coastlines to minimise exposure to rough sea conditions. Depth is the most influential determinant of habitat selection at a fine-scale within aggregation areas, with whales preferentially occupying water less than 10 metres deep. Habitat selection at a fine-scale is also affected by internal population factors, with differential use of habitat according to breeding status and behaviour.

Habitat occupancy contracted substantially as a result of commercial whaling, and current Australian coastal distribution patterns are those of much depleted/remnant populations. Although southern right whales are tolerant of a wide range of environmental conditions, are highly mobile, are recorded throughout their former known coastal distribution, and can form successful breeding aggregations in a range of habitats, their strong site fidelity and social cues are likely to constrain their capacity to establish regular aggregations in new or previously used locations, even where apparently suitable habitat is available. So far, the increase in abundance has been reflected principally as an increase in whale numbers in already occupied aggregation areas in the south-west part of the range, although several additional areas are now emerging and may become established as known aggregation sites.

Reference: Conservation Management Plan for the Southern Right Whale; A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 - 2011>2021

Investigator Strait, Backstairs Passage and indeed the whole of the North Coast of Kangaroo Island form a significant part of essential migratory pathways and as such are critically important, particularly to the South Eastern population and are likely to experience disruption due to the levels of acoustic disturbance which this proposal will generate.

To what level exactly is somewhat clouded by a complete absence of accurate sound modelling data which should be required at both construction and operational phases.

Southern right whales in Australian waters were until recently considered to be one population. It is now proposed, based on differentiation in mtDNA haplotype but not nuclear gene frequencies, that south-east Australian right whales may be demographically separate from those in south-west Australia, although they may interact for the purposes of mating.

This means conservation management needs to be based around the existence of two populations in Australian waters with different recovery rates, rather than the single population model that was assumed previously.

Considerable latitudinal overlap of calving/nursing and foraging/feeding areas means that migration between the two is not necessarily one from lower to higher latitudes as traditionally thought.

Reference: Conservation Management Plan for the Southern Right Whale; A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 - 2011>2021

The Southern right whale population at the Head of the Bight has grown at close to biological maximum for this species (7%) relates to the South Western population only. It does not take account of impacts upon the South Eastern population which is so much at risk while migrating through the area to be impacted upon by anthropogenic noise generated by port developments and increased shipping.

The current rate of increase in the Australian population has been estimated at about 7-8% per annum (Bannister 2008). However, this is based on work in south-western Australia where human population density and near-shore activity and infrastructure is low compared with south-eastern Australia.

Southern Right Whales in New South Wales belong to south-eastern Australian stocks, which show significant genetic differentiation from south-western stocks, and should be considered as separate populations (Patenaude & Harcourt 2006; Carroll 2009; Carroll et al. in press). The south-eastern population is very small and is not considered to be recovering at the same rate as the south-western population (DEWHA 2010; R. Pirzl pers. comm. 2011).

Other potential threats to the Southern Right Whale include ingestion of marine debris such as plastic, and acoustic pollution (e.g. noise from marine vessels and seismic survey activity) which affects cetacean reactions, and may also disrupt the connectivity of coastal habitat, but the impact is not well researched in Southern Right Whales (Richardson et al. 1995; Smith 2001; DEH 2005).

Reference: Southern Right Whale Eubalaena australis - Endangered Species Listing NSW Environment and Heritage www.environment.nsw.gov.au/determinations/southernrightwhalefd.htm

Although commercial harvesting of the Southern Right Whale has ceased, and populations both globally and in south-western Australia appear to be stable or increasing, the south-eastern Australian stock of Southern Right Whales has not shown the same level of recovery, and the breeding biology of the species means that any recovery will be protracted.

Furthermore, there is no indication that the area of occupancy for calving grounds is anywhere near pre-exploitation levels, with predictions that the species may take at least a century to recover (Braham & Rice 1984). In addition, fishing, aquaculture, shipping and boating activities are expanding within the range of the species and it is inevitable that such activities will increasingly affect Southern Right Whales in the future.

Reference: Southern Right Whale Eubalaena australis - Endangered Species Listing NSW Environment and Heritage www.environment.nsw.gov.au/determinations/southernrightwhalefd.htm

<u>The effective closure of elements of migratory pathways</u> adjacent to calving grounds for any part of a season could have dire consequences.

Calving range and occupancy of calving grounds has remained restricted, with whales not yet re-colonising many historically used sites, particularly in NSW (e.g. Twofold Bay) (Pirzl 2008; DEWHA 2010). The current Australian calving range shows an east-west and north-south contraction representing less than 25% of the species' likely former calving range (Pirzl 2008).

An estimated 26 to 34 coastal locations across Australia were regularly occupied historically, compared to five locations that are occupied now, a reduction of around 80–85%. No established calving grounds now occur in NSW (Pirzl 2008). As a result of strong philopatry and aggregation tendencies (Payne 1986, Burnell 2001; Pirzl 2008) the ability of Southern Right Whales to establish new calving sites is constrained and there has been no evidence of expansion in calving range since the end of exploitation (Pirzl 2008).

Reference: Southern Right Whale Eubalaena australis - Endangered Species Listing NSW Environment and Heritage www.environment.nsw.gov.au/determinations/southernrightwhalefd.htm

A limited calving range is likely to place the population at higher risk of impacts. Southern Right Whales are vulnerable to entanglement of marine debris as they spend around half the year migrating through coastal waters where there is much fishing activity (Clapham et al. 1999).

Entanglements occur from a range of fishing techniques, including droplines, longlines, finfish farms, lines or ropes associated with traps and pots set to catch crustaceans, floats/buoys, floating fish cages and boat mooring lines (Best et al. 2001; Knowlton & Kraus 2001; Kemper et al. 2003; Shaughnessy et al. 2003; Kemper et al. 2008). 'Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments' is listed as a Key Threatening Process under the Threatened Species Conservation Act 1995.

Reference: Southern Right Whale Eubalaena australis - Endangered Species Listing NSW Environment and Heritage www.environment.nsw.gov.au/determinations/southernrightwhalefd.htm

Site fidelity for foraging and calving are also issues little considered by KIPT in their application. Movement away from preferred locations is likely, given demonstrated avoidance of anthropogenic noise sites.

Climate Variability and Potential Impacts:

KIPT have also failed to take into account climate variability including climate change and in particular, changes in sea surface temperature. Their "degree of certainty" with respect to Cetacean movements, is astounding and flies in the face of emerging Science! For example Sea Surface Temperature accounted for 84.4% of variation in blue whale presence in a study recently released.

Blue whales Balaenoptera musculus aggregate to feed in a regional upwelling system during November–May between the Great Australian Bight (GAB) and Bass Strait. We analysed sightings from aerial surveys over 6 upwelling seasons (2001–02 to 2006–07) to assess within-season patterns of blue whale habitat selection, distribution, and relative abundance.

Habitat variables were modelled using a general linear model (GLM) that ranked sea surface temperature (SST) and sea surface chlorophyll (SSC) of equal importance, followed by depth, distance to shore, SSC gradient, distance to shelf break, and SST gradient. Further discrimination by hierarchical partitioning indicated that SST accounted for 84.4% of variation in blue whale presence explained by the model, and that probability of sightings increased with increasing SST.

The large study area was resolved into 3 zones showing diversity of habitat from the shallow narrow shelf and associated surface upwelling of the central zone, to the relatively deep upper slope waters, broad shelf and variable upwelling of the western zone, and the intermediate features of the eastern zone. Density kernel estimation showed a trend in distribution from the west during November–December, spreading south-eastward along the shelf throughout the central and eastern zones during January–April, with the central zone most consistently utilised.

Encounter rates in central and eastern zones peaked in February, coinciding with peak upwelling intensity and primary productivity. Blue whales avoided inshore upwelling centres, selecting SST ~1°C cooler than remotely sensed ambient SST. Whales selected significantly higher SSC in the central and eastern zones than the western zone, where relative abundance was extremely variable. Most animals departed from the feeding ground by late April.

Reference: Blue whale habitat selection and within-season distribution in a regional upwelling system off southern Australia Gill, Peter C., Morrice, Margie, G., Page, Brad, Pirzl, Rebecca, Levings, Andrew H. and Coyne, Michael 2011, Blue whale habitat selection and within-season distribution in a regional upwelling system off southern Australia, Marine ecology progress series, vol. 421, pp. 243-263.

Potential changes to sea surface temperatures through warming have not been factored in to KIPT's application but they are clearly outlined in the Marine Climate Change in Australia - Impacts and Adaption Responses 2012 Report Card.

What is happening

Substantial evidence that sea surface temperature influences foraging locations and reproductive success of marine mammals. However, studies on long-term effects of warming are rare, with only one study providing evidence that dugongs extend their range in warm years.

What is expected

Warmer water temperatures are likely to have a profound influence on the distribution of marine mammals; the ranges of species currently associated with tropical and temperate waters are likely to expand southwards.

Summary

Australian waters are home to 52 recognised marine mammal species. Of these, at least seven are listed as threatened, though insufficient information exists on a further 25 to determine conservation status. Foraging locations, foraging behavior, distribution and reproductive success of several marine mammal species have been linked to climatic factors. Similarly, cetacean and dugong strandings, drowning of seal pups, habitat loss and exposure of coastal species to altered water conditions and disease have followed storms, floods and cyclones.

There is currently a very low to low level of confidence in the predicted effects of climate change on Australian marine mammals. This is due to a distinct lack of information on most species, with almost nothing known of the distributions, population sizes or ecologies of many species, particularly cetaceans.

Therefore, the adaptive capacity of Australian marine mammals to climate change is poorly known though some species, particularly those that occupy near-shore habitats, display high site fidelity and have fractured distributions, may be particularly vulnerable to impacts of climate change. However, there is some evidence that several species may modify their physiological responses to warming temperatures or alter their foraging locations, foraging behaviour or diet in response to shifts in prey availability and distribution.

Changes in distribution are likely, as ranges of warm-water species expand to the south, and those of cold-water species contract, though how this will affect community structure and dynamics is unknown. Some species may also be limited by their inability to cross deep, oceanic waters, potentially resulting in extirpations in southern parts of their range. Finally, climatic changes may result in changes in reproductive success, a potential decline in the extent of suitable breeding and feeding habitat, greater exposure of coastal species to pathogens and pollutants, an increased incidence of cetacean and dugong strandings, and changes in habitat quality.

Multiple stressors

Non-climatic stressors may act in synergy with climatic impacts to increase the vulnerability of marine mammals to environmental variability and change. However, there is a paucity of data on Australian marine mammals and consequently, the long term, cumulative impacts of these on marine mammals are not well understood, though strategic amelioration of manageable stressors will increase the resilience of marine mammals to climate change.

Finally, acoustic pollution, including noise from vessels, industry and coastal developments and seismic activity for oil and gas exploration, may affect marine mammals, potentially causing them to abandon key habitats such as migration routes and breeding sites (Bannister et al. 1996). In the Southern Ocean, acoustic disturbance potentially disrupts swimming or feeding activities in whales which use sound for orientation, communication and to locate prey. While this typically occurs seasonally and along discrete shipping routes, data on impacts of noise pollution is lacking (Leaper and Miller 2011).

Observed impacts

Temperature

Marine mammals may be influenced by water temperature, through its effects on thermoregulation and biological productivity, as well as by ambient temperature, though it is not always clear which of these are the key influences or whether they operate in tandem. Some species may have a thermal tolerance limit that drives their distribution

However, the primary climatic influence on many marine mammals appears to be the link between ocean temperature, and food availability and distribution (Neuman 2001, Leaper et al. 2006). Accordingly, sea surface temperature (SST) is commonly used as a proxy for biological productivity (e.g., Bradshaw et al. 2004b). Many marine mammals select particular SST in which to forage. Similarly, blue whales in South Australia occupied areas of warmer SST within feeding zones, though SST preferences vary across the species' geographical range (Gill et al. 2011). They may also feed at depths where sub-surface temperature gradients concentrate biological productivity (Gill et al. 2011).

SST influences marine mammal distribution at a macro-scale. Although data on changes in cetacean distribution are lacking for Australian waters, evidence of distributional shifts in relation to SST has been recorded elsewhere in the world.

Sea surface temperature may also influence reproductive success, and a strong relationship has been recorded in the calving output of southern right whales and SST deviations, presumably driven by the availability of krill (Leaper et al. 2006).

Hence the need for caution in interfering with known areas of important habitat like the North Coast of Kangaroo Island.

Ocean currents, winds and circulation

Cetaceans

Ocean currents and winds have a profound impact on marine mammals. In particular, upwelling systems influence patterns of distribution (Pompa et al. 2011). For example, several marine mammals aggregate in the Bonny Upwelling, a seasonally predictable area of upwelling during summer and autumn (Butler et al. 2002, Nieblas et al. 2009) along the coast of southern Australia between Cape Jaffa, South Australia and Portland, Victoria (Nieblas et al. 2009). This upwelling system is driven primarily by winds (Butler et al. 2002, Nieblas et al. 2009) and is a feeding area for blue whales (Gill 2002).

However, a variety of other cetaceans have also been observed in this upwelling zone (Gill 2002, 2004). Similarly, Perth Canyon in Western Australia, also an area of upwelling, is known to be exploited by a range of cetaceans, including blue whales and Australian sea lions (McCauley et al. 2004, Rennie 2005). Whereas strandings have been associated with short-term storm events, they also demonstrate a cyclic pattern in response to longer-term climatic perturbations (Evans et al. 2005).

During years of persistent westerly and southerly winds associated with large-scale sea-level pressure gradients, more strandings of cetaceans, most commonly sperm whales, common dolphins, long-finned pilot whales Globicephala melas, bottlenose dolphins and pygmy right whales Caperea marginata, are known to occur in south-eastern Australia. This is probably due to the wind-driven transport of colder, nutrient-

rich water to the southern coast of Australia or more frequent turnover of the water column along the coast, which results in higher coastal productivity. Thus, cetaceans follow their prey northward, resulting in an increased number of cetaceans in the region and, correspondingly, more stranding events (Evans et al. 2005).

Potential impacts by 2030 (and/or 2100)

Temperature

Cetaceans

There is limited information on the distribution and habitat preferences of most marine mammal species and it is, therefore, difficult to predict the effects of climate change on marine mammal range in response to shifts in prey distribution with changing SST. Nonetheless, increasing water temperatures are likely to have a profound influence on the distribution of marine mammals (reviewed in Trathan et al. 2007 and MacLeod 2009).

For some species, in particular southern right whales, it is possible that the migration southward of their southern limit will be greater than that of their northern limits. This may result in longer migrations between feeding and calving grounds (MacLeod 2009).Projected temperature increases could influence the reproductive output of marine mammals (Trathan et al. 2007). Modelling of reductions in krill abundance in response to sea ice extent, for example, suggests that birth rates in blue whales may decline with reduced krill availability, slowing recovery of this species (Wiedenmann et al. 2011).

Climate change also has the potential to alter the breeding phenology of marine mammals (Trathan et al. 2007). Critical stages in the life history of animals, such as breeding and weaning, may be timed to match peak abundances of prey. Therefore, changes in conditions that influence prey distribution may result in a lack of temporal and/or spatial synchrony between predator and prey. Species that undertake long migrations between feeding and breeding areas may be particularly susceptible (Simmonds and Eliot 2009). Such mismatches could have important implications for reproductive output and survival.

Adaptation responses

However, effects of climate changes on marine mammals do not act in isolation, and other threatening processes may elevate any adverse effects of climate change on marine mammals. Although our understanding of the cumulative effect of multiple threats, including climate change, is poor, strategic amelioration of manageable threats will almost certainly add resilience to species most vulnerable to climate change.

However, the development and implementation of appropriate policies designed to protect and assist marine mammals to adapt to changing environmental conditions are hampered by a lack of knowledge. Therefore, information on trends in abundance, general ecology and conservation status is required for many marine mammals, particularly cetaceans. Key habitat also needs to be identified.

Reference: Marine Climate Change in Australia - Impacts and Adaptation Responses 2012 REPORT CARD 353 Marine Mammals: Nicole Schumann1, John. P. Y. Arnould1, Nick Gales2 and Robert Harcourt 31 School of Life and Environmental Sciences, Deakin University, 221 Burwood Hwy, Burwood, VIC 3125, Australia, nsc@deakin.edu.au. 2Australian Antarctic Program, Australian Antarctic Division, 203 Channel Hwy, Kingston, TAS 7050, Australia 3Graduate School of the Environment, Macquarie University, Sydney NSW 2109, Australia, Schumann, N. et al. (2012) Marine Mammals. In Marine Climate Change

Impacts and Adaptation Report Card for Australia 2012 (Eds. E.S. Poloczanska, A.J. Hobday and A.J. Richardson) www.oceanclimatechange.org.au ISBN: 978-0-643-10928-5

Given the potential impacts, it is imperative that all necessary steps to ensure a more robust, resilient population than currently exists are developed and necessary measures need to be adopted. This means minimizing disruptions and anthropogenic impacts.

Even though there is a degree of uncertainty demonstrated in all that has been presented in this paper currently, which suggests employing the precautionary principle, this may simply not be enough.

A more proactive stance of eliminating threats or not allowing them to occur may be the necessary course of action.

The following excerpts from the 2012 Report Card give clear indicators to the possible impacts upon Blue whales and other Cetaceans. To contemplate such actions as described in the proposal which could impact upon prey species like squid for Blue or Beaked whales, even in the short to medium term, would appear reckless in the extreme**.**

Projected temperature increases could influence the reproductive output of marine mammals (Trathan et al. 2007). Modelling of reductions in krill abundance in response to sea ice extent, for example, suggests that birth rates in blue whales may decline with reduced krill availability, slowing recovery of this species (Wiedenmann et al. 2011).

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The Report Card goes on to explain many more variables and possible impacts, none of which are reflected in any manner in KIPT's referral.

In the section "Adaption Responses" the following recommendation regarding threats is made.

Establishing oil and gas legislation to control seismic activity as well as legislation to manage other sources of noise, such as industry and port development (eg pile driving, dredging, blasting) in key areas.

Reference: Marine Climate Change in Australia - Impacts and Adaptation Responses 2012 REPORT CARD 353 Marine Mammals: Nicole Schumann1, John. P. Y. Arnould1, Nick Gales2 and Robert Harcourt 31 School of Life and Environmental Sciences, Deakin University, 221 Burwood Hwy, Burwood, VIC 3125, Australia, nsc@deakin.edu.au. 2Australian Antarctic Program, Australian Antarctic Division, 203 Channel Hwy, Kingston, TAS 7050, Australia 3Graduate School of the Environment, Macquarie University, Sydney NSW 2109, Australia, Schumann, N. et al. (2012) Marine Mammals. In Marine Climate Change Impacts and Adaptation Report Card for Australia 2012 (Eds. E.S. Poloczanska, A.J. Hobday and A.J. Richardson) www.oceanclimatechange.org.au ISBN: 978-0-643-10928-5

This would seem to imply that the EPBC Act's sound provisions are increasingly being seen as inadequate and in need of review, particularly in light of core government business as declared in the Conservation Management Plan for the Southern Right Whale – A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2011 > 2021.

Impacts on Prey Species

Internationally and nationally considerable research is being undertaken currently with respect to possible impacts of seismic testing upon prey species. There is evidence that sound impacts can have a detrimental effect upon squid, which in turn can effect deep diving species, Sperm and Beaked whales.

The possible consequences of this are graphically outlined in the "60 Minutes" New Zealand episode:

Reference: www.3newss.co.nz/Deep-Trouble-/tabid/371/articleID/169002/Default.aspx

The work of Dr. Stephen O'Shea is a stark reminder of what could occur with a depletion of squid as prey species as a result of this proposal. Disturbing squid, krill, copepods etc as is likely under this proposed action, could have diabolical consequences for a range of species. Even displacement in the short to medium term is problematic, given all the other factors in play, and given the degree of uncertainty engendered.

As indicated by the aerial surveys conducted by Gill et al, Shepherds beaked whales have been recorded in the region. Further recordings of a Shepherds Beaked whale, with photographic evidence were received at the SA Whale Centre, Victor Harbor, SA on February 26th 2013 and further observations were recorded on the IFAW expedition.

These rarely recorded and little known animals are obviously in the region to be affected, together with some of the 18 species of Cetaceans, further demonstrating the need for the highest levels of mitigative diligence - an approach KIPT seemingly eschew in their desire for expedience.

The following passage from the 2012 Report Card says it all.

Critical habitats are defined here, as those that are used for key life history events including breeding, giving birth, nursing young and migrating between feeding and breeding grounds, as well as important feeding areas.

Threats to marine mammals should be ranked and the most significant ones prioritised, focusing on manageable threats at the population level that lead directly to conservation gains. Critical habitats should be strategically managed for the protection of marine mammal populations, with an emphasis on maintaining high quality habitat.

Finally, acoustic pollution, including noise from vessels, industry and coastal developments and seismic activity for oil and gas exploration, may affect marine mammals, potentially causing them to abandon key habitats such as migration routes and breeding sites (Bannister et al. 1996). In the Southern Ocean, acoustic disturbance potentially disrupts swimming or feeding activities in whales which use sound for orientation, communication and to locate prey. While this typically occurs seasonally and along discrete shipping routes, data on impacts of noise pollution is lacking (Leaper and Miller 2011).

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What clearer way to define the degree of uncertainty which exists and can only be addressed through acquiring comprehensive knowledge through further research effort.

Given this high degree of uncertainty and the likely impacts, this referral should certainly be considered a Controlled Action at the very least and serious consideration, given the critical nature of the habitat, should be given to rejection.

We reiterate that we believe this application constitutes a Controlled Action in that it represents significant impact to Threatened Species for the following reasons:

- It is likely to lead to a long-term decrease in the size of a species population with particular respect to Southern right whales *(Eubalaena australis),* Blue whales *(Balaenoptera musculus),* Sperm whales *(Physeter macrocephalus)* and Beaked whales *(Ziphiidae sp.)*
- It will reduce the area of occupancy of Southern right and Blue whale populations
- It will adversely affect habitat critical to the survival of a Southern right and Blue whales
- It will cause disruption to the breeding cycle of a species population with respect to Southern right whales

Migratory Species will have their lifecycle (breeding, feeding, migration or resting behaviour) seriously disrupted.

Avoidance behaviours are assured with the subsequent impacts with respect to energy compromise.
The action is likely to:

- Substantially modify or isolate an area of important habitat for migratory species
- Seriously disrupt the lifestyle of an ecologically significant proportion of migratory species

Environmental impacts on the Commonwealth marine environment will be significant for the following reasons:

- The activity will disturb an important area of habitat such that the functioning of the marine ecosystem suffers from adverse impacts
- The activity is likely to have adverse impacts on marine species or Cetaceans during their lifecycle or impact on their special distribution

Conclusion

Given the uncertainties with respect to short and long term impacts, and in light of the growing body of evidence with respect to the harm anthropogenic sound could be responsible for, this application for approval must be considered a controlled action at the very least and refused, at best.

Thankyou very much for your consideration of this very important matter.

Yours sincerely,

Tony Bartram

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Whale and Dolphin Conservation Dolphin Watch Project Officer

References and Relevant Papers

Jochens, A., D. Biggs, K. Benoit-Bird, D. Engelhaupt, J. Gordon, C. Hu, N. Jaquet, M. Johnson, R. Leben, B. Mate, P. Miller, J. Ortega-Ortiz, A. Thode, P. Tyack, and B. Würsig. 2008.
Sperm Whale Seismic Study In The Gulf Of Mexico: Synthesis Report.
U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico
OCS Region, New Orleans, LA. OCS Study MMS 2008-006. 341 pp.
http://www.gomr.mms.gov/PI/PDFImages/ESPIS/4/4444.pdf

Coordinating author: Ian Boyd. Contributing authors: Bob Brownell, Doug Cato, Chris Clark, Dan Costa, Peter Evans, Jason Gedamke, Roger Gentry, Bob Gisiner, Jonathan Gordon, Paul Jepson, Patrick Miller, Luke Rendell, Mark Tasker, Peter Tyack, Erin Vos, Hal Whitehead, Doug Wartzok, Walter Zimmer.
Marine Board European Science Foundation.
The Effects Of Anthropogenic Sound On Marine Mammals: A Draft Research Strategy.

Potter, J. R., Thillet, M., Douglas, C., Chitre, M.A., Doborzynski, Z. and Seekings, P.J. 2007.
Visual And Passive Acoustic Marine Mammal Observations And High Frequency Seismic Source Characteristics Recorded During A Seismic Survey
IEEE J. Oceanic Engineer, 32: 469-483 Southall, Bowles, Ellison, Finneran, Gentry, Green Jr, Kastak, Ketten, James Miller, Nachtigall, Richardson, Thomas, Tyack.

Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. Aquatic Mammals, Volume 33, Number 4, 2007

Peter L. Tyack.
Implications For Marine Mammals Of Large-scale Changes In The Marine Acoustic Environment Journal of Mammalogy, 89(3): 549-558, 2008.

L.S. Weilgart.
The Impacts Of Anthropogenic Ocean Noise On Cetaceans And Implications For Management
Can. J. Zool. 85: 1091-1116 (2007)

Caroline Weir.
Overt Responses of Humpback Whales (Megaptera novaeangliae), Sperm Whales (Physeter macrocephalus), and Atlantic Spotted Dolphins (Stellena frontalis) to Seismic Exploration off Angola
Aquatic Mammals 2008, 34 (1), 71-83.

Caroline Weir.
Short-Finned Pilot Whales (Globicephala macrorhynchus)
Respond to an Airgun Ramp-up Procedure off Gabon. Aquatic Mammals 2008,
34(3), 349-354.

Lucia Di Iorio1 & Christopher W. Clark
Exposure To Seismic Survey Alters Blue Whale Acoustic Communication
Zoologisches Institut, Universita¨t Zu¨ rich, Winterthurerstrasse 190, 8004 Zu¨ rich, Switzerland
Bioacoustics Research Program, Cornell Laboratory of Ornithology,
159 Sapsucker Woods Road, Ithaca, NY 14850, USA

Clark, C. W. & Gagnon, G. C. 2006
Considering The Temporal And Spatial Scales Of Noise Exposures From Seismic Surveys On Baleen Whales.
Int. Whal. Comm. SC58/E9.

Gordon, J., Gillespie, D., Potter, J., Frantzis, A., Simmonds, M. P., Swift, R. & Thompson, D. 2004
A Review Of The Effects Of Seismic Surveys On Marine Mammals.
Mar. Tech. Soc. J. 37, 16–34. (doi:10.4031/002533203787536998)

IUCN 2008 International Union for Conservation of Nature Red List.
http://www.iucnredlist.org/details/2477

L. Di Iorio & C. W. Clark 53
Blue whales And Seismic Survey Noise
Biol. Lett. (2010)
rsbl.royalsocietypublishing.org June 9, 2012

Miller, P. J. O., Biassoni, N., Samuels, A. & Tyack, P. L. 2000
Whale Songs Lengthen In Response To Sonar.
Nature 405, 903. (doi:10.1038/35016148)

Nowacek, D. P., Thorne, L. H., Johnston, D. W. & Tyack, P. L. 2007
NRC 2005 Marine Mammal Populations And Ocean Noise: Determining When Noise Causes Biologically Significant Effects. Washington, DC: National Academies Press.
Responses of cetaceans to anthropogenic noise.

Mamm. Rev. 37, 81–115. (doi:10.1111/j.1365-2907.2007.00104.x)

Parks, S. E., Clark, C. W. & Tyack, P. L. 2007
Short And Long-term Changes In Right Whale Calling Behavior: The Potential Effects Of Noise On Acoustic Communication.
J. Acoust. Soc. Am. 122, 3725–3731. (doi:10.1121/1.2799904)

Southall, B. L. et al. 2007
Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations.
Aquat. Mamm. 33, 411–521. (doi:10.1578/AM.33.4.2007.411)

Wartzok, D. & Ketten, D. R. 1999
Marine Mammal Sensory Systems. In Biology of Marine Mammals
(eds J. E. Reynolds & S. A. Rommel), pp. 117–174. Washington, DC:
Smithsonian Institution Press.

Wartzok, D., Popper, A. N., Gordon, J. & Merrill, J. 2004
Factors Affecting The Responses Of Marine Mammals To Acoustic Disturbance.
Mar. Tech. Soc. J. 37, 6–15. (doi:10.4031/002533203787537041)

54 L. Di Iorio & C. W. Clark
Blue whales And Seismic Survey Noise
Biol. Lett. (2010)
www.rsbl.royalsocietypublishing.org June 9, 2012

Allen, M. C., & Read A. J. 2000.
Habitat Selection Of Foraging Bottlenose Dolphins In Relation To Boat Density Near Clearwater, Florida.
Marine Mammal Science 16:815–824.

Dawkins, M. S. 2006.
A User's Guide To Animal Welfare Science.
Trends in Ecology and Evolution 21:77–82.

FRID, A., & L. DILL. 2002.
Human-caused Disturbance Stimuli As A Form Of Predation Risk.
Conservation Ecology 6:11

JOHNSON, M. P., P. T. MADSEN, W. M. X. ZIMMER, N. AGUILAR DE
SOTO, AND P. L. TYACK. 2004.
Beaked Whales Echolocate On Prey.
Proceedings of the Royal Society of London, B. Biological Sciences
271:S383–S386.

JOHNSON, M. P., AND P. L. TYACK. 2003.
A Digital Acoustic Recording Tag For Measuring The Response Of Wild Marine Mammals To Sound.
IEEE Journal of Oceanic Engineering 28:3–12

MCEWEN, B., AND J. C. WINGFIELD. 2003.
The Concept Of Allostasis In Biology And Biomedicine.
Hormones and Behavior 43:2–15.
MIKSIS-OLDS, J. L. 2006. Manatee response to environmental noise

levels. Ph.D. dissertation, University of Rhode Island, Kingston.

MILLER, P. J. O., N. BIASSONI, A. SAMUELS, AND P. L. TYACK. 2000.
Whale Songs Lengthen In Response To Sonar.
Nature 405:903

PARKS, S. E., C. W. CLARK, AND P. L. TYACK. 2007.
Short And Longterm Changes In Right Whale Calling Behavior: The Potential Effects Of Noise On Acoustic Communication.
Journal of the Acoustical Society of America 122:3725–3731.

ROMANO, T. A., ET AL. 2004.
Anthropogenic Sound And Marine Mammal Health: Measures Of The Nervous And Immune Systems Before And After Intense Sound Exposure.
Canadian Journal of Fisheries and Aquatic Sciences 61:1124–1134

TYACK, P. L. 1986.
Population Biology, Social Behavior And Communication In Whales And Dolphins.
Trends in Ecology and Evolution 1:144–150.

TYACK, P. L. 1997.
Studying How Cetaceans Use Sound To Explore Their Environment.
Perspectives in Ethology 12:251–297.

TYACK, P. L. 1998.
Acoustic Communication Under The Sea.
Pp. 163-220 in Animal acoustic communication
(S. L. Hopp, M. J. Owren, & C. S. Evans, eds.) Springer-Verlag, New York.

TYACK, P. L., AND H. WHITEHEAD. 1983.
Male Competition In Large Groups Of Male Humpback Whales.
Behaviour 82:132–154.

URICK, R. J. 1983.
Principles Of Underwater Sound.
Peninsula Publishing, Los Altos, California.

WARTZOK, D., J. ALTMANN, W. AU, K. RALLS, A. STARFIELD, AND P. L.TYACK. 2005.
Marine Mammal Populations And Ocean Noise: Determining When Noise Causes Biologically Significant Effects.
National Academy Press, Washington, D.C

WINGFIELD, J. C., ET AL. 1998.
Ecological Bases Of Hormone–behavior Interactions: The ‘‘Emergency Life History Stage.’’
American Zoologist 38:191–206.

WINGFIELD, J. C., AND M. RAMENOFSKY. 1999.
Hormones And The Behavioral Ecology Of Stress. Pp. 1–51 in Stress Physiology In Animals
(P. H. M. Balm, ed.). Sheffield Academic Press, Sheffield, United Kingdom.

ZIMMER, W. M. X., AND P. L. TYACK. 2007.

Repetitive Shallow Dives Pose Decompression Risk In Deep-diving Beaked Whales.
Marine Mammal Science 23:888–925.

ZIMMER, W. M. X., P. L. TYACK, M. P. JOHNSON, AND P. T. MADSEN. 2005.
Three-dimensional Beam Pattern Of Regular Sperm Whale Clicks Confirms Bent-horn Hypothesis.
Journal of the Acoustical Society of America 117:1473–1485.

André, M., M. Terada, and Y. Watanabe. 1997.
Sperm Whale (Physeter macrocephalus) Behavioural Response After The Playback Of Artificial Sounds.
Report of the International Whaling Commission 47:499–504.

Bejder, L., A. Samuels, H. Whitehead, and N. Gales. 2006.
Interpreting Short-term Behavioural Responses To Disturbance Within A Longitudinal Perspective.
Animal Behavior 72:1149–1158.

Buck, J. R., and P. L. Tyack. 2000.
Response Of Gray Whales To Low-frequency Sounds.
Journal of the Acoustical Society of America 107:2774.

Clark, C. W., W. T. Ellison, B. L. Southall, L. Hatch, S. M. Van Parijs, A. Frankel, & D. Ponirakis. 2009.
Acoustic Masking In Marine Ecosystems: Intuitions, Analysis And Implication. Marine Ecology Progress Series 395:201–222.

Clark, C. W., P. Tyack, & W. T. Ellison. 1999.
Responses Of Four Species Of Whales To Sounds Of SURTASS LFA Sonar Transmissions. Cornell University, Ithaca, New York, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, and Marine Acoustics, Arlington, Virginia.

D'Amico, A., R. C. Gisiner, D. R. Ketten, J. A. Hammock, C. Johnson, P. L. Tyack, and J. Mead. 2009.
Beaked Whale Strandings And Naval Exercises.
Aquatic Mammals 35:452–472.

Finneran, J. J., & C. E. Schlundt. 2010.
Frequency-dependent And Longitudinal Changes In Noise-induced Hearing Loss In A Bottlenose Dolphin (Tursiops truncatus). Journal of the Acoustical Society of America 128:567–570.

Frankel, A. S., & C. W. Clark. 1998**. Results Of Low-frequency M-sequence Noise Playbacks to Humpback Whales, Megaptera novaeangliae, In Hawai'i.**
Canadian Journal of Zoology 76:521–535.

Johnson, C. E. 2012.
Regulatory Assessments Of The Effects Of Noise: Moving From Threshold Shift And Injury To Behavior.
Pages 561–564 in A. Popper and A. Hawkins, editors. The Effects of Noise on Aquatic Life. Springer, New York .

Miles, C. W. Clark, P. L. Tyack, & J. E. Bird. 1983.
Investigations Of The Potential Effects Of Underwater Noise From Petroleum Industry Activities On Migrating Gray Whale Behavior. Bolt, Beranek and Newman, Cambridge , Massachusetts .

National Research Council. 2005.
Marine Mammal Populations and Ocean Noise: Determining When Noise Causes Biologically Significant Effects. National Academies Press, Washington , D.C.

Nowacek, D. P., L. H. Thorne, D. W. Johnston, & P. L. Tyack. 2007.
Responses Of Cetaceans To Anthropogenic Noise.
Mammal Review 37:81–115.

Southall, B., et al. 2009.
Addressing The Effects Of Human-generated Sound On Marine Life: An Integrated Research Plan for U.S. Federal Agencies. Interagency Task Force on Anthropogenic Sound and the Marine Environment of the Joint Subcommittee on Ocean Science and Technology, Washington , D.C .

Southall, B. L., et al. 2007.
Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations.
Aquatic Mammals 33:411–521. David K. Mellinger Cooperative Institute for Marine Resources Studies, Oregon State University and Pacific Marine Environmental Laboratory, National Oceanic and Atmospheric Administration, 2030 Southeast Marine Science Dr., Newport, Oregon 97365 2000, 2004 and 2011

Marine Climate Change in Australia - Impacts and Adaptation Responses 2012 REPORT CARD 353 Marine Mammals: Nicole Schumann1, John. P. Y. Arnould1, Nick Gales2 and Robert Harcourt 31 School of Life and Environmental Sciences, Deakin University, 221 Burwood Hwy, Burwood, VIC 3125, Australia, nsc@deakin.edu.au. 2Australian Antarctic Program, Australian Antarctic Division, 203 Channel Hwy, Kingston, TAS 7050, Australia 3Graduate School of the Environment, Macquarie University, Sydney NSW 2109, Australia, Schumann, N. et al. (2012) Marine Mammals. In Marine Climate Change Impacts and Adaptation Report Card for Australia 2012 (Eds. E.S. Poloczanska, A.J. Hobday and A.J. Richardson) www.oceanclimatechange.org.au ISBN: 978-0-643-10928-5

Conservation Management Plan for the Southern Right Whale – A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2011 > 2021.

www.oceana.org

Peru Dolphin Deaths Show What Seismic Testing Might Do June 29, 2012 Matt Huelsenbeck

Appendix

Kangaroo Island / Victor Harbor Dolphin Watch Analysis:

KI North Coast Transience Oct 15th 2016

Kangaroo Island / Victor Harbor Dolphin Watch

Data Analysis – KI North Coast Transience

October 15th 2016

Surveys commenced March 8th 2006 (2 Training Surveys Nov. 30th, Dec. 1st 2005)
Surveys to date: Kangaroo Island – 186 / 5 no sightings

Current Catalogued Bottlenose Dolphins: (no Common Dolphins)
343 confirmed to date (*Numerous unconfirmed IDs and data backlog TBC !)*

- North Cape 176
- Dashwood Bay 65
- Hog Bay 48
- American River/Pelican Lagoon 25
- Pennington Bay 8
- West Bay 14
- Hanson Bay 7

Figures in data analysis carried out in 2015:

- Transience analysis carried out some months ago > currently being updated - figures likely to be much higher.
- "Sighted regularly" refers to more than 1 sighting ie not travellers / visitors, mortalities etc
- A significant no. of catalogued dolphins include new IDs ie recent 1st sightings, calves etc
- A number of catalogued North Cape dolphins have travelled East, some extensively eg to Back Stairs Passage, Hog Bay etc - indicates significant movement between sites
- Survey site visitation is weather dependent > likely to be much higher numbers travelling along the North Coast than able to be observed on surveys

Summary:

1. No. of dolphins in the core pod (sighted regularly) at Dashwood Bay: 47
2. No. of dolphins in the core pod (sighted regularly) at North Cape: 98
3. No. of dolphins in the core pod (sighted regularly) observed in both sites > transients: 66
4. % of current catalogue Dashwood Bay transients (sighted in both sites): 13 27.66%
5. % of current catalogue North Cape transients (sighted in both sites): 53 54.08%

Critical Habitat:

- North Cape and Dashwood Bay: from our observations over nearly 11 years of survey effort, are resting / feeding / nursery sites for core pods of Bottlenose dolphins, plus a large number of visiting or transient dolphins on occasions.
- Linkages of the habitat: it is feasible to make a case that the migratory corridor between the sites forms a part of a critical habitat because of the activities observed; mating, feeding, socialising, resting etc. plus on many occasions calves are in the pod, including newly born, and females can often be seen teaching young juveniles.

Points of Interest:

1. Late in 2014 through until the most recent Dashwood Bay survey in April 2016, extremely large groups of Bottlenose dolphins have been reported by Kangaroo Island Marine Adventures and volunteers on surveys, sometimes 70 - 80 and on one occasion 110+. This is an unusual occurrence for the North Coast from previous observations.
2. Larger numbers of "unidentified" dolphins / new ID's are appearing as part of observations on field surveys. This trend is continuing currently.

Tony Bartram
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Mr Stephan Knoll
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C/- Robert Kleeman
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Department of Planning, Transport and Infrastructure
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May 28, 2019

Dear Minister Knoll,

We write to express our views about the Smith Bay Environmental Impact Statement by Kangaroo Island Plantation Timber.

Wild Migration is an international conservation organisation with considerable experience in the presentation of policy and science of threat abatement and the negotiation of conservation measures for marine, terrestrial, and avian species. Two of our senior policy team live and work from Kangaroo Island on a farm adjacent to a Kangaroo Island Plantation Timber forest (Pentelows).

This close association has given us a unique perspective and we have been impressed by Kangaroo Island Plantation Timber's commitment to extend community consultation and to strive for high standards of environmental stewardship. This is evidenced through their considerable environmental studies. We have scanned these documents and believe this level of transparency and assessment are standards that all Australian companies should apply. Without commenting on the appropriate breadth of substance, we applaud these efforts.

Our focus for this submission relates specifically to the impact of ocean noise during the wharf construction phase, and with the ship activities thereafter.

Between 2015-17 Geoff Prideaux (Wild Migration) was contracted by the UN Convention on Migratory Species (CMS) to author and coordinate the development of the *CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities* (CMS Noise EIA Guidelines). After extensive review and negotiation these were adopted by Resolution by the 12th CMS Conference of the Parties in 2017. As a Party to CMS, Australian Governments (State and Federal) have made a commitment to consider the Guidelines in all marine development processes where noise-generating activities are present.

With this knowledge, we have specifically reviewed *Section 9: Significant marine fauna and hearing* and find that much of the information falls short of what is now accepted as marine species vulnerability to ocean noise. Importantly, impact to marine species extends beyond impact to hearing, especially for fish and shellfish. It is crucial that the full range of impacts are represented, and that modelling of noise-generating activities adequately represents this impact.

We urge Kangaroo Island Plantation Timbers to review the direction within the CMS Noise EIA Guidelines, to carefully consider the Technical Support Information that underpins the Guidelines, and to re-present the case for ocean noise impacts from both the construction activities and the shipping activities that will follow. Geoff would be pleased to be available to Kangaroo Island Plantation Timbers to review the redraft of this section before final submission if this was helpful. Properly presented, this will provide the Department of Planning Transport and Infrastructure with the necessary information to assess the ocean noise impact of the proposal on its merits.

Specifically, the components of the Guidelines we urge to have addressed are:

- VII. EIA Guideline for Construction Works (CMS Noise EIA Guidelines, pages 20 and 21)
- V. EIA Guideline for Shipping and Vessels Traffic (CMS Noise EIA Guidelines, page 15 and 16)
- CMS Noise EIA Guidelines Technical Support information, modules B.1, B.3, B.5, B.10, B.11, and B.12

We have attached both the CMS Noise EIA Guidelines, and their Technical Support Information for your convenience. These documents are also available through the CMS website, at www.cms.int.

Yours sincerely

Margi Prideaux
Policy Director, Wild Migration

Attached:

1. *CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities*
2. *Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities*

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CONVENTION ON MIGRATORY SPECIES

Distribution: General

UNEP/CMS/Resolution 12.14

Original: English

ADVERSE IMPACTS OF ANTHROPOGENIC NOISE ON CETACEANS AND OTHER MIGRATORY SPECIES

Adopted by the Conference of the Parties at its 12th Meeting (Manila, October 2017)

Recalling that in Resolution 9.19 and Resolution 10.24[1] the CMS Parties expressed concern about possible "adverse anthropogenic marine/ocean noise impacts on cetaceans and other biota",

Recognizing that anthropogenic marine noise, depending on source and intensity, is a form of pollution, composed of energy, that may degrade habitat and have adverse effects on marine life ranging from disturbance of communication or group cohesion to injury and mortality,

Aware that, over the last century, anthropogenic noise levels in the world's oceans have significantly increased as a result of multiple human activities,

Recalling the obligations of Parties to the United Nations Convention on the Law of the Sea (UNCLOS) to protect and preserve the marine environment and to cooperate on a global and regional basis concerning marine mammals, paying special attention to highly migratory species, including cetaceans listed in Annex I of UNCLOS,

Recalling that the United Nations General Assembly Resolution A/RES/71/257 on *Oceans and the Law of the Sea* adopted in 2016 "[n]otes with concern that human-related threats, such as marine debris, ship strikes, underwater noise, persistent contaminants, coastal development activities, oil spills and discarded fishing gear, together may severely impact marine life, including its higher trophic levels, and calls upon States and competent international organizations to cooperate and coordinate their research efforts in this regard so as to reduce these impacts and preserve the integrity of the whole marine ecosystem while fully respecting the mandates of relevant international organizations",

Recalling CMS Resolution 10.15 on *Global Programme of Work for Cetaceans*, which urges Parties and non-Parties to promote the integration of cetacean conservation into all relevant sectors by coordinating their national positions among various conventions, agreements and other international fora and instructs the Aquatic Mammals Working Group of the Scientific Council to develop advisory positions for use in Environmental Impact Assessments at the regional level and to provide support to governments and regional bodies for assessing and defining appropriate standards for noise pollution,

[1] Both now consolidated as Resolution 12.14

Recalling that other international fora recognize anthropogenic marine noise as a potential threat to marine species conservation and welfare, and have adopted related decisions and resolutions or issued guidance, including:

a) the Convention on Biological Diversity (CBD) through Decision X.29 concerning marine and coastal biodiversity and in particular its paragraph 12 relating to anthropogenic underwater noise and Decision XIII.10 addressing impacts of anthropogenic underwater noise on marine and coastal biodiversity and in particular paragraphs 1-2 relating to anthropogenic underwater noise,

b) the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) through Resolution 2.16 on *Impact Assessment of Man-Made Noise*, Resolution 3.10 on *Guidelines to Address the Impact of Anthropogenic Noise on Marine Mammals in the ACCOBAMS Area*, Resolution 4.17 on *Guidelines to address the impact of anthropogenic noise on cetaceans in the ACCOBAMS area*, Resolution 5.15 on *Addressing the Impact of Anthropogenic Noise* and Resolution 6.17 on *Anthropogenic Noise*,

c) the Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) through Resolution 5.4 on *Adverse Effects of Sound, Vessels and other Forms of Disturbance on Small Cetaceans*, Resolution 6.2 on *Adverse Effects of Underwater Noise on Marine Mammals during Offshore Construction Activities for Renewable Energy Production* and Resolution 8.11 on *CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities*,

d) the International Maritime Organization (IMO), which in 2008 established in its Marine Environmental Protection Committee a high priority programme of work on minimizing the introduction of incidental noise from commercial shipping operations into the marine environment, and which in 2014 issued MEPC.1/Circ.833 *Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life*,

e) the Convention for the Protection of the Marine Environment of the North-East-Atlantic (OSPAR) Guidance on environmental considerations for offshore wind farm development,

f) the International Union for Conservation of Nature (IUCN) Resolution 3.068 concerning undersea noise pollution (World Conservation Congress at its 3rd Session in Bangkok, Thailand, 17–25 November 2004),

g) following International Whaling Commission (IWC) Resolution 1998-6, the IWC Scientific Committee has investigated the impacts of military sonar, seismic surveys, masking and shipping noise; it has concluded that, in addition to some instances of severe acute effects (e.g. from military sonar and similar noise sources), existing levels of ocean noise can have a chronic effect, and agreed that action should be taken to reduce noise in parallel with efforts to quantify these effects; and the IWC has identified the importance of continued and increased collaboration on this issue with other organizations including ACCOBAMS, ASCOBANS, IMO and IUCN, *Recalling* that according to Article 236 of UNCLOS, that Convention's provisions regarding the protection and preservation of the marine environment do not apply to warships, naval auxiliary and other vessels or aircraft owned or operated by a State and used, for the time being, only on governmental non-commercial service; and that each State is required to ensure, by the adoption of appropriate measures not impairing operations or operational capabilities of such vessels or aircraft owned or operated by it, that such vessels or aircraft act in a manner consistent, so far as is reasonable and practicable, with UNCLOS,

Noting that the Convention on Biological Diversity (CBD) decision VI/20 recognized CMS as the lead partner in the conservation and sustainable use of migratory species over their entire range,

Acknowledging the ongoing activities in other fora to reduce underwater noise such as the activities within NATO to avoid negative effects of sonar use,

Noting Directive 2014/52/EU of the European Parliament and of the Council, amending Directive 2011/92/EU on the *Assessment of the Effects of Certain Public and Private Projects on the Environment*,

Noting the EU Marine Strategy Framework Directive and its implementing act, where Member States in European Union marine waters shall take necessary measures by 2020 to achieve or maintain their determined good environmental status, including on underwater noise, established by each of them and in coordination at Union, regional and sub-regional levels,

Grateful for the invitation of ACCOBAMS and ASCOBANS, accepted in 2014, that CMS participate in the Joint Noise Working Group, which provides detailed and precautionary advice to Parties, particularly on available mitigation measures, alternative technologies and standards required for achieving the conservation goals of the treaties,

Aware that some types of marine noise can travel faster than other forms of pollution over more than hundreds of kilometres underwater unrestricted by national boundaries and that these are ongoing and increasing,

Taking into account the lack of data on the distribution and migration of some populations of marine species and on the adverse human-induced impacts on CMS-listed marine species and their prey,

Aware that incidents of stranding and deaths of some cetacean species have coincided with and may be due to the use of high-intensity mid-frequency active sonar,

Reaffirming that the difficulty of proving possible negative impacts of acoustic disturbance on CMS-listed marine species and their prey necessitates a precautionary approach in cases where such an impact is likely,

Noting the draft research strategy developed by the European Science Foundation on "*the effects of anthropogenic sound on marine mammals",* which is based on a risk assessment framework,

Noting the OSPAR *Code of Conduct for Responsible Marine Research in the Deep Seas and High Seas of the OSPAR Marine Area* and the ISOM *Code of Conduct for Marine Scientific Research Vessels*, providing that marine scientific research is carried out in an environmentally friendly way using appropriate study methods reasonably available,

Aware of the calls on the IUCN constituency to recognize that, when there is reason to expect that harmful effects on biota may be caused by anthropogenic marine noise, lack of full scientific certainty should not be used as a reason for postponing measures to prevent or minimize such effects, *Recognizing* with concern that cetaceans and other marine mammals, reptiles and fish species, and their prey, are vulnerable to noise disturbance and subject to a range of human impacts,

The Conference of the Parties to the
Convention on the Conservation of Migratory Species of Wild Animals

1. *Reaffirms* that there is a need for ongoing and further internationally coordinated research on the impact of underwater noise (including inter alia from offshore wind farms and associated shipping) on CMS-listed marine species and their prey, their migration routes and ecological coherence, in order to give adequate protection to cetaceans and other marine migratory species;

2. *Confirms* the need for international, national and regional limitation of harmful anthropogenic marine noise through management (including, where necessary, regulation), and that this Resolution remains a key instrument in this regard;

3. *Urges* Parties and invites non-Parties that exercise jurisdiction over any part of the range of marine species listed on the appendices of CMS, or over flag vessels that are engaged within or beyond national jurisdictional limits, to take special care and, where appropriate and practical, to endeavour to control the impact of anthropogenic marine noise pollution in habitats of vulnerable species and in areas where marine species that are vulnerable to the impact of anthropogenic marine noise may be concentrated, to undertake relevant environmental assessments on the introduction of activities that may lead to noise-associated risks for CMS-listed marine species and their prey;

4. *Strongly urges* Parties to prevent adverse effects on CMS-listed marine species and their prey by restricting the emission of underwater noise; and where noise cannot be avoided, *further urges* Parties to develop an appropriate regulatory framework or implement relevant measures to ensure a reduction or mitigation of anthropogenic marine noise;

5. *Calls* on Parties and *invites* non-Parties to adopt whenever possible mitigation measures on the use of high intensity active naval sonars until a transparent assessment of their environmental impact on marine mammals, fish and other marine life has been completed and as far as possible aim to prevent impacts from the use of such sonars, especially in areas known or suspected to be important habitat to species particularly sensitive to active sonars (e.g. beaked whales) and in particular where risks to marine species cannot be excluded, taking account of existing national measures and related research in this field;

6. *Urges* Parties to ensure that Environmental Impact Assessments take full account of the effects of activities on CMS-listed marine species and their prey and consider a more holistic ecological approach at a strategic planning stage;

7. *Endorses* the “CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities” attached as Annex and *welcomes* the Technical Support Information contained in UNEP/CMS/COP12/Inf.11[2];

8. *Invites* Parties to ACCOBAMS and ASCOBANS to consider adopting these Guidelines, in the elaboration of which they were fully involved, at their next Meetings of the Parties;

9. *Further invites* Signatories to relevant Memoranda of Understanding concluded under CMS to consider using these Guidelines as guiding documents;

10. *Recognizes* that the work done in relation to marine noise is rapidly evolving, and *requests* the Scientific Council, in collaboration with the Joint Noise Working Group of CMS, ACCOBAMS and ASCOBANS, to review and update these Guidelines regularly;

[2] also provided online at http://www.cms.int/guidelines/cms-family-guidelines-EIAs-marine-noise

11. *Urges* Parties and *encourages* non-Parties to disseminate these Guidelines, where necessary translating the Guidelines into different languages for their wider dissemination and use;

12. *Invites* the private sector and other stakeholders to make full use of these Guidelines in order to assess, mitigate and minimize negative effects of anthropogenic marine noise on marine biota;

13. *Welcomes* the efforts of the private sector and other stakeholders to reduce their environmental impact and *strongly encourages* them to continue making this a priority;

14. *Recommends* that Parties, the private sector and other stakeholders apply Best Available Techniques (BAT) and Best Environmental Practice (BEP) including, where appropriate, clean technology, in their efforts to reduce or mitigate marine noise pollution;

15. *Further recommends* that Parties, the private sector and other stakeholders use, as appropriate, noise reduction techniques for offshore activities such as: air-filled coffer dams, bubble curtains or hydro-sound dampers, or different foundation types (such as floating platforms, gravity foundations or pile drilling instead of pile driving);

16. *Stresses* the need of Parties to consult with any stakeholder conducting activities known to produce anthropogenic marine noise with the potential to cause adverse effects on CMS-listed marine species and their prey, such as the oil and gas industry, shoreline developers, offshore extractors, marine renewable energy companies, other industrial activities and oceanographic and geophysical researchers recommending, how best practice of avoidance, diminution or mitigation of risk should be implemented. This also applies to military authorities to the extent that this is possible without endangering national security interests. In any case of doubt the precautionary approach should be applied;

17. *Encourages* Parties to integrate the issue of anthropogenic noise into the management plans of marine protected areas (MPAs) where appropriate, in accordance with international law, including UNCLOS;

18. *Invites* the private sector to assist in developing mitigation measures and/or alternative techniques and technologies for coastal, offshore and maritime activities in order to minimize anthropogenic noise pollution of the marine environment to the highest extent possible;

19. *Encourages* Parties to facilitate:

- regular collaborative and coordinated temporal and geographic monitoring and assessment of local ambient noise (both of anthropogenic and biological origin);
- further understanding of the potential for sources of noise to interfere with long-range movements and migration;
- the compilation of a reference signature database, to be made publicly available, to assist in identifying the source of potentially damaging sounds;
- characterization of sources of anthropogenic noise and sound propagation to enable an assessment of the potential acoustic risk for individual species in consideration of their auditory sensitivities;
- studies on the extent and potential impact on the marine environment of high- intensity active naval sonars and seismic surveys in the marine environment; and the extent of noise inputs into the marine environment from shipping and to provide an assessment, on the basis of information to be provided by the Parties, of the impact of current practices; and
- studies reviewing the potential benefits of “noise protection areas”, where the emission of underwater noise can be controlled and minimized for the protection of cetaceans and other biota;

whilst recognizing that some information on the extent of the use of military sonars (e.g. frequencies used) will be classified and would not be available for use in the proposed studies or databases;

20. *Recommends* that Parties that have not yet done so establish national noise registries to collect and display data on noise-generating activities in the marine area to help assess exposure levels and the likely impacts on the marine environment, and that data standards are made compatible with regional noise registries, such as the ones developed by the International Council for the Exploration of the Sea (ICES) and ACCOBAMS;

21. *Urges* all Parties to endeavour to develop provisions for the effective management of anthropogenic marine noise in CMS daughter agreements and other relevant bodies and Conventions;

22. *Invites* the Parties to strive, wherever possible, to ensure that their activities falling within the scope of this Resolution avoid harm to CMS-listed marine species and their prey;

23. *Requests* the Scientific Council, supported by the Joint Noise Working Group of CMS, ACCOBAMS and ASCOBANS, to continue monitoring new available information on the effects of underwater noise on marine species, as well as the effective assessment and management of this threat, and to make recommendations to Parties as appropriate;

24. *Requests* the Secretariat and *calls upon* Parties to contribute to the work of the IMO MEPC on noise from commercial shipping;

25. *Invites* Parties to provide the CMS Secretariat, for transmission to the Scientific Council, with copies of relevant protocols/guidelines and provisions for the effective management of anthropogenic noise, taking security needs into account, such as those of relevant CMS daughter agreements, OSPAR, IWC, IMO, NATO and other fora, thereby avoiding duplication of work; and

26. *Repeals*

    a) Resolution 9.19, *Adverse Anthropogenic Marine/Ocean Noise Impacts on Cetaceans and Other Biota*; and

    b) Resolution 10.24, *Further Steps to Abate Underwater Noise Pollution for the Protection of Cetaceans and Other Migratory Species*.

Annex to Resolution 12.14

CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities

These **CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities** have been developed to present the Best Available Techniques (BAT) and Best Environmental Practice (BEP), as called for in CMS Resolutions 9.19, 10.24 and 10.15, ACCOBAMS Resolution 5.15 and ASCOBANS Resolutions 6.2 and 8.11. In addition to the parent convention, CMS, these guidelines are relevant to:

- Agreement on the Conservation of Cetaceans of the Black Seas Mediterranean Seas and Contiguous Atlantic Area (ACCOBAMS)
- Agreement on the Conservation of Seals in the Wadden Sea (Wadden Sea Seals)
- Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)
- MOU Concerning Conservation Measures for the Eastern Atlantic Populations of the Mediterranean Monk Seal (*Monachus monachus*) (Atlantic Monk Seals)
- MOU Concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa (Atlantic Marine Turtles)
- MOU Concerning the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia (Western African Aquatic Mammals)
- MOU for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region (Pacific Islands Cetaceans)
- MOU on the Conservation and Management of Dugongs (*Dugong dugon*) and their Habitats throughout their Range (Dugong)
- MOU on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA)
- MOU on the Conservation of Migratory Sharks (Sharks)

Contents

I. Introduction

1. These **CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities** are designed to provide regulators with tailored advice to apply in domestic jurisdictions, as appropriate, to create EIA standards between jurisdictions seeking to manage marine noise-generating activities. The requirements within each of the modules are designed to ensure that the information being provided by proponents will provide decision-makers with sufficient information to make an informed decision about impacts. The modules should be read in tandem with the **Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities** (available at www.cms.int/guidelines/cms-family-guidelines-EIAs-marine-noise). They are structured to stand as one complete unit or to be used as discrete modules, tailored for national and agreement approaches.

2. The sea is the interconnected system of all the Earth's oceanic waters, including the five named 'oceans' - the Atlantic, Pacific, Indian, Southern and Arctic Oceans - a continuous body of salty water that covers over 70 per cent of the Earth's surface. This vast aquatic environment is home to a wider range of higher animal taxa than exists on land. Many marine species have yet to be discovered and the number known to science is expanding annually.

3. The sea also provides people with food—mainly fish, shellfish and seaweed—as well as other marine resources. It is a shared resource for us all.

4. Marine wildlife relies on sound for vital life functions, including communication, prey and predator detection, orientation and for sensing surroundings. The ocean environment is filled with natural sound (ambient noise) from biological (marine animals) and physical processes (earthquakes, wind, ice and rain) (Urick, 1983). Species living in this environment are adapted to these sounds.

5. Over the past century many anthropogenic marine activities have increased levels of noise (Hildebrand 2009; André et.al. 2010; Miksis-Olds and Nichols 2016) These modern anthropogenic noises have the potential for physical, physiological and behavioural impacts (Southall et.al. 2007).

6. Parties to CMS, ACCOBAMS and ASCOBANS have in several resolutions recognized underwater noise as a major threat to many marine species. These resolutions also call for noise-related considerations to be taken into account as early as the planning stages of activities, especially by making effective use of Environmental Impact Assessments (EIAs). The Convention on Biological Diversity Decision XII/23 also encourages governments to require EIAs for noise-generating offshore activities, and to combine acoustic mapping with habitat mapping to identify areas where these species may be exposed to noise impacts. (Prideaux, 2017b)

7. Wildlife exposed to elevated or prolonged anthropogenic noise can suffer direct injury and/or temporary or permanent auditory threshold shifts. Noise can mask important natural sounds, such as the call of a mate, or the sound made by prey or predator. Anthropogenic noise can also displace wildlife from important habitats. These impacts are experienced by a wide range of species including fish, crustaceans, cephalopods, pinnipeds (seals, sea lions and walrus), sirenians (dugong and manatee), sea turtles, the polar bear, marine otters and cetaceans (whales, dolphins and porpoises) (Southall et.al. 2007; Aguilar de Soto, 2017a; 2017b; Castellote, 2017a; 2017b; Frey, 2017; Hooker, 2017; McCauley, 2017; Marsh, 2017; Notarbartolo di Sciara, 2017a; 2017b; 2017c; Parks, 2017; Truda Palazzo, 2017; Vongraven, 2017). Where there is risk, full assessment of impact should be conducted.

8. The propagation of sound in water is complex and requires many variables to be carefully considered before it can be known if a noise-generating activity is appropriate or not. It is inappropriate to generalize sound transmission without fully investigating propagation (Prideaux, 2017a). Often, statements are made in Environmental Impact Assessments that a noise-generating activity is 'X' distance from 'Y' species or habitat and therefore, will have no impact. In these cases, distance is used as a basic proxy for impact but is rarely backed with scientifically modelled information. (Wright et.al. 2013; Prideaux and Prideaux 2015)

9. To present a defensible Environmental Impact Assessment for any noise-generating activity proposal, proponents need to have expertly modelled the noise of the proposed activity in the region and under the conditions they plan to operate. Regulators should have an understanding of the ambient or natural sound in the proposed area. This might require CMS Parties or jurisdictions to develop a metric or method for defining this, by drawing on the range of resources available worldwide. (Prideaux, 2017a)

10. All EIAs should include operational procedures to mitigate impact effectively during activities, and there should be proof of the mitigation's efficacy. These are the operational mitigation procedures that should be detailed in the national or regional regulations of the jurisdictions where the activity is proposed. Operational monitoring and mitigation procedures differ around the world, and may include industry/company best practices. Monitoring often includes, *inter alia*:

a. periods of visual and other observation before a noise-generating activity commences
b. passive acoustic monitoring
c. marine mammal observers
d. aerial surveys

Primary mitigation often includes, *inter alia*:

e. delay to start, soft start and shut-down procedures
f. sound dampers, including bubble curtains and cofferdams; sheathing and jacket tubes
g. alternative low-noise or noise-free options (such as compiled in the OSPAR inventory of measures to mitigate the emission and environmental impact of underwater noise)

Secondary mitigation, where the aim is to prevent encounters of marine life with noise sources, includes *inter alia*:

h. spatial & temporal exclusion of activities

11. Approaches to mitigate the impact of particle motion (e.g. reducing substrate or sea ice vibration) should also be investigated. Assessment of the appropriateness and efficacy of all operational procedures should be the responsibility of the government agency assessing Environmental Impact Assessments (EIA).

II. Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities

12. **Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities** is provided as a full document and as stand-alone modules at: www.cms.int/guidelines/cms-family-guidelines-EIAs-marine-noise.

13. This **Technical Support Information** has been specifically designed to provide clarity and certainty for regulators, when deciding to approve or restrict proposed activities. The document provides detailed information about species' vulnerabilities, habitat considerations, impact of exposure levels and proposed assessment criteria for all of the CMS-listed species groups and their prey.

14. The document is structured to cover specific areas, as follows:

- ‘Module A: Sound in Water is Complex’ provides an insight into the characteristics of sound propagation and dispersal. This module is designed to provide decision-makers with necessary foundation knowledge to interpret the other modules in these guidelines and any impact assessments that are presented to them for consideration.
- ‘Module B: Expert Advice on Specific Species Groups’ presents twelve separate detailed sub-modules covering each of the CMS species groups, focusing on species' vulnerabilities, habitat considerations, impact of exposure levels and assessment criteria.
- ‘Module C: Decompression Stress’ provides important information on bubble formation in marine mammals, source of decompression stress, source frequency, level and duration, and assessment criteria.
- ‘Module D: Exposure Levels’ presents a summary of the current state of knowledge about general exposure levels.
- ‘Module E: Marine Noise-generating Activities’ provides a brief summary of military sonar, seismic surveys, civil high-powered sonar, coastal and offshore construction works, offshore platforms, playback and sound exposure experiments, shipping and vessel traffic, pingers and other noise-generating activities. Each section presents current knowledge about sound intensity level, frequency range and the activities’ general characteristics. The information is summarized in a table within the module.
- ‘Module F: Related Intergovernmental or Regional Economic Organization Decisions’ presents the series of intergovernmental decisions that have determined the direction for regulation of anthropogenic marine noise.
- ‘Module G: Principles of EIAs’ establishes basic principles including strategic environmental assessments, transparency, natural justice, independent peer review, consultation and burden of proof.
- ‘Module H: CMS-Listed Species Potentially Impacted by Anthropogenic Marine Noise’

15. The evidence presented in the **Technical Support Information** Modules B, C and D establishes that the effective use of EIA for all marine noise-generating activities is in line with CMS Resolutions 9.19, 10.24 and 10.15, ACCOBAMS Resolution 5.15 and ASCOBANS Resolutions 6.2 and 8.11.

16. The **Technical Support Information** was developed before the release of ISO 18405: Underwater acoustics – Terminology that provides valuable consistency to language used. The Guidelines have been slightly adapted to reflect this new ISO standard, without losing the vital connection to the **Technical Support Information**. Decision-makers should refer to both documents wherever possible.

III. Technical Advisory Notes

17. The following advisory notes should be considered in conjunction with the individual EIA Guideline tables, as presented in Modules IV through XI.

III.1. Ambient Sound

18. ISO 18405 refers to ambient sound as “*sound that would be present in the absence of a specified activity*” and “*is location-specific and time-specific*”. These Guidelines more specifically define it as the average ambient (non-anthropogenic) sound levels from biological (marine animals) and physical processes (earthquakes, wind, ice and rain etc) of a given area. It should be measured (including daily and seasonal variations of frequency bands), for each component of an activity, prior to an EIA being developed and presented.

III.2 Sound Intensity

19. ISO 18405 defines sound intensity as “the product of the sound pressure”, which is the contribution to total pressure caused by the action of sound, “and sound particle velocity”, which is the contribution to velocity of a material element caused by the action of sound.

III.3. Exclusion Zones

20. Where exclusion zones are referred to in these Guidelines, these are areas that are designed for the protection of specific species and/or populations. Activities, and noise generated by activities, should not propagate into these areas.

III.4. Independent, Scientific Modelling of Noise Propagation

21. The objective of noise modelling for EIAs is to predict how much noise a particular activity will generate and how it will disperse. The aim is to model the received sound levels at given distances from the noise source. The amount of sound lost at the receiver from the sound source is propagation loss.

22. The intention of EIAs is to assess the impact of proposed activities on marine species and the environment. EIAs should not only present the main output of interest to the activity proponent, but should fully disclose the full frequency bandwidth of a proposed anthropogenic noise source, the intensity/pressure/energy output within that full range, and the principal or mean/median operating frequency of the source(s). (Urick, 1983, Etter, 2013; Prideaux, 2017a)

23. Many propagation models have been developed such as ray theory, normal modes, multipath expansion, fast field, wavenumber integration or parabolic equation. However, no single model accounts for all frequencies and environments. Factors that influence which propagation model/s should be used include the activity noise frequencies, water depth, seabed topography, temperature and salinity, and spatial variations in the environment. (Urick, 1983, Etter, 2013; Prideaux, 2017a)

24. The accuracy (i.e. bias) of sound propagation models depends heavily on the accuracy of their input data.

25. Commonly missing in EIAs is the modelling of particle motion propagation. Invertebrates, and some fish, detect sound through particle motion to identify predator and prey. Like sound intensity, particle motion varies significantly close to noise sources and in shallow water. Excessive levels of ensonification of these animal groups may lead to injury (barotrauma). Specific modelling techniques are required to predict the impact on these species.

III.5. Sound Exposure Level cumulative (SEL_{cum})

26. Sound Exposure Level (SEL) is generally referred to as dB 0 to peak or peak to peak (dB 0 to peak or dB p to p) for impulsive noise like air guns or pile driving, and dB Root Mean Squared (dB_{rms}) for non-impulsive noise such as ship noise, dredging or a wind farm’s constant drone. Often this metric is normalized to a single sound exposure of one second (NOAA, 2016). The SEL cumulative (SEL_{cum}) metric allows the cumulative exposure of an animal to a sound field for an extended period (often 24 hours) to be assessed against a predefined threshold for injury. (Southall, 2007; NOAA, 2016)

27. NOAA recommends a baseline accumulation period of 24 hours, but acknowledges that there may be specific exposure situations where this accumulation period requires adjustment (e.g., if activity lasts less than 24 hours or for situations where receivers are predicted to experience unusually long exposure durations). (NOAA, 2016) The limit value for pile driving in Germany is a sound exposure level of SEL_{05} and the sound pressure level L_{peak} at a distance of 750 metres.

III.6. Particle Motion/Displacement

28. Sound exposure levels works well for marine mammals but not well for a number of other marine species, including crustaceans, bivalves and cephalopods, because these species are thought to mainly detect sound through particle motion. Particle motion or particle displacement is the displacement of a material element caused by the action of sound. For these Guidelines the motion concerned is the organism resonating in sympathy with the surrounding sound waves, oscillating back and forth in a particular direction, rather than through the tympanic mechanism of marine mammals or swim-bladders of some fish species. (Mooney, et.al., 2010; André, et.al., 2011; Hawkins and Popper, 2016; NOAA, 2016)

29. The detection of particle motion or particle displacement requires different types of sensors than those utilized by a conventional hydrophone. These sensors must specify the particle motion in terms of the particle displacement, or its time derivatives (particle velocity or particle acceleration).

IV. EIA Guideline for Military and Civil High-powered Sonar

This EIA Guideline should be used in combination with the appropriate modules on species and impact from the **Technical Support Information** (B.1-12, C and D) as required for individual regional and domestic circumstances.

The EIA Guideline for Shipping and Vessels Traffic (V) should be used when the vessel is underway/making way with sonar off.

Component	Detail
Description of area	• Detail of the spatial extent and nature of the activity – including seabed bathymetry and composition, description of known stratification characteristics and broad ecosystem descriptions – as well as the spatial area that will experience anthropogenic noise, generated by the proposed activity, above natural ambient sound levels • Detail of the typical weather conditions and day length for the area during the proposed activity period • Identification of previous and simultaneous activities, their seasons and duration in the same or adjoining areas, existence and location of any marine protected areas, and a review of activity findings and implications

<table>
<tr><th>Component</th><th>Detail</th></tr>
<tr><td>Description of the equipment and activity</td><td>• Explanation of all activity technologies available and why each proposed technology is chosen
• Description of the activity technology including:
a. name and description of the vessel/s to be used (except where details would risk national security)
b. total duration of the proposed activity
c. proposed timing of operations – season/time of day/during all weather conditions
d. signal duration and sound intensity level (dB peak to peak) in water @ 1 metre, frequency ranges and ping rate
• Specification of the activity including anticipated nautical miles to be covered, track-lines, speed of vessels and sonar power setting changes
• Identification of other activities having an impact in the region during and after the planned activity, if there is information, accompanied by the analysis and review of potential cumulative or synergistic impacts</td></tr>
<tr><td>Modelling of noise propagation loss</td><td>• Detail of independent, scientific modelling of noise propagation loss in the same season/weather conditions as the proposed activity accounting for local propagation features (depth and type of sea bottom, local propagation paths related to thermal stratification, SOFAR or natural channel characteristics) from point source out to a radius where the noise levels generated are close to natural ambient sound levels
• Identification and mapping of proposed exclusion zones for species and description of how noise propagation into these zones will be minimized, taking into consideration the local propagation features</td></tr>
<tr><td>Species impact</td><td>• General:
a. Identification and density of species likely to be present that will experience sound transmission generated by the proposed activity above natural ambient sound levels; and calculated from this, the extent of the impact zones
b. Specification of the type of impact predicted (direct and indirect) as well as direct and indirect impacts on prey species
c. Information on the behaviour of each species group, and the ability to detect each of the species for mitigation purposes (e.g. for marine mammals this will include diving behaviour, vocal behaviour, and conspicuousness when at the surface).
• For each species group, also detail of the following (refer to module B species summaries):
a. Species vulnerabilities:
i. specific vulnerabilities to noise
ii. lifecycle components of these vulnerabilities
b. Habitat:
i. specific habitat components considered
ii. presence of critical habitat (calving, spawning, feeding grounds, resting bays etc.)
c. Scientific assessment of impact:
i. exposure levels
ii. total exposure duration
iii. determination of precautionary safe/harmful exposure levels (direct impact, indirect impact and disturbance) that account for uncertainty and avoids erroneous conclusions.
• Quantification of the effectiveness of proposed mitigation methods</td></tr>
</table>

Component	Detail
Mitigation and monitoring plans	• Detail of: a. Scientific monitoring programmes before the survey to assess species distribution and behaviour, to facilitate the incorporation of monitoring results into the impact assessment. b. Scientific monitoring programmes, conducted during and after the activity, to assess impact c. Transparent processes for regular real-time public reporting of activity progress and all impacts encountered d. Most appropriate methods of species detection (e.g. visual/acoustic) and the range of available methods, and their advantages and limitations, as well their practical application during the activity. e. Impact mitigation proposals: i. 24-hour visual or other means of detection, especially under conditions of poor visibility (including high winds, night conditions, sea spray or fog) ii. establishing exclusion zones to protect specific species, accompanied by scientific and precautionary justification for these zones iii. soft start and shut-down protocols iv. spatio-temporal restrictions
Reporting plans	• Detail of post operation reporting plans including verification of the effectiveness of mitigation
Consultation and independent review	• Description of consultation, prior to EIA submission: a. List of stakeholders consulted b. Detail of information provided to stakeholders, opportunities given for appropriate engagement and the timeframe for feedback c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why • Description of independent review of draft EIA: a. Detail of the independent reviewers (species experts) including affiliation and qualifications b. Description of the comments, queries, requests and concerns received from each reviewer c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why

V. EIA Guideline for Shipping and Vessels Traffic

This EIA Guideline should be used in combination with the appropriate modules on species and impact from the **Technical Support Information** (B.1-12, C and D) as required for individual regional and domestic circumstances.

This EIA Guideline is directed to shipping regulators, including port and harbour authorities. Cumulative impact of shipping, identifying appropriate exclusion zones and shipping lanes should be the focus.

Component	Detail
Description of area	• Detail of the spatial extent and nature of the activity – including seabed bathymetry and composition, description of known stratification characteristics and broad ecosystem descriptions – as well as the spatial area that will experience anthropogenic noise, generated by the proposed shipping, above natural ambient sound levels • Detail of the typical weather conditions and day length for the area during the proposed activity period • Existence and location of any marine protected areas
Description of vessels and equipment	• Description of vessel/s (tonnage, propulsion and displacement) and equipment activity • Detail of all activities including sound intensity levels (dB_{rms}) @ 1 metre and frequency ranges (all frequencies to encompass, *inter alia*, propeller resonance, harmonics, cavitations, engine and hull noise) • Identification of other activities having an impact in the region accompanied by the analysis and review of potential cumulative or synergistic impacts
Modelling of noise propagation loss	• Detail of independent, scientific modelling of noise propagation loss in confined areas (harbours and channels) and accounting for local propagation features (depth and type of sea bottom, local propagation paths related to thermal stratification, SOFAR or natural channel characteristics) from point source out to a radius where the noise levels generated are close to natural ambient sound levels • Identification and mapping of proposed species exclusion zones and description of how noise propagation into these zones will be minimized, taking into consideration the local propagation features

Component	Detail
Species impact	• General: a. Identification and density of species likely to be present that will experience sound transmission generated by the proposed activity above natural ambient sound levels. Calculated from this, the extent of the impact zones, and the number of animals affected by the activity. b. Specification of the type of impact predicted (direct and indirect) as well as direct and indirect impacts on prey species c. Information on the behaviour of each species group, and the ability to detect each of the species for mitigation purposes (e.g. for marine mammals this will include diving behaviour, vocal behaviour, and conspicuousness when at the surface). • For each species group, also detail of the following (refer to module B species summary): a. Species vulnerabilities: i. specific vulnerabilities to noise ii. lifecycle components of these vulnerabilities b. Habitat: i. specific habitat components considered ii. presence of critical habitat (calving, spawning, feeding grounds, resting bays etc.) c. Scientific assessment of impact: i. exposure levels ii. total exposure duration iii. determination of precautionary safe/harmful exposure levels (direct impact, indirect impact and disturbance) that account for uncertainty and avoids erroneous conclusions
Monitoring plans	• Explanation of access to the evaluation of ongoing scientific monitoring data to assess impacts • Quantification of the effectiveness of proposed mitigation methods • Spatio-temporal restrictions
Consultation and independent review	• Description of consultation, prior to EIA submission: a. List of stakeholders consulted b. Detail of information provided to stakeholders, opportunities given for appropriate engagement and the timeframe for feedback c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why • Description of independent review of draft EIA: a. Detail of the independent reviewers (species experts) including affiliation and qualifications b. Description of the comments, queries, requests and concerns received from each reviewer c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why

VI. EIA Guideline for Seismic Surveys (Air Gun and Alternative Technologies)

This EIA Guideline should be used in combination with the appropriate modules on species and impact from the **Technical Support Information** (B.1-12, C and D) as required for individual regional and domestic circumstances.

Component	Detail
Description of area	• Detail of the spatial extent and nature of the survey – including seabed bathymetry and composition, description of known stratification characteristics and broad ecosystem descriptions – as well as the spatial area that will experience anthropogenic noise, generated by the proposed survey, above natural ambient sound levels • Detail of the typical weather conditions and day length for the area during the proposed activity period • Identification of previous and simultaneous activities, their seasons and duration in the same or adjoining areas, existence and location of any marine protected areas, and a review of activity findings and implications
Description of the equipment and activity	• Explanation of all survey technologies available (including low-noise or noise-free options) and why the proposed technology has been chosen. If low-noise options have not been chosen, an explanation should be provided about why these technologies are not preferred • Description of the survey technology including: a. name and description of the vessel/s to be used b. total duration of the proposed survey, date, timeframe c. proposed timing of operations – season/time of day/during all weather conditions d. sound intensity level (dB peak to peak) in water @ 1 metre and all frequency ranges and discharge rate e. if an air gun technology is proposed: i. number of arrays ii. number of air guns within each array iii. air gun charge pressure to be used iv. volume of each air gun in cubic inches v. official calibration figures supplied by the survey vessel to be charted, for noise modelling vi. depth the air guns to be set vii. number and length of streamers, distance set apart and depth the hydrophones are set • Specification of the survey including anticipated nautical miles to be covered, track-lines, speed of vessels, start-up and shut-down procedures, distance and procedures for vessel turns including any planned air gun power setting changes • Identification of other activities having an impact in the region during the planned survey, accompanied by the analysis and review of potential cumulative or synergistic impacts

Component	Detail
Modelling of noise propagation loss	• Detail of independent, scientific modelling of noise propagation loss in the same season/weather conditions as the proposed activity accounting for local propagation features (depth and type of sea bottom, local propagation paths related to thermal stratification, SOFAR or natural channel characteristics) from point source out to a radius where the noise levels generated are close to natural ambient sound levels • Identification and mapping of proposed species exclusion zones and description of how noise propagation into these zones will be minimized, taking into consideration the local propagation features
Species impact	• General: a. Identification and density of species likely to be present that will experience sound transmission generated by the proposed activity above natural ambient sound levels. Calculated from this, the extent of the impact zones, and the number of animals affected by the activity. a. Specification of the type of impact predicted (direct and indirect) as well as direct and indirect impacts to prey species b. Information on the behaviour of each species group, and the ability to detect each of the species for mitigation purposes (e.g. for marine mammals this will include diving behaviour, vocal behaviour, and conspicuousness when at the surface). • For each species group, also detail of the following (refer to module B species summary): a. Species vulnerabilities: i. specific vulnerabilities to noise ii. lifecycle components of these vulnerabilities b. Habitat: i. specific habitat components considered ii. presence of critical habitat (calving, spawning, feeding grounds, resting bays etc.) c. Scientific assessment of impact: i. exposure levels ii. total exposure duration iii. determination of precautionary safe/harmful exposure levels (direct impact, indirect impact and disturbance) that account for uncertainty and avoids erroneous conclusions

Component	Detail
Mitigation and monitoring plans	• Detail of: a. Scientific monitoring before the survey to assess baselines, species distribution and behaviour to facilitate the incorporation of monitoring results into the impact assessment b. Scientific monitoring programmes, conducted during and after the survey, to assess impact, including noise monitoring stations placed at specified distances c. Transparent processes for regular real-time public reporting of survey progress and all impacts encountered d. Most appropriate methods of species detection (e.g. visual/acoustic) and the range of available methods, and their advantages and limitations, as well their practical application during the activity. e. Impact mitigation proposals: i. 24-hour visual or other means of detection, especially under conditions of poor visibility (including high winds, night conditions, sea spray or fog) ii. establishing exclusion zones to protect specific species, including scientific and precautionary justification for these zones iii. soft start and shut-down protocols iv. protocols in place for consistent and detailed data recording (observer/PAM sightings and effort logs, survey tracks and operations) v. detailed, clear, chain of command for implementing shut-down mitigation protocols vi. spatio-temporal restrictions • Quantification of the effectiveness of proposed mitigation methods
Reporting plans	• Detail of post operation reporting plans including verification of the effectiveness of mitigation, and any shut-down procedures occurring and reasons why
Consultation and independent review	• Description of consultation, prior to EIA submission: a. List of stakeholders consulted b. Detail of information provided to stakeholders, opportunities given for appropriate engagement and the timeframe for feedback c. Explanation of what amendments and changes have been made to the proposed survey in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why • Description of independent review of draft EIA: a. Detail of the independent reviewers (species experts) including affiliation and qualifications b. Description of the comments, queries, requests and concerns received from each reviewer c. Explanation of what amendments and changes have been made to the proposed survey in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why

VII. EIA Guideline for Construction Works

This EIA Guideline should be used in combination with the appropriate modules on species and impact from the **Technical Support Information** (B.1-12, C and D) as required for individual regional and domestic circumstances. This guideline should be applied to all forms of marine construction, including dredging and similar vessel based activities where ships may be stationary, but under way. All commissioning and decommissioning activities should also follow these guidelines.

Component	Detail
Description of area	• Detail of the spatial extent and nature of the activity – including seabed bathymetry and composition, description of known stratification characteristics and broad ecosystem descriptions – as well as the spatial area that will experience anthropogenic noise, generated by the proposed activity, above natural ambient sound levels • Detail of the typical weather conditions and day length for the area during the proposed activity period • Identification of previous and simultaneous activities, their seasons and duration in the same or adjoining areas, existence and location of any marine protected areas, and a review of activity findings and implications
Description of the equipment and activity	• Explanation of all activity technologies available and why each proposed technology is chosen, including consideration of noise-free installation methods • Specification of: a. total duration of the proposed activity b. proposed timing of operations – season/time of day/during all weather conditions c. sound intensity level (dB peak to peak) in water @ 1 metre and frequency ranges d. If explosives are proposed: i. what type of explosive and what charge weight is proposed, also whether the explosive is going to be used on the seabed or subsurface ii. specification of sound intensity level (dB 0 to peak) in water @ 1 metre, frequency range and number of detonations and interval time • Description of noise counter measures e.g.: bubble curtains, noise dampers and cofferdams, including a description of state-of-the-art technology, Best Environmental Practice (BEP) or Best Available Technology (BAT) • Identification of other activities having an impact in the region during the planned activity, accompanied by the analysis and review of potential cumulative or synergistic impacts
Modelling of noise propagation loss	• Detail of independent, scientific modelling of noise propagation loss in the same season/weather conditions as the proposed activity accounting for local propagation features (depth and type of sea bottom, local propagation paths related to thermal stratification, SOFAR or natural channel characteristics) from point source out to a radius where the noise levels generated are close to natural ambient sound levels • Identification and mapping of proposed exclusion zones for species and description of how noise propagation into these zones will be minimized, taking into consideration the local propagation features

Component	Detail
Species impact	• General: a. Identification and density of species likely to be present that will experience sound transmission generated by the proposed activity above natural ambient sound levels; and calculated from this, the extent of the impact zones b. Specification of the type of impact predicted (direct and indirect) as well as direct and indirect impacts to prey species c. Information on the behaviour of each species group, and the ability to detect each of the species for mitigation purposes (e.g. for marine mammals this will include diving behaviour, vocal behaviour, and conspicuousness when at the surface). • For each species group, also detail of the following (refer to module B species summary): a. Species vulnerabilities: i. specific vulnerabilities to noise ii. lifecycle components of these vulnerabilities b. Habitat: i. specific habitat components considered ii. presence of critical habitat (calving, spawning, feeding grounds, resting bays etc.) c. Scientific assessment of impact: i. exposure levels ii. total exposure duration iii. determination of precautionary safe/harmful exposure levels (direct impact, indirect impact and disturbance) that account for uncertainty and avoids erroneous conclusions
Mitigation and monitoring plans	• Detail of: a. Scientific monitoring programmes, conducted before, during and after the activity, to assess impact, including noise monitoring stations placed at specified distances b. Transparent processes for regular real-time public reporting of activity progress and all impacts encountered c. Most appropriate methods of species detection (e.g. visual/acoustic) and the range of available methods, and their advantages and limitations, as well their practical application during the activity. d. Impact mitigation proposals: i. 24-hour visual or other means of detection, especially under conditions of poor visibility (including high winds, night conditions, sea spray or fog) ii. establishing exclusion zones to protect specific species, including scientific and precautionary justification for these zones iii. soft start and shut-down protocols iv. spatio-temporal restrictions • Quantification of the effectiveness of proposed mitigation methods
Reporting plans	• Detail of post operation reporting plans including verification of the effectiveness of mitigation, and any shut-down procedures occurring and reasons why

Component	Detail
Consultation and independent review	• Description of consultation, prior to EIA submission: a. List of stakeholders consulted b. Detail of information provided to stakeholders, opportunities given for appropriate engagement and the timeframe for feedback c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why e. If it is decided that BEP or BAT is not used, this should be justified • Description of independent review of draft EIA: a. Detail of the independent reviewers (species experts) including affiliation and qualifications b. Description of the comments, queries, requests and concerns received from each reviewer c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why

VIII. EIA Guideline for Offshore Platforms

This EIA Guideline should be used in combination with the appropriate modules on species and impact from the **Technical Support Information** (B.1-12, C and D) as required for individual regional and domestic circumstances.

All commissioning and decommissioning activities should also follow these guidelines. Where impulsive activities, such as offshore platforms being constructed through impact driven piles, the guidelines for VII: Construction Works should also be applied.

Component	Detail
Description of area	• Detail of the spatial extent and nature of the activity – including seabed bathymetry and composition, description of known stratification characteristics and broad ecosystem descriptions – as well as the spatial area that will experience anthropogenic noise, generated by the proposed activity, above natural ambient sound levels • Detail of the typical weather conditions and day length for the area during the proposed activity period • Identification of previous and simultaneous activities, their seasons and duration in the same or adjoining areas, existence and location of any marine protected areas, and a review of activity findings and implications

Component	Detail
Description of the equipment and activity	• Explanation of all activity technologies available and why each proposed technology is chosen, including consideration of alternatives • Description of the activity technology including name and description of the vessel/s and sea floor equipment to be used • Specification of: a. total duration of the proposed activity b. sound intensity level (dB_{rms}) in water @ 1 metre (from noise source e.g.: platform caissons or drill ship's hull etc.) and frequency ranges c. sound intensity levels (peak and rms) during planned maintenance schedules • Identification of other activities having an impact in the region during the planned activity, accompanied by the analysis and review of potential cumulative or synergistic impacts
Modelling of noise propagation loss	• Detail of independent, scientific modelling of noise propagation loss in the same season/weather conditions as the proposed activity accounting for local propagation features (depth and type of sea bottom, local propagation paths related to thermal stratification, SOFAR or natural channel characteristics) from point source out to a radius where the noise levels generated are close to natural ambient sound levels • Identification and mapping of proposed exclusion zones for species and description of how noise propagation into these zones will be minimized, taking into consideration the local propagation features
Species impact	• General: a. Identification and density of species likely to be present that will experience sound transmission generated by the proposed activity above natural ambient sound levels; and calculated from this, the extent of the impact zones b. Specification of the type of impact predicted (direct and indirect) as well as direct and indirect impacts to prey species c. Information on the behaviour of each species group, and the ability to detect each of the species for mitigation purposes (e.g. for marine mammals this will include diving behaviour, vocal behaviour, and conspicuousness when at the surface). • For each species group, also detail of the following (refer to module B species summary): a. Species vulnerabilities: i. specific vulnerabilities to noise ii. lifecycle components of these vulnerabilities b. Habitat: i. specific habitat components considered ii. presence of critical habitat (calving, spawning, feeding grounds, resting bays etc.) c. Scientific assessment of impact: i. exposure levels ii. total exposure duration: iii. determination of precautionary safe/harmful exposure levels (direct impact, indirect impact and disturbance) that account for uncertainty and avoids erroneous conclusions

Component	Detail
Mitigation and monitoring plans	• Detail of: a. Scientific monitoring programmes, conducted before, during and after the activity, to assess impact, including noise monitoring stations placed at specified distances b. Transparent processes for regular real-time public reporting of activity progress and all impacts encountered c. Most appropriate methods of species detection (e.g. visual/acoustic) and the range of available methods, and their advantages and limitations, as well their practical application during the activity. d. Impact mitigation proposals e. 24-hour visual or other means of detection, especially under conditions of poor visibility (including high winds, night conditions, sea spray or fog) f. Spatio-temporal restrictions • Quantification of the effectiveness of proposed mitigation methods
Reporting plans	• Detail of post operation reporting plans including verification of the effectiveness of mitigation
Consultation and independent review	• Description of consultation, prior to EIA submission: a. List of stakeholders consulted b. Detail of information provided to stakeholders, opportunities given for appropriate engagement and the timeframe for feedback c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why • Description of independent review of draft EIA: a. Detail of the independent reviewers (species experts) including affiliation and qualifications b. Description of the comments, queries, requests and concerns received from each reviewer c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why

IX. EIA Guideline for Playback and Sound Exposure Experiments

This EIA Guideline should be used in combination with the appropriate modules on species and impact from the **Technical Support Information** (B.1-12, C and D) as required for individual regional and domestic circumstances.

Component	Detail
Description of area	• Detail of the spatial extent and nature of the activity – including seabed bathymetry and composition, description of known stratification characteristics and broad ecosystem descriptions – as well as the spatial area that will experience anthropogenic noise, generated by the proposed activity, above natural ambient sound levels • Detail of the typical weather conditions and day length for the area during the proposed activity period • Identification of previous and simultaneous activities, their seasons and duration in the same or adjoining areas, existence and location of any marine protected areas, and a review of activity findings and implications
Description of the equipment and activity	• Noting that the scale of the noise needed to elicit a response (with respect to level and duration) may be much lower than in industry activities; and that noise can be controlled in order to affect only a small area or small number of individuals, the noise control measures of the experimental design should be described in detail. • Explanation of all technologies available for the activity and why each proposed technology is chosen • Description of the chosen technology including name and description of the vessel/s to be used • Specification of: a. lowest practicable sound intensity level required b. total duration of the proposed activity c. proposed timing of operations – season/time of day/during all weather conditions d. sound intensity level (dB peak to peak) in water @ 1 metre and all frequency ranges and discharge rate e. if an air gun technology is proposed refer to VI f. if explosives are proposed refer to VII • Specification of the activity including anticipated nautical miles to be covered, track-lines, speed of vessels, start-up and shut-down procedures, distance and procedures for vessel turns including any planned air gun power setting changes • Identification of other activities having an impact in the region during the planned activity, accompanied by the analysis and review of potential cumulative or synergistic impacts
Modelling of noise propagation loss	• Detail of independent, scientific modelling of noise propagation loss in the same season/weather conditions as the proposed activity accounting for local propagation features (depth and type of sea bottom, local propagation paths related to thermal stratification, SOFAR or natural channel characteristics) from point source out to a radius where the noise levels generated are close to natural ambient sound levels • Identification and mapping of proposed exclusion zones for species and description of how noise propagation into these zones will be minimized, taking into consideration the local propagation features

Component	Detail
Species impact	• General: a. Identification and density of species likely to be present that will experience sound transmission generated by the proposed activity above natural ambient sound levels; and calculated from this, the extent of the impact zones b. Specification of the type of impact predicted (direct and indirect) as well as direct and indirect impacts to prey species c. Information on the behaviour of each species group, and the ability to detect each of the species for mitigation purposes (e.g. for marine mammals this will include diving behaviour, vocal behaviour, and conspicuousness when at the surface). • For each species group, also detail of the following (refer to module B species summary): a. Species vulnerabilities: i. specific vulnerabilities to noise ii. lifecycle components of these vulnerabilities b. Habitat: i. specific habitat components considered ii. presence of critical habitat (calving, spawning, feeding grounds, resting bays etc.) c. Scientific assessment of impact: i. exposure levels ii. total exposure duration iii. determination of precautionary safe/harmful exposure levels (direct impact, indirect impact and disturbance) that account for uncertainty and avoids erroneous conclusions iv. how the experiment design will monitor target and non-target species and the steps that will be taken to halt sound emission if adverse response or behavioural changes are observed v. how exposures that are expected to elicit particular behavioural responses (e.g. responses elicited by predator sounds, conspecific signals) will inform specific mitigation and monitoring protocols. In such cases, impact assessment should also articulate what responses may not be related to the loudness of the exposure but to the behavioural significance of the signal/noise used.

Component	Detail
Mitigation and monitoring plans	• Detail of: a. Scientific monitoring programmes, conducted before, during and after the activity, to assess impact b. Transparent processes for regular real-time public reporting of activity progress and all impacts encountered c. Most appropriate methods of species detection (e.g. visual/acoustic) and the range of available methods, and their advantages and limitations, as well their practical application during the activity. d. Impact mitigation proposals: i. 24-hour visual or other means of detection, especially under conditions of poor visibility (including high winds, night conditions, sea spray or fog) ii. establishing exclusion zones to protect specific species, including scientific and precautionary justification for these zones iii. soft start and shut-down protocols iv. spatio-temporal restrictions • Quantification of the effectiveness of proposed mitigation methods
Reporting plans	• Detail of post operation reporting plans including verification of the effectiveness of mitigation
Consultation and independent review	• Description of consultation, prior to EIA submission: a. List of stakeholders consulted b. Detail of information provided to stakeholders, opportunities given for appropriate engagement and the timeframe for feedback c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why • Description of independent review of draft EIA: a. Detail of the independent reviewers (species experts) including affiliation and qualifications b. Description of the comments, queries, requests and concerns received from each reviewer c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why

X. EIA Guideline for Pingers (Acoustic Deterrent/Harassment Devices, Navigation)

This EIA Guideline should be used in combination with the appropriate modules on species and impact from the **Technical Support Information** (B.1-12, C and D) as required for individual regional and domestic circumstances.

Component	Detail
Description of area	• Detail of the spatial extent and nature of the activity – including seabed bathymetry and composition, description of known stratification characteristics and broad ecosystem descriptions – as well as the spatial area that will experience anthropogenic noise, generated by the proposed activity, above natural ambient sound levels. • Detail of the typical weather conditions and day length for the area during the proposed activity period • Identification of previous and simultaneous activities, their seasons and duration in the same or adjoining areas, existence and location of any marine protected areas, and a review of activity findings and implications
Description of the equipment and activity	• Explanation of all technologies available for the activity and why the proposed technology is chosen, including the description should also contain the consideration of alternatives • Specification of sound intensity level (dB peak to peak) in water @ 1 metre, frequency ranges and ping rate, sound exposure level (SEL), as well as proposed spacing of pingers • Identification of other activities having an impact in the region accompanied by the analysis and review of potential cumulative or synergistic impacts
Modelling of noise propagation loss	• Detail of independent, scientific modelling of noise propagation loss in the same season/weather conditions as the proposed activity accounting for local propagation features (depth and type of sea bottom, local propagation paths related to thermal stratification, SOFAR or natural channel characteristics) from point source out to a radius where the noise levels generated are close to natural ambient sound levels • Identification and mapping of proposed exclusion zones for species and description of how noise propagation into these zones will be minimized, taking into consideration the local propagation features

Component	Detail
Species impact	• General: a. Identification and density of species likely to be present that will experience sound transmission generated by the proposed activity above natural ambient sound levels; and calculated from this, the extent of the impact zones a. Specification of the type of impact predicted (direct and indirect) as well as direct and indirect impacts to prey species b. Information on the behaviour of each species group, and the ability to detect each of the species for mitigation purposes (e.g. for marine mammals this will include diving behaviour, vocal behaviour, and conspicuousness when at the surface). • For each species group, also detail of the following (refer to module B species summary): a. Species vulnerabilities: i. specific vulnerabilities to noise ii. lifecycle components of these vulnerabilities b. Habitat: i. specific habitat components considered ii. presence of critical habitat (calving, spawning, feeding grounds, resting bays etc.) c. Scientific assessment of impact: i. exposure levels ii. total exposure duration iii. determination of precautionary safe/harmful exposure levels (direct impact, indirect impact and disturbance) that account for uncertainty and avoids erroneous conclusions
Monitoring plans	• Detail of scientific monitoring programmes, conducted before, during and after the activity, to assess impact • Spatio-temporal restrictions • Quantification of the effectiveness of proposed mitigation methods
Reporting plans	• Detail of post operation reporting plans including verification of the effectiveness of mitigation
Consultation and independent review	• Description of consultation, prior to EIA submission: a. List of stakeholders consulted b. Detail of information provided to stakeholders, opportunities given for appropriate engagement and the timeframe for feedback c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why • Description of independent review of draft EIA: a. Detail of the independent reviewers (species experts) including affiliation and qualifications b. Description of the comments, queries, requests and concerns received from each reviewer c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why

XI. EIA Guideline for Other Noise-generating Activities (Acoustic Data Transmission, Wind, Tidal and Wave Turbines and Future Technologies)

This EIA Guideline should be used in combination with the appropriate modules on species and impact from the **Technical Support Information** (B.1-12, C and D) as required for individual regional and domestic circumstances.

All commissioning and decommissioning activities should also follow these guidelines.

Component	Detail
Description of area	• Detail of the spatial extent and nature of the activity – including seabed bathymetry and composition, description of known stratification characteristics and broad ecosystem descriptions – as well as the spatial area that will experience anthropogenic noise, generated by the proposed activity, above natural ambient sound levels • Detail of the typical weather conditions and day length for the area during the proposed activity period • Identification of previous and simultaneous activities, their seasons and duration in the same or adjoining areas, existence and location of any marine protected areas, and a review of activity findings and implications
Description of the equipment and activity	• Explanation of all technologies available for the activity • Specification of sound intensity level (dB) in water @ 1 metre, and frequency ranges. This should include dB peak to peak for acoustic data transmission for example, dB_{rms} for wind, tidal and wave turbines and future technologies categorized accordingly • Identification of other activities having an impact in the region during the planned activity, accompanied by the analysis and review of potential cumulative or synergistic impacts
Modelling of noise propagation loss	• Detail of independent, scientific modelling of noise propagation loss in the same season/weather conditions as the proposed activity accounting for local propagation features (depth and type of sea bottom, local propagation paths related to thermal stratification, SOFAR or natural channel characteristics) from point source out to a radius where the noise levels generated are close to natural ambient sound levels • Identification and mapping of proposed exclusion zones for species and description of how noise propagation into these zones will be minimized, taking into consideration the local propagation features

Component	Detail
Species impact	• General: a. Identification and density of species likely to be present that will experience sound transmission generated by the proposed activity above natural ambient sound levels; and calculated from this, the extent of the impact zones b. Specification of the type of impact predicted (direct and indirect) as well as direct and indirect impacts to prey species c. Information on the behaviour of each species group, and the ability to detect each of the species for mitigation purposes (e.g. for marine mammals this will include diving behaviour, vocal behaviour, and conspicuousness when at the surface). • For each species group, also detail of the following (refer to module B species summary): a. Species vulnerabilities: i. specific vulnerabilities to noise ii. lifecycle components of these vulnerabilities b. Habitat: i. specific habitat components considered ii. presence of critical habitat (calving, spawning, feeding grounds, resting bays etc.) c. Scientific assessment of impact: i. exposure levels ii. total exposure duration iii. determination of precautionary safe/harmful exposure levels (direct impact, indirect impact and disturbance) that account for uncertainty and avoids erroneous conclusions • Quantification of the effectiveness of proposed mitigation methods
Monitoring plans	• Explanation of ongoing scientific monitoring programmes to assess impact • Most appropriate methods of species detection (e.g. visual/acoustic) and the range of available methods, and their advantages and limitations, as well their practical application during the activity. • Spatio-temporal restrictions
Consultation and independent review	• Description of consultation, prior to EIA submission: a. List of stakeholders consulted b. Detail of information provided to stakeholders, opportunities given for appropriate engagement and the timeframe for feedback c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why • Description of independent review of draft EIA: a. Detail of the independent reviewers (species experts) including affiliation and qualifications b. Description of the comments, queries, requests and concerns received from each reviewer c. Explanation of what amendments and changes have been made to the proposed activity in response to the comments, queries, requests and concerns d. Explanation of which comments, queries, requests and concerns have not been accommodated and why

XII. References

Aguilar de Soto, N., 2017a, ‘Beaked Whales’, in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Aguilar de Soto, N., 2017b, ‘Marine Invertebrates’, in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

André, M Morell, M Alex, M Solé Carbonell, M Connor, M Van der Schaar, RM Houégnigan, L Zaugg, SA. and Castell Balaguer, JV. 2010. ‘Best practices in management, assessment and control of underwater noise pollution’ Barcelona, LAB, UPC

Castellote, M. 2017a, ‘Inshore Odontocetes’, in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Castellote, M. 2017b, ‘Offshore Odontocetes’, in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Etter PC. 2013. ‘Underwater acoustic modelling and simulation’ (Boca Raton: CRC Press, Taylor and Francis Group)

Frey, S., 2017, ‘Exposure Levels’, in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Hawkins, AD and Popper, AN. 2016, Developing Sound Exposure Criteria for Fishes. In The Effects of Noise on Aquatic Life II, Springer: 431-39.

Hildebrand JA. 2009, ‘Anthropogenic and natural sources of ambient noise in the ocean’, Marine Ecology Progress Series, 395 (5).

Hooker, S, 2017, ‘Decompression Stress’, in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Marsh, H, 2017, ‘Sirenians’, in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

McCauley, R., 2017, ‘Fin-fish’, in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Miksis-Olds, JL. and Nichols, SM., 2016, Is low frequency ocean sound increasing globally? The Journal of the Acoustical Society of America, 139(1), pp.501-511.

NOAA. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

Notarbartolo di Sciara, G., 2017a, Pinnipeds, in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Notarbartolo di Sciara, G., 2017b, 'Marine and Sea Otters', in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Notarbartolo di Sciara, G., 2017c, 'Marine Turtles', in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Parks, S., 2017, 'Mysticetes', in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Prideaux, G. and Prideaux, M. 2015, 'Environmental impact assessment guidelines for offshore petroleum exploration seismic surveys' Impact Assessment and Project Appraisal (Online 12/2015)

Prideaux, G., 2017a, 'Sound in Water is Complex', in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Prideaux, M., 2017b, 'Related Decisions of Intergovernmental Bodies or Regional Economic Organisations', in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Southall BL, Bowles AE, Ellison WT, Finneran JJ, Gentry RL, Greene Jr CR, Kastak D, Ketten DR, Miller JH. and Nachtigall PE. 2007. 'Marine mammal noise-exposure criteria: initial scientific recommendations', Bioacoustics, 17 (1-3), 273-75.

Truda Palazzo, J., 2017, 'Elasmobranchs', in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Urick RJ., 1983. 'Principles of Underwater Sound' New York: McGraw-Hill Co.

Vongraven, D., 2017, 'Polar Bears', in Prideaux, G. (ed) Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities, CMS, Bonn

Wright, AJ., Dolman, SJ., Jasny, M., Parsons, ECM., Schiedek, D., and Young, SB. 2013. 'Myth and Momentum: A Critique of Environmental Impact Assessments', Journal of Environmental Protection. 4: 72–77

Additional references are detailed in the Technical Support Information at www.cms.int/guidelines/cms-family-guidelines-EIAs-marine-noise.

Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities

CMS

ACCOBAMS

ASCOBANS

Geoff Prideaux
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Gouvernement Princier
PRINCIPAUTÉ DE MONACO

ocean care

Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities

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Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities

Parties to the Convention on Migratory Species (CMS), the Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS) and the Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS) have recognized underwater noise as a major threat to many marine species. Several resolutions have been passed calling for effective measures to mitigate and minimize the impact of noise pollution on marine life.

CMS, ACCOBAMS and ASCOBANS decisions also recognize that addressing this issue effectively requires that noise-related considerations should be taken into account starting with the planning stage of activities, especially by making effective use of Environmental Impact Assessments (EIA). The Convention on Biological Diversity Decision XII/23 encourages governments to require EIAs for noise-generating offshore activities and to combine acoustic mapping with habitat mapping to identify areas where these species may be exposed to noise impacts.

A considerable number of national and regional operational guidelines detail the impacts to be avoided and mitigation measures to be taken during proposed operations. For the most part, these focus on cetaceans. Few guidelines cover other species, and almost none has been developed for the specific content that should be provided in EIAs before approvals and permits are granted.

Thanks to a voluntary contribution from the Principality of Monaco under the Migratory Species Champions programme, and an additional contribution from OceanCare, the CMS, ASCOBANS and ACCOBAMS Secretariats are pleased to have developed guidelines for Environmental Impact Assessment for noise-generating offshore industries, providing a clear pathway to implementing the Best Available Techniques (BAT) and Best Environmental Practice (BEP).

This Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities is structured to stand as one complete unit or to be used as discrete modules, tailored for national and agreement approaches.

The full document and the stand-alone modules are online at cms.int/guidelines/cms-family-guidelines-EIAs-marine-noise

The Government of the Principality of Monaco were recognized as Champion for their generous support and commitment towards marine species conservation for the period 2015–2017. The development of this Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities has been funded with the contribution granted by Monaco under the Migratory Species Champion Programme.

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This document is Revision 1

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Acronyms

ACCOBAMS	Agreement on the Conservation of Cetaceans in the Black Sea Mediterranean Sea and Contiguous Atlantic Area
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic, North East Atlantic, Irish and North Seas
BAT	Best Available Techniques
BEP	Best Environmental Practice
CBD	Convention on Biological Diversity
CMS	Convention on the Conservation of Migratory Species of Wild Animals or Convention on Migratory Species
dB	decibels
DSC	deep sound channel
EEH	Equal Energy Hypothesis
EIA	Environmental Impact Assessment
IMO	International Maritime Organization
IWC	International Whaling Commission
NOAA	National Oceanic and Atmospheric Administration (US)
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PTS	permanent threshold shift
RMS	root mean squared
SEA	Strategic Environmental Assessment
SEL	sound exposure level
SEL_{cum}	cumulative sound exposure level
SIL	Sound Intensity Level
SOCAL-BRS	Biological and Behavioural Response Studies of Marine Mammals in Southern California
SOFAR	Sound Fixing and Ranging Channels
SPL	Sound Pressure Level
TTS	temporary threshold shift
UK	United Kingdom of Great Britain and Northern Ireland
US	United States of America

Tables

Executive Summary

The sea is the interconnected system of all the Earth's oceanic waters, including the five named 'oceans' - the Atlantic, Pacific, Indian, Southern and Arctic Oceans - a connected body of salty water that covers over 70 percent of the Earth's surface.

This vast environment is home to a broader spectrum of higher animal taxa than exists on land. Many marine species have yet to be discovered, and the number known to science is expanding annually. The sea also provides people with substantial supplies of food, mainly fish, shellfish and seaweed, in addition to marine resource extraction. It is a shared resource for us all.

Levels of anthropogenic marine noise have doubled in some areas of the world, every decade, for the past 60 years. When considered in addition to the number other anthropogenic threats in the marine environment, increasing noise can be a life-threatening trend for many marine species.

Marine wildlife rely on sound for vital life functions, including communication, prey and predator detection, orientation and for sensing surroundings. While the ocean is certainly a sound-filled environment and many natural (or biological) sounds are very loud; wildlife is not adapted to anthropogenic noise.

Animals exposed to elevated or prolonged anthropogenic noise can suffer direct injury and temporary or permanent auditory threshold shifts. Noise can mask important natural sounds, such as the call of a mate, the sound made by prey or a predator. They can be displaced from important habitats. These impacts are experienced by a wide range of species including fish, crustaceans and cephalopods, pinnipeds (seals, sea lions and walrus), sirenians (dugong and manatee), sea turtles, the polar bear, marine otters and cetaceans (whales, dolphins and porpoises).

The *Technical Support Information to the CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities* has been developed to present the Best Available Techniques (BAT) and Best Environmental Practice (BEP). The document is structured to stand as one complete unit or to be used as discrete modules, tailored for national and agreement approaches.

The modules that follow are structured to cover species area, as follows:

'**Module A: Sound in Water is Complex**' provides an insight into the characteristics of sound propagation and dispersal. This module is designed to provide decision-makers with necessary foundation knowledge to interpret the other modules in these guidelines and any impact assessments that are presented to them for consideration.

'**Module B: Expert Advice on Specific Species Groups**' presents 12 separate detailed sub-modules covering each of the CMS species groups, focusing on species' vulnerabilities, habitat considerations, the impact of exposure levels and assessment criteria.

'**Module C: Decompression Stress**' provides important information on bubble formation in marine mammals, source of decompression stress, source frequency, level and duration, and assessment criteria.

'**Module D: Exposure Levels**' presents a summary of the current state of knowledge about general exposure levels.

'**Module E: Marine Noise-generating Activities**' provides a summary of military sonar, seismic surveys, civil high-powered sonar, coastal and offshore construction works, offshore platforms, playback and sound exposure experiments, shipping and vessel traffic, pingers and other noise-generating activities. Each section presents current knowledge about sound intensity level, frequency range and the general characteristics of activities. The information is summarized in a table within the module.

'**Module F: Related Intergovernmental or Regional Economic Organisation Decisions**' presents the series of intergovernmental decisions that have determined the direction for regulation of anthropogenic marine noise.

'**Module G: Principles of EIAs**' establishes basic principles including strategic environmental assessments, transparency, natural justice, independent peer review, consultation and burden of proof.

'**Module H: CMS-Listed Species Potentially Impacted by Anthropogenic Marine Noise**' provides the list of relevant CMS listed as of CMS CoP11.

The Technical *Support Information to the CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities* is structured to stand as one complete unit or to be used as discrete modules, tailored for national and agreement approaches.

The complete document and the discrete modules are online at: cms.int/guidelines/cms-family-guidelines-EIAs-marine-noise

A. Sound in Water is Complex

Geoff Prideaux
Wild Migration

The ocean environment is filled with natural sound from animals and physical processes. Species living in this environment are adapted to these sounds. Over the past century, many anthropogenic marine activities have increased levels of noise. (André *et al* 2010, Hildebrand 2009) These modern anthropogenic noises have the potential for physical, physiological and behavioural impacts on marine fauna–mammals, reptiles, fish and invertebrates. (Southall *et al* 2007)

The propagation of sound in water is complex and requires many variables to be carefully considered before it can be known if a noise-generating activity is appropriate or not. It is inappropriate to generalize sound transmission without fully investigating propagation.

Often, statements are made in Environmental Impact Assessments that a noise-generating activity is 'X' distance from 'Y' species or habitat, and therefore will have no impact. In these cases, distance is used as a proxy for impact but is rarely backed with scientifically modelled information. (Wright *et al* 2013, Prideaux and Prideaux 2015)

The behaviour of sound in the marine environment is different from sound in air. The extent and way that sound travels (propagation) is affected by many factors, including the frequency of the sound, water depth and density differences within the water column that vary with temperature, salinity and pressure. (Clay and Medwin 1997, Etter 2013, Lurton 2010, Wagstaff 1981) Seawater is roughly 800–1,500 times denser than air and sound travels around five times faster in this medium. (Lurton 2010) Consequently, a sound arriving at an animal is subject to propagation conditions that are complex. (Calambokidis *et al* 2002, Hildebrand 2009, Lurton 2010, McCauley *et al* 2000)

To present a defensible Environmental Impact Assessment for any noise-generating activity proposal, proponents need to have 'independent, scientific modelling of sound propagation' of the proposed activity in the region and under the conditions they plan to operate.

Understanding what basic concepts should be presented is important to assess if the Environmental Impact Assessment is defensible and sufficient.

A.1. Basic concepts

The study of acoustics is a specialised and technical field. Professional acousticians will consider much more complexities beyond the scope of this paper.

The basic concepts that decision-makers may need to understand are outlined in a very simplified form, specifically to be accessible to a lay-audience.

A.1.1. Elasticity

The speed of sound is not a fixed numerical value. Sound wave speed varies widely and depends on the medium, or material, it is transmitted through, such as solids, gas or liquids. Sound waves move through a medium by transferring kinetic energy from one molecule to the next. (Lurton 2010) Each medium has its own elasticity (or resistance to molecular deformity). This elasticity factor affects the sound wave's movement significantly. Solid mediums, such as metal, transmit sound waves extremely fast because the solid molecules are tightly packed together, providing only tiny spaces for vibration. Through this high-elasticity medium, solid molecules act like small springs aiding the wave's movement. The speed of sound through aluminium, for example, is around 6,319ms^{-1}. Gas, such as air, vibrates at a slower speed because of larger spaces between each molecule. This allows greater deformation and results in lower elasticity. Sound waves, moving through air at a temperature of 20°C, will only travel around 342ms^{-1}. Liquid molecules, such as seawater, bond together in a tighter formation compared with gas molecules. This results in less deformation, creating a higher elasticity than gas. Sound waves, moving through the water at 22°C, travel at around 1,484ms^{-1}. (Brekhovskikh and Lysanov 2006, Au and Hastings 2009, Ross 2013) Temperature also affects molecules. Molecules move faster under higher temperatures, transmitting sound waves more rapidly across the medium. Conversely, decreasing temperatures cause the molecules to vibrate at a slower pace, hindering the sound wave's movement. (Brekhovskikh and Lysanov 2006, Au and Hastings 2009, Ross 2013) The temperature of seawater at different depths is therefore of importance to modelling.

A.1.2. Spherical Spreading, Cylindrical Spreading, Transmission Loss and Absorption Loss

The way sound propagates is also important. Spherical spreading is simply sound leaving a point source in an expanding spherical shape. As sound waves reach the sea surface and seafloor, they can no longer maintain their spherical shape, and they begin to resemble the shape of an expanding cheese wheel. This is called cylindrical spreading.

The transmission loss, or the decrease in the sound intensity levels, happens uniformly in all directions during spherical transmission. However, when sound is in a state of cylindrical transmission, it cannot propagate uniformly. The sound is effectively contained between the sea surface and the sea floor, while the radius still expands uniformly (the sides of the cheese wheel). The height is now fixed, and so the sound intensity level decreases more slowly. (Urick 1983, Au and Hastings 2009, Lurton 2010, Jensen *et al* 2011)

In actuality, the seabed is rarely, if ever, flat and parallel to the sea surface. These natural variations add extra complexities to modelling cylindrical spreading. (Lurton 2010, Jensen *et al* 2011)

Absorption is a form of loss that obeys a different law of variation with range than the loss due to spreading. It involves a process of conversion of acoustic energy into heat and thereby represents a true loss of acoustic energy where the propagation is taking place. (Urick 1983) Absorption losses are less for lower frequencies noise relative to higher frequency noise; that is lower frequency noise generally propagates further in the marine environment.

However, all of these characteristics must be known to model accurately, as should the water depth and the rise and fall of the seabed surrounding it.

A.1.3. Sound Fixing and Ranging Channels (SOFAR)

As well as spherical and cylindrical spreading, another variable can impact how far sound will be transmitted. This is usually called a Sound Fixing and Ranging Channel (SOFAR) and is a horizontal layer of water in the ocean at which depth, the speed of sound is at its minimum.

The SOFAR channel is created through the interactive effect of temperature and water pressure (and, to a smaller extent, salinity). This occurs because the pressure in the ocean increases with depth, but the temperature is more variable, generally falling rapidly in the main thermocline from the surface to around a thousand metres deep and then remaining almost unchanged from there to the ocean floor. Near the surface, the rapidly falling temperature causes a decrease in sound speed (or a negative sound speed gradient). With increasing depth, the increasing pressure causes an increase in sound speed (or a positive sound speed gradient). The depth where the sound speed is at a minimum is called the sound channel axis. The speed gradient above and below the sound channel axis acts as a lens, bending sound towards the depth of minimum speed. The portion of sound that remains within the sound channel encounters no acoustic loss from the reflection of the sea surface and seafloor. Because of this low transmission loss, very long distances can be obtained from moderate acoustic power. (Urick 1983, Brekhovskikh and Lysanov 2006, Lurton 2010, Jensen *et al* 2011)

A.1.4. Decibels (dB)

The decibel (dB), 1/10th of a Bel, is used to measure sound level. It is the unit that will be presented in documentation.

The dB is a logarithmic unit used to describe a ratio. The ratio may be power, sound pressure or intensity.

The logarithm of a number is the exponent to which another fixed value, the base, must be raised to produce that number. For example, the logarithm of 1,000 to base 10 is 3, because 1,000 is 10 to the power 3:

$$1{,}000 = 10 \times 10 \times 10 = 10^3.$$

More generally, if $x = b^y$, then y is the logarithm of x to base b, and is written y = logb(x), so log10 (1,000) = 3. (Au and Hastings 2009, Jensen *et al* 2011, Ross, 2013)

A common mistake made by people that are unfamaiair with the dB scale is to assume that 10dB is half as loud as 20dB and a third of 30dB.

To explain, suppose there are two

loudspeakers, the first playing a sound with power P1, and another playing a louder version of the same sound with power P2, but everything else (distance and frequency) remains the same.

The difference in decibels between the two is defined as:

10 log (P2/P1) dB where the log is to base 10.

If the second produces twice as much power as the first, the difference in dB is:

10 log (P2/P1) = 10 log 2 = 3 dB.

To continue the example, if the second has 10 times the power of the first, the difference in dB is:

10 log (P2/P1) = 10 log 10 = 10 dB.

If the second has a million times the power of the first, the difference in dB is:

10 log (P2/P1) = 10 log 1,000,000 = 60 dB.

This example shows one feature of decibel scales that are useful in discussing sound: they can describe very big ratios using manageable numbers.

A.1.5. Peak and RMS values

Peak value, as the term implies, is the point of a sound wave with the greatest amplitude. Peak values should be provided with impulsive (also known as plosive, explosive and pulsive) sounds like seismic air guns, pile driving, low-frequency sonar and explosives. (Au and Hastings 2009)

RMS (root mean squared) is the formula used to calculate the mean of a sound wave over time. RMS values should be provided with constant non-impulsive (also known as non-plosive or continuous) sounds like shipping propeller and engine noise, oil rig operations, some mid to high-frequency sonar and water-based wind turbines. (Au and Hastings 2009)

This is important to note as attempts to establish noise thresholds based on one pressure metric when modelling has utilised another, will produce errors that can reduce the effectiveness of any proposed mitigation measures. For example, noise measured in RMS can be ~10 dB less than the peak level and ~16 dB less than the peak-to-peak level.

A.1.6. Phase

Phase can be best described as the relational alignment with two or more sound waves over time. Very simplistically, waves with the same phase will constructively interfere to produce a wave whose amplitude is the sum of the two interfering waves, while two waves which are 180 degrees out of phase will destructively interfere to cancel each other out. (Rossing and Fletcher 2013)

A.1.7. MicroPascals (µPa)

The pascal (Pa) is the standard measure for pressure. Scientists have agreed to use 1 microPascal (1µPa) as the reference pressure for underwater sound. This figure will usually be represented at one meter from a noise source (ie 1µPa @ 1m)

Most anthropogenic sound in the marine environment is produced across a large area. Sound measured in the acoustic 'near-field' environment tends to be highly variable, and if the sound is intense, can be physically impossible to measure.

To overcome this, sound modelling often makes source level measurements in the acoustic 'far-field' at sufficient distance from the source that the field has settled down. Source levels are then calculated back by a measured or modelled transmission loss to present a µPa measurement. This can introduce some assumptions/errors.

A.2. Necessity of Modelling

A.2.1. Sound Exposure Level cumulative (SEL_{cum})

Sound exposure level (SEL) is an important parameter when considering the impact of anthropogenic noise on marine species. SEL is a measure of the total energy contained within a noise signature; it depends on both amplitude of the sound and duration. This is often normalised to 1 second and is reported as 1 $\mu Pa^2 s$**.**

According to NOAA's paper, Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing, (NOAA, 2016) sound exposure level works well for marine mammals but not well for other marine species (crustaceans, bivalves, cephalopods, finned fish, etc) because many non-mammal marine species detect sound through particle motion (the organism resonating in sympathy with the surrounding sound waves) rather than through a tympanic mechanism as with marine mammals. A more informed measurement introduced to modelling is sound exposure level cumulative (SEL_{cum}) by which a time component is extended beyond 1 second. (NOAA, 2016)

NOAA has set a default time of 24 hours for SEL_{cum}. An alternate prescribed time can be applied to SEL_{cum} if stated. Within the SEL_{cum} metric, a reference to sound intensity level (0 to peak, peak to peak or rms) is not relevant due to the extended time parameter. (NOAA, 2016)

A.2.2. Independent, scientific modelling of sound propagation

These complexities illustrate the necessity for 'independent, scientific modelling of sound propagation' of sound propagation from noise-generating activities. (Urick 1983, Etter 2013) While noise modelling is common for land-based anthropogenic noise-producing activities, it is less common for proposals in the marine environment. The lack of rigorous noise modelling in the marine setting needs to be urgently addressed. (Prideaux and Prideaux 2015)

Independent, scientific modelling of sound propagation of each noise-generating activity proposal should be impartially conducted to provide decision-makers with credible and defensible information. The accuracy (i.e. bias) of models of sound propagation depends heavily on the accuracy of their inputs. Similarly, quantification of the precision (i.e. variability) of sound propagation models is rarely acknowledged but is also heavily dependent on the precision of the inputs into these models.

The modelling should provide a clear indication of sound dispersal characteristics, informed by local propagation features. (Urick 1983, Etter 2013)

With this information, the acoustic footprint of the noise-generating activity can be identified, and informed decisions about levels of noise propagation can be made. (Prideaux and Prideaux 2015)

References

André, M Morell, M Alex, M Solé Carbonell, M Connor, M Van der Schaar, RM Houégnigan, L Zaugg, SA. and Castell Balaguer, JV. 2010. 'Best practices in management, assessment and control of underwater noise pollution' (Barcelona, LAB, UPC)

Au, WWL. and Hastings, MC. 2009. 'Principles of Marine Bioacoustics' (New York: Springer Science and Business Media)

Brekhovskikh, LM. and Lysanov, YP. 2006. 'Fundamentals of Ocean Acoustics: Edition 3' (New York: Springer Science and Business Media)

Calambokidis J Chandler T. and Douglas A. 2002. 'Marine mammal observations and mitigation associated with USGS seismic-reflection surveys in the Santa Barbara Channel 2002. Final report prepared for US Geological Survey, Menlo Park, CA and National Marine Fisheries Service', *Office of Protected Resources* (Silver Spring MD: Prepared by Cascadia Research, Olympia, WA).

Clay CS. and Medwin H. 1997. 'Acoustical Oceanography' (New York: Wiley Interscience).

Etter PC. 2013. 'Underwater acoustic modelling and simulation' (Boca Raton: CRC Press, Taylor and Francis Group)

Hildebrand JA. 2009, 'Anthropogenic and natural sources of ambient noise in the ocean', *Marine Ecology Progress Series,* 395 (5).

Jensen, FB Kuperman, WA Porter, MB. and Schmidt, H. 2011. 'Computational Ocean Acoustics: Edition 2' (New York: Springer Science and Business Media)

Lurton X. 2010. 'An Introduction to Underwater Acoustics: Principles and Applications: 2nd edition (Westport:Springer).

McCauley RD Fewtrell J Duncan AJ Jenner C Jenner MN Penrose JD Prince RIT Adhitya A Murdoch J and McCabe K. 2000. 'Marine seismic surveys–a study of environmental implications', *APEA Journal*, 692-708.

NOAA. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

Prideaux, G. and Prideaux, M. 2015. 'Environmental impact assessment guidelines for offshore petroleum exploration seismic surveys' *Impact Assessment and Project Appraisal* (Online 12/2015)

Ross, Donald. 2013. 'Mechanics of Underwater Noise' (New York: Elsevier/Pergamon Press)

Rossing, T. and Fletcher, NH. 2013. 'Principles of Vibration and Sound: Edition 2' (New York: Springer Science and Business Media)

Southall BL Bowles AE Ellison WT Finneran JJ Gentry RL Greene Jr CR Kastak D Ketten DR Miller JH. and Nachtigall PE. 2007. 'Marine mammal noise-exposure criteria: initial scientific recommendations', *Bioacoustics,* 17 (1-3), 273-75.

Urick RJ. 1983. 'Principles of Underwater Sound' (New York: McGraw-Hill Co).

Wagstaff RA. 1981. 'Low-frequency ambient noise in the deep sound channel - The missing component', *The Journal of the Acoustical Society of America,* 69 (4), 1009-14.

Wright, AJ Dolman, SJ Jasny, M Parsons, ECM Schiedek, D. and Young, SB. 2013. 'Myth and Momentum: A Critique of Environmental Impact Assessments', *Journal of Environmental Protection.* 4: 72–77

B. Expert Advice on Specific Species Groups

The sea is the interconnected system of all the Earth's oceanic waters, including the five named 'oceans' - the Atlantic, Pacific, Indian, Southern and Arctic Oceans - a connected body of salty water that covers over 70 percent of the Earth's surface.

This vast environment is home to a broader spectrum of higher animal taxa than exists on land. Many marine species have yet to be discovered, and the number known to science is expanding annually. The sea also provides people with substantial supplies of food, mainly fish, shellfish and seaweed. It is a shared resource for us all.

Levels of anthropogenic marine noise have doubled in some areas of the world, every decade, for the past 60 years. (McDonald and Hildebrand *et al* 2006, Weilgart 2007) When considered in addition to the number other anthropogenic threats in the marine environment, increasing noise can be a life-threatening trend for many marine species.

Marine wildlife rely on sound for its vital life functions, including communication, prey and predator detection, orientation and for sensing surroundings. (Hawkins and Popper 2014, Simmonds, Dolman *et al* 2014) While the ocean is certainly a sound-filled environment and many natural (or biological) sounds are very loud, wildlife is not adapted to anthropogenic noise.

The species groups covered in the following sub-modules are:

- Inshore Odontocetes
- Offshore Odontocetes
- Beaked Whales
- Mysticetes
- Pinnipeds
- Polar Bears
- Sirenians
- Marine and Sea Otters
- Marine Turtles
- Fin-fish
- Elasmobranchs
- Marine Invertebrates

General principles

Building on the information from module section A.1, sound waves move through a medium by transferring kinetic energy from one molecule to the next. Animals that are exposed to elevated or prolonged anthropogenic noise may experience passive resonance (particle motion) resulting in direct injury ranging from bruising to organ rupture and death (barotrauma). This damage can also include permanent or temporary auditory threshold shifts, compromising the animal's communication and ability to detect threats. Animals can be displaced from important habitats. Finally, noise can mask important natural sounds, such as the call of a mate, the sound made by prey or a predator.

These mechanisms, as well as factors such as stress, distraction, confusion and panic, can affect reproduction, death and growth rates, in turn affecting the long-term welfare of the population. (Southall, Schusterman *et al* 2000, Southall, Bowles *et al* 2007, Clark, Ellison *et al* 2009, Popper *et al* 2014, Hawkins and Popper 2016)

These impacts are experienced by a wide range of species including fish, crustaceans and cephalopods, pinnipeds (seals, sea lions and walrus), sirenians (dugong and manatee), sea turtles, the polar bear, marine otters and cetaceans (whales, dolphins and porpoises)–the most studied group of marine species when considering the impact of marine noise.

The NOAA acoustic guidelines (NOAA 2016), which employ the most up-to-date scientific information on the effects of noise on marine mammals, for impulsive and non-impulsive noise sources, are based on a dual metric–dB peak for instantaneous sound pressure and SEL accumulated over 24 h for both impulsive and non-impulsive, whichever is reached first. It is important to note that some jurisdictions, notably Germany, require appropriate sound intensity level metrics (0 to peak) in addition to SEL at a specified distance. Their duel requirement is because the way the energy is delivered–regarding both the duty cycle and the energy within the individual pulses of sound–influences the effects of sound exposure.

Sound exposure levels work well for marine mammals but not well for a number of other marine species, including crustaceans, bivalves and cephalopods, because these species detect sound through particle motion

(the organism resonating in sympathy with the surrounding sound waves) rather than through a tympanic mechanism of marine mammals or swim-bladders of some fish species. (Mooney, et.al., 2010; André, et.al., 2011; NOAA, 2016) Where sound pressure acts in all directions, particle pressure is an oscillation back and forth in a particular direction.
The detection of particle motion requires different types of sensors than those utilized by a conventional hydrophone. These sensors must specify the particle motion regarding the particle displacement, or its time derivatives (particle velocity or particle acceleration).

There is the need for a coordinated effort by biologists and physicists to quantify (through both dedicated measurements and modelling) particle motion in the marine environment to assess noise impacts on fish and invertebrates. Dedicated measurements need to be carried out to collect data on particle motion at different depths and locations for the different sound sources.

While specific metrics about the impact of sound pressure are presented, where available, impact metrics (standard specifications and measurements) have not yet been developed for particle motion impact on marine species. Decisions makers are urged to use their judgement about the potential impact of particle motion, in the absence of well-defined guidelines.

The thresholds used in many jurisdictions consider only the onset of Permanent Threshold Shift (PTS) as an auditory injury, whereas in Germany, the onset of Temporary Threshold Shift (TTS) is considered the threshold of injury. This is based on the finding that in the long term even a TTS can result in neuron degeneration of synaptic contacts between hair cells and nerves (Kujawa and Liberman 2009; Kujawa and Liberman, 2015)

The current knowledge base is summarized in the following modules. If the Technical Background Information is revised at a later stage, the inclusion of diving seabirds would be a helpful addition.

This important volume of information should guide the assessment of Environmental Impact Assessment proposals.

Table 1: Potential results of sound exposure (from Hawkins and Popper 2016)

Impact	Effects on animal
Mortality	Death from damage sustained during sound exposure
Injury to tissues; disruption of physiology	Damage to body tissue, e.g internal haemorrhaging, disruption of gas-filled organs like the swim bladder, consequent damage to surrounding tissues
Damage to the auditory system	Rupture of accessory hearing organs, damage to hair cells, permanent threshold shift, temporary threshold shift
Masking	Masking of biologically important sounds including sounds from conspecifics
Behavioural changes	Interruption of normal activities including feeding, schooling, spawning, migration, and displacement from favoured areas
These effects will vary depending on the sound level and distance	

References

André, M., Solé, M., Lenoir, M., Durfort, M., Quero, C., Mas, A., Lombarte, A., Van der Schaar, M., López-Bejar, M., Morell, M. and Zaugg, S., 2011. Low-frequency sounds induce acoustic trauma in cephalopods. Frontiers in Ecology and the Environment, 9(9), pp.489-493.

Clark, C W. Ellison, *et al* 2009. 'Acoustic Masking in Marine Ecosystems as a Function of Anthropogenic Sound Sources.' Paper submitted to the *61st IWC Scientific Committee* (SC-61 E10).

Hawkins, AD. and Popper, A. 2014. 'Assessing the impacts of underwater sounds on fishes and other forms of marine life.' *Acoust Today* 10(2): 30-41.

Hawkins, AD and Popper. AN. 2016. Developing Sound Exposure Criteria for Fishes. The Effects of Noise on Aquatic Life II. (Springer: New York) p 431-439.

Kujawa, SG. and Liberman, MC. 2009. Adding insult to injury: cochlear nerve degeneration after "temporary" noise-induced hearing loss. The Journal of neuroscience: the official journal of the Society for Neuroscience 29(45): 14077-14085.

Kujawa, SG. and Liberman, MC. 2015. Synaptopathy in the noise-exposed and ageing cochlea: Primary neural degeneration in acquired sensorineural hearing loss. Hear Res.

McDonald, MA Hildebrand, JA. *et al* 2006. 'Increases in deep ocean ambient noise in the Northeast Pacific west of San Nicolas Island, California.' *The Journal of the Acoustical Society of America* 120(2): 711-718.

Mooney, T. Aran, Roger T. Hanlon, Jakob Christensen-Dalsgaard, Peter T. Madsen, Darlene R. Ketten, and Paul E. Nachtigall. 2010, "Sound detection by the longfin squid (Loligo pealeii) studied with auditory evoked potentials: sensitivity to low-frequency particle motion and not pressure." Journal of Experimental Biology 213, no. 2: 3748-3759.

Popper, AN Hawkins, AD Fay, RR Mann, D Bartol, S Carlson, T Coombs, S Ellison, WT Gentry, R. and Halvorsen, MB. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. (Springer)

Simmonds, MP Dolman, SJ. *et al* 2014. 'Marine Noise Pollution-Increasing Recognition But Need for More Practical Action.' *Journal of Ocean Technology* 9(1): 71-90.

Southall, B Bowles, A. *et al* 2007. 'Marine mammal noise-exposure criteria: initial scientific recommendations.' *Bioacoustics* 17(1-3): 273-275.

Southall, B Schusterman, R. *et al.,* 2000. 'Masking in three pinnipeds: Underwater, low-frequency critical ratios.' *The Journal of the Acoustical Society of America* 108(3): 1322-1326.

Weilgart, L. 2007. 'The impacts of anthropogenic ocean noise on cetaceans and implications for management.' *Canadian Journal of Zoology* 85(11): 1091-1116.

B.1. Inshore Odontocetes

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Odontocetes close to shore or in shallow waters

Consider when assessing

- Seismic surveys
- Civil high power sonar
- Coastal and offshore construction works
- Offshore platforms
- Playback and sound exposure experiments
- Vessel traffic greater than 100 metric tons
- Vessel traffic less than 100 metric tons
- Pingers and other noise-generating activities

Related CMS agreements

- Agreement on the Conservation of Cetaceans of the Black Seas Mediterranean Seas and Contiguous Atlantic Area (ACCOBAMS)
- Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)
- MOU for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region (Pacific Islands Cetaceans)
- MOU Concerning the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia (West African Aquatic Mammals)

Related modules

- Refer also to modules B.10, B.12 and C when assessing impact to inshore odontocetes

B.1.1. Species Vulnerabilities

Close-range, acute noise exposure is known to generate spatial displacement, often extended over the duration of the noise exposure (Anderwald *et al* 2013, Pirotta *et al* 2013), temporary hearing impairment (temporary threshold shifts or TTS)(e.g. Kastelein *et al* 2015, Lucke *et al* 2009) reduction in both occurrence and efficiency, or even cessation, of foraging behaviour (e.g. Pirotta *et al* 2014).

Permanent hearing impairment (permanent threshold shifts or PTS) has not been documented empirically (unethical) but is expected to occur and exposure thresholds have been predicted (e.g. Southall *et al* 2007, NOAA 2016) , see table 2.

Long-range (and therefore of wider spatial magnitude), chronic noise exposure is also known to generate spatial displacement, often extended over the duration of the noise exposure (Campana *et al* 2015). Masking of communication and other biologically important acoustic signals also occurs (e.g. Gervaise *et al* 2012).

Spatial displacement can cause the temporary loss of important habitat, such as prime feeding ground, forcing individuals to exploit suboptimal foraging areas. This effect is of significant concern if foraging behaviour is seasonal and/or if foraging habitat is limited or patched. Similarly, displacement can reduce breeding opportunities if it occurs during the mating season. Therefore, foraging habitat and breeding season are particularly sensitive components to noise impact.

B.1.2. Habitat Considerations

Inshore odontocetes often feed on opportunistic, seasonally abundant prey (e.g. Shane *et al* 1986). Habitat is often degraded due to proximity to highly populated coastal areas, and are particularly exposed to higher levels of existing anthropogenic underwater noise (associated with coastal development, commercial ports, recreational boat ramps, etc.) in parts of their habitat range. Thus, populations have been fragmented or are in the process of being fragmented. For these reasons, suboptimal habitat should be available to perform the biological tasks that will be disturbed by the introduction of noise. Population structure should be known in enough detail to allow evaluation of the population's resilience to the disturbance. Some odontocetes show diel (24 hour cycle) movement patterns from offshore to inshore regions for resting (Thorne *et al* 2012), or prey accessibility (Goodwin 2008). Similarly, seasonal patterns have been described for inshore odontocetes mainly driven by their prey's life cycle (Pirotta *et al* 2014) or seasonality in human disturbance (Castellote *et al* 2015). These movement patterns and co-occurring disturbances should be considered to minimize odontocetes' exposure to noise or reduce cumulative impact. Some species have small home ranges or show high site fidelity with low connectivity. They therefore may be more vulnerable to population level impacts, particularly in areas of repeated anthropogenic activity. Caution should be taken to minimise overlaps with such areas. Appropriate scheduling of noise-generating activities at periods with the lowest presence of odontocetes should be prioritized. Feeding can be concentrated in habitat specific features such as river mouths (Goetz *et al* 2007) or canyons (Moors-Murphy 2014). These spatial particularities of habitat should also be considered and their disturbance minimized.

B.1.3. Impact of Exposure Levels

The harbour porpoise has been described as the inshore odontocete most sensitive to noise exposure among the species of which we have data (Lucke *et al* 2009, Dekeling *et al* 2014, but see Popov *et al* 2011).

Based on the NOAA acoustic guidelines (NOAA 2016), which employ the most up-to-date scientific information on the effects of noise on marine mammals, onset of physiological effects, that is TTS and PTS, for impulsive and non-impulsive noise sources is based on a dual metric (dB peak for instantaneous sound pressure and SEL accumulated over 24 h for both impulsive and non-impulsive, whichever is reached first) and is summarized in the table (below) for high frequency hearing specialists, which includes the harbour porpoise.

These thresholds are based on weighted measurements, which take into consideration hearing sensitivity across frequencies for each hearing functional group. For more details please see NOAA (2016).

A more restrictive decision from the German Federal Maritime and Hydrographic Agency on the onset for physiological effects on harbour porpoises must also be considered in this context. This Agency has implemented a different threshold since 2003, specifically for pile driving operations. Criteria consist of a dual metric, SEL = 160dB re 1 mPa^2/s and SPL(peak-peak) = 190 dB re 1µPa. Both measures should not be exceeded at a distance of 750 m from the piling site.

Regarding onset of behavioural disruption, NOAA has not yet updated its guidelines, and a threshold of 120 dB RMS for non-impulsive and 160 dB RMS for impulsive noise remain as the onset thresholds for all cetacean species. New information obtained through controlled noise exposure studies on offshore cetacean species (e.g. SOCAL-BRS, 3S), suggests that onset of behavioural disruption is context dependent, and not only received levels but also distance to the source might play an important role in triggering a reaction. Few studies have been focused on behavioural reaction to noise on inshore odontocetes. These show how the onset of a response is triggered by the perceived loudness of the sound, not just received levels (Dyndo *et al* 2015). At least for harbour porpoises, this finding lends weight to the recent proposal by Tougaard *et al* (2015) that behavioural responses can be predicted from a certain level above their threshold at any given frequency (e.g. in the range of 40–50 dB above the hearing threshold for harbour porpoise).

For loud noise sources such as large diameter pile driving or seismic surveys commonly found in inshore odontocete habitat, the onset for behavioural response can occur at very substantial distances (e.g. Tougaard *et al* 2009, Thompson *et al* 2013).

Table 2: TTS and PTS from impulsive and non-impulsive noise sources for inshore odontocetes (from NOAA 2016, based on high frequency functional group.)

Metric	TTS onset		PTS onset	
	Impulsive	Non-impulsive	Impulsive	Non-impulsive
LE,24h	140 dB	153 dB	155 dB	173 dB
Lpk,flat	196 dB	n/a	202 dB	202 dB

B.1.4. Assessment Criteria

Several key characteristics on the biology of a species should be adequately assessed in an EIA. Population stock structure is a critical element to allow evaluating potential negative effects outside the scope of the individual level. This information is often unavailable for inshore odontocetes, and regulators or decision makers should adopt a much stricter position regarding this criterion for impact assessment decisions. Correct impact evaluation cannot be accomplished without understanding the extent of a potentially impacted population. Because spatial displacement is by far the most prominent effect to occur in noisy activities occurring in inshore odontocete habitat, sufficient information on habitat use and the availability of unaffected suboptimal habitat should be addressed in the evaluation. Other more general points should not be forgotten when determining if this species group has been adequately considered by an EIA, such as the correct relationship between the spectral content of the noise source and hearing information for the affected species, and the integration of both behavioural and physiological effects for the estimated proportion of the population to be affected by the activity. One more important point to consider is the potential for cumulative effects, due to the coastal exposure of these populations of inshore odontocetes. The introduction of new anthropogenic noise should be assessed in consideration with other already occurring stressors in their habitat, such as other noise sources, chemical pollutants, or physical disturbance, among others.

References

Anderwald, P Brandecker, A Coleman, M Collins, C Denniston, H Haberlin, MD O'Donovan, M Pinfield, R Visser, F. and Walshe, L. 2013. 'Displacement responses of a mysticete, an odontocete, and a phocid seal to construction-related vessel traffic'. *Endangered Species Research* 21: 231-240.

Campana, I Crosti, R Angeletti, D Carosso, L David, L Di-Meglio, N Moulins, A Rosso, M Tepsich, P. and Arcangeli, A. 2015. 'Cetacean response to summer maritime traffic in the Western Mediterranean Sea'. *Marine Environmental Research* 109 (2015) 1-8.

Castellote, M Brotons, M Chicote, C Gazo JM. and Cerdà, M. 2015. 'Acoustic monitoring of bottlenose dolphins in Spanish Mediterranean Marine Protected Areas'. *Ocean and Coastal Management* 113:54-66.

Dyndo, M Wisniewska, DM Rojano-Donate, L. and Madsen, PT. 2015. 'Harbour porpoises react to low levels of high frequency vessel noise'. *Scientific Reports* 5:11083.

Dekeling, RPA Tasker, ML Van der Graaf, AJ Ainslie, MA, Andersson, MH André, M Borsani, JF Brensing, K Castellote, M Cronin, D Dalen, J Folegot, T Leaper, R Pajala, J Redman, P Robinson, SP Sigray, P Sutton, G Thomsen, F Werner, S Wittekind, D. and Young, JV. 2014. 'Monitoring Guidance for Underwater Noise in European Seas - Background Information and Annexes. Guidance Report part III.' 2nd Report of the Technical Subgroup on Underwater Noise (TSG Noise).

Gervaise, C Roy, N Kinda, B. and Menard, N. 2012. 'Shipping noise in whale habitat: characteristics, sources, budget, and impact on belugas in Saguenay-St. Lawrence Marine Park hub'. *J Acoust Soc Am* 132:76–89.

Goetz, KT Rugh, DJ Read, AJ. and Hobbs, RC. 2007. 'Habitat use in a marine ecosystem: beluga whales Delphinapterus leucas in Cook Inlet'. *Alaska. Mar. Ecol. Prog. Ser.* 330:247-256.

Goodwin L. 2008. 'Diurnal and Tidal Variations in Habitat Use of the Harbour Porpoise (*Phocoena phocoena*) in Southwest Britain'. *Aquat Mamm* 34:44-53.

Kastelein, RA Gransier, R Marijt, MAT. and Hoek, L. 2015. 'Hearing frequency thresholds of a harbor porpoise (*Phocoena phocoena*) temporarily affected by played back offshore pile driving sounds.' *J. Acoust. Soc. Am.* 137, 556–564.

Lucke, K Siebert, U Lepper, P. and Blanchet, MA. 2009. 'Temporary shift in masked hearing thresholds in a harbor porpoise (*Phocoena phocoena*) after exposure to seismic airgun stimuli'. *J Acoust Soc Am* 125:4060– 4070.

Moors-Murphy, HB. 2014. 'Submarine canyons as important habitat for cetaceans, with special reference to the Gully: A review. Deep Sea Res. Part II'. 104:6–19.

NOAA. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

Norrman, EB Duque, SD. and Evans, PGH. 2015. 'Bottlenose dolphins in Wales: Systematic mark-recapture surveys in Welsh waters. Natural Resources Wales Evidence Report Series No. 85. (Natural Resources Wales: Bangor) 83pp.

Pirotta, E Laesser, BE Hardaker, A Riddoch, N Marcoux, M. and Lusseau, D. 2013. 'Dredging displaces bottlenose dolphins from an urbanised foraging patch'. *Mar. Pollut. Bull.* 74, 396–402.

Pirotta, E Thompson, PM Miller, PI Brookes, KL Cheney, B Barton, TR Graham, IM. and Lusseau, D. 2014. 'Scale-dependent foraging ecology of a marine top predator modelled using passive acoustic data'. *Funct. Ecol.* 28, 206–217.

Shane, SH.,Wells, RS Würsig, B. 1986. 'Ecology, behavior and social organisation of the bottlenose dolphin: a review'. *Mar. Mamm. Sci.* 2, 24e63.

Southall, BL Bowles, AE Ellison, WT Finneran, JJ Gentry, RL Greene, CR Jr Kastak, D Ketten, DR Miller, JH Nachtigall, PE Richardson, WJ Thomas, JA and Tyack, PL. 2007. 'Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations'. *Aquat. Mamm.* 33, 411–521.

Thompson, PM Brookes, KL Graham, IM Barton, TR Needham, K Bradbury, G. And Merchant, ND. 2013. 'Short-term disturbance by a commercial two-dimensional seismic survey does not lead to long-term displacement of harbour porpoises'. *Proceedings of the Royal Society B* 280:20132001.

Thorne, LH Johnston, DW Urban, DL Tyne, J Bejder, L. and Baird, RW *et al* 2012. 'Predictive Modelling of Spinner Dolphin (*Stenella longirostris*) Resting Habitat in the Main Hawaiian Islands'. *PLoS ONE* 7(8): e43167.

Tougaard, J Wright, AJ. and Madsen, PT. 2015. 'Cetacean noise criteria revisited in the light of proposed exposure limits for harbour porpoises'. *Mar. Pollut. Bull.* 90, 196–208.

Tougaard, J Carstensen, J Teilmann, J Skov, H Rasmussen, P. 2009. 'Pile driving zone of responsiveness extends beyond 20 km for harbour porpoises (*Phocoena phocoena, (L.)*)'. *J. Acoust. Soc. Am.* 126, 11–14.

B.2. Offshore Odontocetes

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Odontocetes in deeper waters

Consider when assessing

- Military sonar
- Seismic surveys
- Civil high power sonar
- Offshore platforms
- Playback and sound exposure experiments
- Vessel traffic greater than 100 metric tons

Related CMS agreements

- Agreement on the Conservation of Cetaceans of the Black Seas Mediterranean Seas and Contiguous Atlantic Area (ACCOBAMS)
- Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)
- MOU for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region (Pacific Islands Cetaceans)
- MOU Concerning the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia (West African Aquatic Mammals)

Related modules

- Beaked whales are considered separately in module B.3.
- Refer also to modules B.10, B.12 and C when assessing impact to offshore odontocetes

B.2.1. Species Vulnerabilities

While spatial displacement has been well documented in several inshore odontocetes species, little data is available for offshore odontocetes (other than beaked whale species), but similar behavioural responses are expected. Few direct measures of displacement are available (e.g. Goold 1996, Bowles *et al* 1994), and some indirect measures of disturbance exist, such as changes in vocal behaviour in short beaked common dolphins, Atlantic spotted dolphins and striped dolphins in the presence of anthropogenic noise (Papale *et al* 2015). Sperm whales exposed to tactical active sonar reduced energy intake or showed significant displacement with no immediate compensation (Isojunno *et al* 2016, Miller *et al* 2012). However, sperm whales chronically exposed to seismic airgun survey noise in the Gulf of Mexico did not appear to avoid a seismic airgun survey, though they significantly reduced their swimming effort during noise exposure along with a tendency toward reduced foraging (Miller *et al* 2009). Changes in vocal behaviour are normally associated with displacement in other odontocetes (e.g. Holt *et al* 2009, Lesage 1999).

Physiological impact by close-range, acute noise exposure, such as temporary threshold shift, has never been described in offshore odontocetes due to the difficulty to maintain these species in captivity. There is just one anecdotal description of physiological injury due to airgun noise exposure on a pantropical spotted dolphin (Graya and Van Waerebeek, 2011).

This lack of evidence should not be considered conclusive but rather as reflecting the absence of studies. Furthermore, due to similarities in sound functionality, hearing anatomy and physiology between offshore and inshore odontocetes, the vulnerabilities described for inshore species are expected to be very similar for offshore species.

Because of the lack of knowledge on offshore odontocete habitat seasonal preferences (e.g. it is not known whether reproduction occurs in similar habitats as where foraging occurs), noise impact on these species cannot be broken into lifecycle components.

B.2.2. Habitat Considerations

Little survey effort has been dedicated to offshore waters in most exclusive economic offshore zones and even less in international waters. As a consequence, data on offshore odontocete occurrence, distribution and habitat preferences is scarce for most species. However, some generalizations can be highlighted: Sperm whales do not use offshore regions uniformly; topography plays a key role in shaping their distribution (e.g Pirotta *et al* 2011). Moreover, solitary individuals use the habitat differently from groups (Whitehead 2003).

The occurrence of eddies, often associated with numerous seafloor topographic structures (canyons and seamounts), are known to favour ecosystem richness and consequently, cetacean occurrence (Ballance *et al* 2006, Hoyt 2011, Redfern *et al* 2006, Correia *et al* 2015). Therefore, areas where eddies are known to occur, particularly those related to underwater topography features, should be taken into special consideration when assessing impact to offshore odontocetes, even if no knowledge on cetacean occurrence is available.

B.2.3. Impact of Exposure Levels

Offshore odontocetes fall in their majority into the mid frequency hearing specialists. This group was considered for noise impact assessments during an international panel review (Southall *et al* 2007). This review has been updated in recent efforts by the U.S. Navy and NOAA. NOAA's most updated draft on acoustic guidelines (NOAA 2016) considers TTS and PTS, for impulsive and non-impulsive noise sources is based on a dual metric (dB peak for unweighted instantaneous sound pressure (Lpk) and SEL accumulated over 24 h (LE,24h) for both impulsive and non-impulsive, whichever is reached first) and is summarized in the table below for mid frequency hearing specialists (Table 3).

Table 3: TTS and PTS from impulsive and non-impulsive noise sources for offshore odontocetes, excluding beaked whales (from NOAA 2016, based on mid frequency functional group)

Metric	TTS onset		PTS onset	
	Impulsive	Non-impulsive	Impulsive	Non-impulsive
LE,24h	170 dB	178 dB	185 dB	198 dB
Lpk,flat	224 dB	n/a	230 dB	230 dB

Please note cummulative thresholds are based on weighted measurements, which take into consideration hearing sensitivity across frequencies for each hearing functional group. For more details please see NOAA (2016).

Regarding onset of behavioural disruption, NOAA has not yet updated its guidelines, and a threshold of 120 dB RMS for non-impulsive and 160 dB RMS for impulsive noise remains as the onset thresholds for all cetacean species. Recent results from one of the few behavioural response studies where offshore odontocetes, other than beaked whales, are targeted identified higher thresholds than expected for avoidance of military tactic sonar by free-ranging long-finned pilot whales (Antunes *et al* 2015). The US Navy currently uses a generic dose–response relationship to predict the responses of cetaceans to naval active sonar (US Navy 2008), which has been found to underestimate behavioural impacts on killer whales and beaked whales in multiple studies (Tyack *et al* 2011, DeRuiter *et al* 2013, Miller *et al* 2012 and 2014, Kuningas *et al* 2013). The navy curve appears to match more closely results with long-finned pilot whales, though the authors of this study suggest that the probability of avoidance for pilot whales at long distances from sonar sources could well be underestimated. These results highlight how functional hearing grouping, particularly for offshore odontocete species, might not be the most conservative approach for noise mitigation purposes. Behavioural responses of cetaceans to sound stimuli often are strongly affected by the context of the exposure, which implies that species and the received sound level alone is not enough to predict type and strength of a response. Although limited in sample size, this new information has not yet been profiled in EIA procedures. Contextual variables are important and should be included in the assessment of the effects of noise on cetaceans (see Ellison *et al* 2012 for a context-based proposed approach).

B.2.4. Assessment Criteria

Because our limited knowledge on offshore odontocete ecology and their seasonal habitat preferences, common sense mitigation procedures such as avoiding the season of higher odontocete occurrence might be difficult to implement. However, habitat predictive modelling is often applicable with limited data (Redfern *et al* 2006), and should be encouraged in situations where impact assessments suffer from odontocete data deficit.

It should also be noted that in some particular cases, spatial displacement has generated drastic indirect effects at the population level. Good examples are the several episodes of large numbers of narwhals entrapped in ice in Canada and West Greenland attributed to displacement caused by seismic surveys (Heide –Jørgensen *et al* 2013). Displacement in offshore areas could drive odontocetes towards fishing grounds, increasing the risk of entanglement. In cases where planned offshore disturbance is proposed near potential risk areas for odontocetes, this indirect impact mechanism must be evaluated. In the case of sperm whales, regulations tend to be made assuming that animals avoid areas with high sound levels. Thus some policies assume benefits of avoidance in terms of reduced sound exposure, even in the absence of evidence that it occurs for some noise sources (Madsen *et al* 2006). Avoidance can also have adverse effects, with the biological significance depending upon whether important activities are affected by animal movement away from an aversive sound.

Other more general points should not be forgotten when determining if this species group has been adequately considered by an EIA, such as the correct relationship between the spectral content of the noise source and hearing information for the affected species, and the integration of both behavioural and physiological effects for the estimated proportion of the population to be affected by the activity.

References

Antunes, A Kvadsheim, PH Lam, FPA Tyack, PL Thomas, L Wensveen PJ. and PJO. Miller. 2014. 'High thresholds for avoidance of sonar by free-ranging long-finned pilot whales (*Globicephala melas*)'. *Marine Pollution Bulletin*, 83(1): 165-180

Ballance, LT Pitman, RL. and Fiedler, PC. 2006. 'Oceanographic influences on seabirds and cetaceans of the eastern tropical Pacific: a review'. *Prog. Oceanogr.* 69, 360–390.

Bowles, AE Smultea, M Würsig, B Demaster, D P. and Palka, D. 1994. 'Relative abundance and behaviour of marine mammals exposed to transmissions from the Heard Island Feasibility Test'. *Journal of the Acoustical Society of America,* 96(2), 469–484.

Correia, AM Tepsich, P Rosso, M Caldeira, R and Sousa-Pinto, I. 2015. 'Cetacean occurrence and spatial distribution: habitat modelling for offshore waters in the Portuguese EEZ (NE Atlantic)'. *Journal of Marine Systems* 143:73–85

DeRuiter, SL Southall, BL Calambokidis, J Zimmer, WMX Sadykova, D Falcone, EA Friedlaender, AS Joseph, JE Moretti, D Schorr, GS Thomas, L. and Tyack, PL. 2013. 'First direct measurements of behavioural responses by Cuvier's beaked whales to mid-frequency active sonar'. *Biol. Lett.* 9, 20130223.

Ellison, WT Southall, BL Clark, CW Frankel, AS. 2012. 'New context-based approach to assess marine mammal behavioral responses to anthropogenic sounds'. *Conserv. Biol.* 26, 21–28.

Goold, JC. 1996. 'Acoustic assessment of populations of common dolphin (*Delphinus delphis*) in conjunction with seismic surveying'. *Journal of the Marine Biological Association of the UK,* 76, 811–820.

Gray, H and Van Waerebeek, K. 2011. 'Postural instability and akinesia in a pantropical spotted dolphin, *Stenella attenuata*, in proximity to operating airguns of a geophysical seismic vessel'. *J. Nat. Cons.* 19 (6): 363-367.

Heide-Jørgensen, MP Hansen, RG Westdal, K Reeves, RR. and Mosbech, A. 2013. 'Narwhals and seismic exploration: is seismic noise increasing the risk of ice entrapments?' *Biol Conserv* 158:50–54

Holt, MM Noren, DP Veirs,V Emmons, CK Veirs, S. 2009. 'Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise'. *J Acoust Soc Am* 125: EL27–EL32.

Hoyt, E. 2011. Marine Protected Areas for Whales, Dolphins and Porpoises. 2nd ed. (Earthscan: New York, USA)

Isojunno, S Cure, C. and Kvadsheim, PH *et al* 2016. 'Sperm whales reduce foraging effort during exposure to 1-2 kHz sonar and killer whale sounds'. *Ecological Applications*, 26 (1) : 77-93

Kuningas, S Kvadsheim, PH Lam, FPA. and Miller, PJO. 2013. 'Killer whale presence in relation to naval sonar activity and prey abundance in northern Norway'. *ICES J. Mar. Sci.* 70(7):1287-1293.

Lesage, V Barrettme, C Kingsleaynd, CS Sjare, B. 1999. 'The effect of vessel noise on the vocal behaviour of belugas in the St. Lawrence River estuary', *Canada. Mar Mam Sci* 15: 65–84.

Madsen, PT Johnson, M Miller, PJO Aguilar de Soto, N. and Tyack, PL. 2006. 'Quantitative measures of airgun pulses recorded on sperm whales (*Physeter macrocephalus*) using acoustic tags during controlled exposure experiments'. *Journal of the Acoustical Society of America* 120: 2366–2379.

Miller, PJO Antunes, RN Wensveen, PJ Samarra, FIP Alves, AC Tyack, PL Kvadsheim, PH Kleivane, L Lam, FA Ainslie, MA. and Thomas, L. 2014. 'Dose–response relationships for the onset of avoidance of sonar by free-ranging killer whales'. *J. Acoust. Soc. Am.* 135 (2), 975–993

Miller, PJO Kvadsheim, PH Lam, FA Wensveen, PJ Antunes, R Alves, AC Visser, F Kleivane, L Tyack, PL. and Sivle, LD. 2012. 'The severity of behavioral changes observed during experimental exposures of killer (*Orcinus orca*), longfinned Pilot (*Globicephala melas*), and sperm (*Physeter macrocephalus)* Whales to Naval Sonar'. *Aquat. Mammal.* 38, 362–401.

Miller, PJO. , Johnson, MP Madsen, PT Biassoni, N Quero, M. and Tyack, PL. 2009. 'Using at-sea experiments to study the effects of airguns on the foraging behaviour of sperm whales in the Gulf of Mexico'. *Deep-Sea Research I* 56 (7): 1168–1181.

Miller, PJO Kvadsheim, PH. and Lam, FPA *et al.* 2012. 'The Severity of Behavioral Changes Observed During Experimental Exposures of Killer (Orcinus orca), Long-Finned Pilot (Globicephala melas), and Sperm (Physeter macrocephalus) Whales to Naval Sonar'. *Aquatic Mammals* 38(4): 362-401

NOAA. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

Papale, E Gamba, M Perez-Gil, M. and Martin, VM Giacoma, C. 2015. 'Dolphins Adjust Species-Specific Frequency Parameters to Compensate for Increasing Background Noise'. *PLoS ONE* 10(4): e0121711.

Pirotta, E Matthiopoulos, J MacKenzie, M Scott-Hayward, L. and Rendell, L. 2011. 'Modelling sperm whale habitat preference: a novel approach combining transect and follow data'. *Marine Ecology Progress Series*. 2011,436: 257–272.

Redfern, JV Ferguson, MC Becker, EA Hyrenbach, KD Good, C Barlow, J. and Kaschner, K *et al*. 2006. 'Techniques for cetacean-habitat modelling'. *Mar. Ecol. Prog. Ser.* 310, 271–295.

Southall, BL Bowles, AE Ellison, WT Finneran, JJ Gentry, RL Greene Jr CR Kastak, D Ketten, DR Miller, JH Nachtigall, PE Richardson, WJ Thomas, JA. and Tyack, PL 2007. 'Criteria for injury: TTS and PTS'. *Aquat. Mammal.* 33, 437– 445.

Tyack, PL Zimmer, WMX Moretti, M Southall, BL Claridge, DE Durban, JW Clark, CW D'Amico, A DiMarzio, N Jarvis, S McCarthy, E Morrissey, R Ward, J. and Boyd, IL. 2011. 'Beaked whales respond to simulated and actual navy sonar'. *Plos One* 6, e17009.

US Navy. 2008. Southern California Range Complex, Final Environmental Impact Statement/ Overseas Environmental Impact Statement. December 8, 2008.

Whitehead, H. 2003. Sperm whales: social evolution in the ocean. (University of Chicago Press: London).

B.3. Beaked Whales

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Consider when assessing

- Military sonar
- Seismic surveys
- Civil high power sonar
- Coastal and offshore construction works
- Offshore platforms
- Playback and sound exposure experiments
- Vessel traffic greater than 100 metric tons
- Vessel traffic less than 100 metric tons
- Pingers and other noise-generating activities

Related CMS agreements

- Agreement on the Conservation of Cetaceans of the Black Seas Mediterranean Seas and Contiguous Atlantic Area (ACCOBAMS)
- Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)
- MOU for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region (Pacific Islands Cetaceans)

Related modules

- Refer also to modules B.10, B.12 and C when assessing impact to beaked whales

B.3.1. Species Vulnerabilities

Beaked whales (Ziphiids) became widely known to the public due to mass mortalities of whales stranded with gas/fat emboli when exposed to submarine-detection naval sonar or underwater explosions (Jepson *et al* 2003, Fernández *et al* 2005). Most researchers agree that a 'fight or flight' stress response is responsible for the deaths of whales following noise disturbances (Cox *et al* 2006). Interruption of foraging and avoidance at high speed have been found in different species of beaked whales subject to playbacks of naval sonar at 1/3rd octave RMS received levels as low as 89–127 dB re 1 µPa (Tyack *et al* 2011, DeRuiter *et al* 2013, Miller *et al* 2015). Beaked whales may also be sensitive to other sources of anthropogenic noise, as suggested by the effectiveness of acoustic pingers in reducing the bycatch of beaked whales in deep-water fisheries, much higher than for other species (Carretta *et al* 2011), and by their apparent response to low levels of ship noise (Aguilar de Soto *et al* 2006). There has been a number of mass-strandings of beaked whales coincident in time and space with seismic activities (Malakof 2001, Castellote and Llorens 2016), but the lack of adequate post-mortem examinations has prevented assessing possible cause-effects relationships in these cases. This means that any intense underwater anthropogenic noise can be considered as of concern for beaked whales: blasting, intense naval and scientific sonar, seismics, pingers, etc.

It is still unknown why beaked whales are more sensitive to noise than many other marine mammal species. The reasons may lie in their specialized way of life. Ziphiids stretch their physiological capabilities to perform dives comparable to sperm whales, but with a much smaller body size (Tyack *et al* 2006). Their poor social defences from predators such as highly vocal killer whales may explain why beaked whales limit their vocal output (Aguilar de Soto *et al* 2012) and respond behaviourally to sound at relatively low received levels. The combination of a low threshold of response and a potentially delicate physiological balance may explain why behavioural responses can cause mortalities (Cox *et al* 2006).

Population data for beaked whales are scarce offshore, but long-term monitoring shows that local populations in nearshore deep-waters are small (<100-150 individuals), have high site-fidelity and apparently low connectivity and calving rate (Claridge, 2013, Reyes *et al* 2015). These characteristics generally reduce animal resilience to population-level impacts. Differences in population structure, with a reduced number of young, have been found between beaked whales inhabiting a naval training range and a semi-pristine neighbouring area in the Bahamas (Claridge, 2013). In summary, while discrete noise activities are of concern due to potential acute exposures/responses, there is a risk for population-level effects of noise on beaked whales inhabiting areas where impacts are repetitive.

B.3.2. Habitat Considerations

Some of the 22 species of the Ziphiidae family can be found in the deep waters of all oceans. However, beaked whales have a low probability of visual and acoustic detection (Barlow *et al* 2006, Barlow *et al* 2013) and knowledge about their distribution and abundance is poor, preventing identification of hot-spots offshore. Until more data exist, the assumption is that any area with deep waters is potential beaked whale habitat year-round.

Most mass-strandings related to naval sonar or underwater explosives have been recorded when the activities occurred in nearshore areas of steep bathymetry, suggesting that whales might die due to the stranding process. However, there is at least one mass-stranding case indicating that animals can die offshore before stranding: the naval exercise “Majestic Eagle”. This exercise occurred > 100 km offshore from the Canary Islands and dead whales were carried to the shore by the current and winds. The whales showed the same pathological findings identified previously as symptomatic of whales stranded alive in coincidence to naval exposure (Fernández *et al* 2012).

Thus, the vulnerability of beaked whales and their wide distribution make EIA relevant whenever human activities emitting intense sound occur near the slope or in abyssal waters offshore.

B.3.3. Impact of Exposure Levels

Beaked whales show strong avoidance reactions to a variety of anthropogenic sounds with the most sensitive fraction of the population responding at received levels of naval sonar below 100 dB re 1 μPa, and most of the animals tested responding at received levels of 140 dB re 1 μPa. This corresponds to ranges of several km from the ship operating the sonar (Miller *et al* 2015, Tyack *et al* 2011).

There are no data for thresholds of response for other noise sources. The range at which beaked whales may be expected to be at risk of disturbance from a given anthropogenic noise can be estimated from the characteristics of the sound source, acoustic propagation modelling and the dose: response data provided by behavioural response studies. For example, Tolstoy *et al* (2009) present broadband calibrated acoustic data on a seismic survey performed in shallow waters and received at deep (1600 m) and shallow water (50 m) sites. The line fit to have 95% of the received levels falling below a given received level (RL) was RL = 175.64 – 29.21 $\log_{10}$(range in km) for the deep water site and RL = 183.62 – 19 $\log_{10}$(range in km) at the shallow site. Solving the equation for shallow water and a RL of 140 dB at which beaked whales may be expected to be disturbed, the potential disturbance range would be range = $10^{43.62/19}$ = 197 km. The range predicted to disturb more sensitive individuals within the population would be greater.

The spectrum of the air gun sounds reported by Tolstoy *et al* (2009) is highest below 80 Hz, well below the naval sonars whose effects have been studied for dose-response curves, and in a frequency range where beaked whales are expected to have less sensitive hearing. It is difficult to weight the level of air guns by the hearing of beaked whale given the data available, but it is possible to make a rough estimate of the energy from air guns in the third octave band (which roughly match the frequency bands over which the mammalian ear integrates energy) of the naval sonars whose effects have been measured. The broadband SEL measured at 1 km for shallow water was 175 dB re 1 $\mu Pa^2 s$. Third octave levels were also reported for a shot recorded in shallow water at 1 km range. The third octave level for this shot at the 3 kHz sonar frequency was about 130 dB re1 $\mu Pa^2 s$, suggesting that this frequency band was about 45 dB lower than the broadband source level (SL). This suggests using a sound pressure level of 183.62 - 45 dB to estimate received level in this frequency band at 1 km range. In addition, seawater absorbs sound at about 0.18 dB/km at the 3 kHz sonar frequencies, and this absorption must be accounted for in the transmission loss. Therefore Transmission Loss (TL)= 19 $\log_{10}$(range) + 0.18*range. The range at which sensitive beaked whales, which respond at 100 dB re 1 μPa may respond, given that TL = SL – RL, i.e. 19 $\log_{10}$(range) + 0.18*range = 183.62-45-100 = 38.62, is estimated at 43 km.

These rough calculations show that beaked whales could be expected to be disturbed by exposure to airguns at ranges of 43-197+ km, assuming conditions as found by Tolstoy *et al* (2009). The actual values will depend upon the actual signature of the air gun array to be used, and the propagation conditions in the area. This guidance coupled with current data on beaked whale responses to anthropogenic noise suggests that each proposer should assess how sound is expected to propagate from the survey site to any beaked whale habitat with hundreds of km. If any of this habitat is expected to be exposed to levels of sound above those shown to disturb beaked whales (i.e. 100 dB re 1 μPa for the most sensitive individuals tested), then a further assessment should be made of the number of animals likely to be disturbed.

B.3.4. Assessment Criteria

EIA should consider different types of impacts, ranging from exposure of whales to intense received levels causing hearing damage to behavioural reactions with potential physiological consequences in some cases, to displacement and ecological effects (e.g. reduction in feeding rates or displacement from preferred habitat due to avoidance behaviour resulting in lower fitness).

A framework for mitigation targeted to reduce risk of the different impacts above needs to be included in the EIA, including actions during the planning-phase, real-time mitigation protocols and post-activity reporting to inform future planning and mitigation (e.g. Aguilar de Soto *et al* 2015). An effective mitigation method is spatio-temporal avoidance of high density areas (Dolman *et al* 2011). This is informed by surveys and habitat modelling and can be aided by simulation engines. However, the scarcity of data supporting density maps for beaked whales increases uncertainty about the number of whales to be expected in a given area and the identification of high density areas. Thus, planning-phase mitigation is essential but it does not eliminate the possibility of encountering and affecting/harming beaked whales. Another aspect of planning-phase mitigation is the choice of acoustic devices to be used during the activity, as well as the source levels required to achieve the objectives of the activity. *In situ* measurements of sound transmission loss shortly before the activity may allow adjustment of source level to below the maximum, so that the maximum is not used by default. A protocol towards reducing total acoustic energy and peak source levels transmitted to the environment should be defined before the activity, for any activity, within workable limits.

Depending on the activity, EIA may require updated information of the density of beaked whales and other vulnerable species, before the activity, in order to allow current data to be compared with existing density maps and to improve their accuracy. Also, if a choice of locations is evaluated, it would be possible to decide locating the activity in the place with lower concentration of vulnerable species.

A powerful and cost-effective way to monitor the effects would be to moor passive acoustic recorders in the beaked whale habitats exposed to sound levels above 100 dB re 1 µPa and to monitor both the actual levels of anthropogenic sound and also to monitor for the rates at which beaked whale echolocation clicks are detected. In the case of seismic, modern seismic surveys often include the deployment of cabled geophones at the seabed. These could be easily equipped with high frequency hydrophones to record beaked whales and other marine fauna.

Given the low probability of visual detection of beaked whales even in good sea conditions, real-time mitigation methods proposed in the EIA require increasing probability of detection by using passive acoustic monitoring systems with detectors programmed for automated classification of beaked whale vocalizations. Automatic detections can then be checked by trained personnel to take decisions about initiation of mitigation protocols.

B.3.5. Species not listed on the CMS Appendices that should also be considered during assessments

All beaked whales not currently listed by CMS seem to be particularly vulnerable to anthropogenic marine noise.

References

DeRuiter, SL Southall, BL Calambokidis, J Zimmer, WMX Sadykova, D Falcone, EA Friedlaender, AS Joseph, JE Moretti, D Schorr, GS Thomas, L. and Tyack, PL. 2013. 'First direct measurements of behavioural responses by Cuvier's beaked whales to mid-frequency active sonar'. *Biol. Lett.* 9, 20130223.

Ellison, WT Southall, BL Clark, CW Frankel, AS. 2012. 'New context-based approach to assess marine mammal behavioral responses to anthropogenic sounds'. *Conserv. Biol.* 26, 21–28.

NOAA. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

Redfern, JV Ferguson, MC Becker, EA Hyrenbach, KD Good, C Barlow, J. and Kaschner, K *et al*. 2006. 'Techniques for cetacean-habitat modelling'. *Mar. Ecol. Prog. Ser.* 310, 271–295.

Southall, BL Bowles, AE Ellison, WT Finneran, JJ Gentry, RL Greene Jr CR Kastak, D Ketten, DR Miller, JH Nachtigall, PE Richardson, WJ Thomas, JA. and Tyack, PL. 2007. 'Criteria for injury: TTS and PTS'. *Aquat. Mammal.* 33, 437– 445.

Tyack, PL Zimmer, WMX Moretti, M Southall, BL Claridge, DE Durban, JW Clark, CW D'Amico, A DiMarzio, N Jarvis, S McCarthy, E Morrissey, R Ward, J. and Boyd, IL. 2011. 'Beaked whales respond to simulated and actual navy sonar'. *Plos One* 6, e17009.

B.4. Mysticetes

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Consider when assessing

- Military sonar
- Seismic surveys
- Civil high power sonar
- Coastal and offshore construction works
- Offshore platforms
- Playback and Sound Exposure Experiments
- Vessel traffic greater than 100 metric tons
- Vessel traffic less than 100 metric tons
- Pingers and other noise-generating activities

Related CMS agreements

- Agreement on the Conservation of Cetaceans of the Black Seas Mediterranean Seas and Contiguous Atlantic Area (ACCOBAMS)
- Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)
- MOU for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region (Pacific Islands Cetaceans)

Related modules

- Refer also to modules B.12 and C when assessing impact to mysticetes

B.4.1. Species Vulnerabilities

Mysticete whales are all known to rely upon acoustic communication to mediate critical life history activities, including social interactions associated with breeding, raising young, migration and foraging (Edds-Walton 1997, Clark 1990). Research into the hearing capabilities of mysticetes, based primarily on anatomical modelling, indicate that mysticetes, as a group, are possibly capable of hearing signals from a minimum of approximately 7 Hz up to 35 kHz (Southall *et al* 2007). This range of frequencies spans many sources of anthropogenic noise in the ocean, excluding only the highest frequency sonar systems and pinger systems > 25 kHz (Hildebrand *et al* 2009). Previous research has documented impacts of noise exposure to physiology, behaviour, and habitat usage in mysticetes (Richardson *et al* 1995, Nowacek *et al* 2007, Tyack 2008).

Physiological impacts have been documented in mysticetes in response to noise exposure. This includes evidence of a decrease in physiological stress levels in North Atlantic right whale associated with a reduction in shipping noise (Rolland *et al* 2012). Techniques are currently under development to allow testing of acute stress responses to short-term high amplitude noise exposure (Hunt *et al* 2013).

Behavioral impacts have been documented in mysticetes in response to a variety of noise sources over the past three decades. This includes evidence of military sonar affecting movement, foraging and acoustic behaviour (Miller et a. 2000, Tyack 2009, Goldbogen *et al* 2013), seismic survey and air guns affecting movement and acoustic behaviour (Malme *et al* 1988, Di Iorio and Clark 2010, Castellote *et al* 2012), vessel noise affecting foraging, social and acoustic behaviour (Melcon *et al* 2012), and response to playback of predator and/or alarm stimuli (Cummings and Thompson 1971, Dunlop *et al* 2013, Nowacek *et al* 2004)

Habitat usage impacts have been documented in a number of cases. Previous studies have documented abandonment of habitat areas during periods of intense noise. One of the earliest documented cases occurred when commercial dredging and shipping activities resulted in abandonment of a critical calving ground in gray whales for the duration of human activities in an enclosed shallow water bay (Bryant *et al* 1984). Seismic surveys have resulted in large-scale, temporary, displacements of mysticete whales away from regions of seismic exploration in the Mediterranean (Castellote *et al* 2012). A further concern, of long-standing (Payne and Webb 1971), is the potential for even relatively low amplitude anthropogenic noise raising the background noise to a degree that it significantly reduces the range of communication for mysticetes. Recent studies have demonstrated the potential degree of masking experienced by mysticetes in urbanized habitat areas due to vessel traffic (Clark *et al* 2009, Hatch *et al* 2012). This is a major concern to result in chronic erosion of suitable habitat conditions through raising the baseline background noise levels.

B.4.2. Habitat Considerations

Based on previous studies, mysticetes show variable response to noise exposures in different habitat areas, possibly linked to differences in the behavioural states and/or the availability of suitable alternative habitats (Nowacek *et al* 2007). Most mysticete whales show some level of seasonal migratory behaviours (Corkeron and Connor 1999), therefore many habitats may seasonably pose relatively higher or lower risk depending on presence or absence of particular species. Calving grounds, breeding grounds, and foraging grounds are seasonally vulnerable areas for which there may not be suitable alternate habitat for many species, and would be of particular concern to highly endangered populations with limited available critical habitat areas.

Studies of responsiveness to noise exposure have been conducted on calving and breeding grounds (Miller *et al* 2000), on migratory corridors (e.g. Malme *et al* 1988, Tyack 2009, Dunlop *et al* 2013), and on foraging grounds for a variety of species (Di Iorio and Clark 2010, Parks *et al* 2011, Goldbogen *et al* 2013). Studies of migrating whales indicate that individuals may be highly responsive to noise exposure during migration, but may be able to deviate around acoustic disturbance without significant changes to the migratory distance (Malme *et al* 1988, Tyack 2009, Dunlop *et al* 2013).

The greatest data gaps regarding relative risk by h

abitat and season come from the facts that a) many species only have been tested in one type of habitat area and b) detection of an overt behavioural response may not truly indicate disturbance if animals are unable or unwilling to leave the habitat for foraging or breeding purposes. Also, for several species there is little known on the location of biologically important habitats (breeding, calving and foraging grounds).Future research to assess physiological responses to the same acoustic disturbance in multiple habitat areas are needed to have a high level of confidence regarding the actual impacts of noise exposure to mysticetes.

B.4.3. Impact of Exposure Levels

Relatively little data are available regarding the hearing abilities of mysticetes. Much of the current level of understanding comes from either anatomical modelling studies (Ketten 2000) or indirectly through interpretation of behavioural responses of mysticetes to controlled exposure experiments (Mooney *et al* 2012). A thorough review of exposure criteria for behavioural responses for mysticetes is summarized in Southall *et al* (2007). The thresholds for detectable behavioural responses to noise exposure varied by species, location and time of year, giving a wide range of thresholds for responses to multiple pulses and non-pulse signals.

Table 4: TTS and PTS from impulsive and non-impulsive noise sources for mysticetes (NOAA 2016)

Metric	TTS onset		PTS onset	
	Impulsive	Non-impulsive	Impulsive	Non-impulsive
SEL cum 24h	168 dB	179 dB	183 dB	199 dB
dB peak	213 dB	n/a	219 dB	n/a

Peak sound pressure (dB peak) has a reference value of 1 µPa, and the 24 hour cumulative sound exposure level (SEL cum 24h) has a reference value of 1µPa^{2}s.

B.4.4. Assessment Criteria

Based on an extensive body of literature on the effects of noise on mysticetes (including physiology, behaviour and temporary habitat abandonment), a number of detailed criteria should be considered to assess potential risk of an signal generating activity. These include:

- Amplitudes, signal structure (pulse, multi-pulse, non-pulse), and anticipated cumulative time of exposure.
- Vulnerability of the species or sustainable 'take' – Some mysticete species and stocks are highly endangered, and warrant additional consideration if proposed activities have any potential to cause impacts at any level.
- Seasonal variability in the potential risk due to migratory timing of occupancy (can activities be seasonally shifted to minimize overlap with mysticete presence in critical habitat areas?).
- Data on noise exposure studies of target species, or closely related species, with similar signal type
- Comparison of the proposed acoustic exposure relative to the ambient, background levels and spectra of environmental noise (i.e. relatively low level noise exposure may be more significant in acoustically 'pristine' habitats).
- Consideration of potential cumulative effects of an additional introduction of sound into the environment (i.e. increase in potential for masking, increase in duration of exposure on daily and/or seasonal scales).

B.4.5. Species not listed on the CMS Appendices that should also be considered during assessments

Several of the CMS Appendix I and II species have not previously been studied regarding responses to noise exposure.

In particular, relatively little is known regarding the acoustic behaviours of sei whale, *Balaenoptera borealis,* Antarctic minke whale, *Balaenoptera bonaerensis,* Bryde's whale, *Balaenoptera edeni* and Omura's whale, *Balaenoptera omurai.*

In addition to the species listed in CMS Appendix I and II gray whale, *Eschrichtius robustus*, should be considered, due to recent documentation of individuals in 'novel' habitats including multiple confirmed sightings in the Atlantic Ocean (McKeon *et al* 2016) and severely threatened stocks in the Eastern Pacific (Rugh 2005).

References

Bryant PJ Lafferty CM. and Lafferty SK. 1984. 'Reoccupation of Laguna Guerrero Negro, Baja California, Mexico, by gray whales' in The gray whale, *Eschrichtius robustus'*. Jones ML Swartz S. L Leatherwood S eds. (Academic Press: Orlando, Florida). 375–387

Castellote, M Clark, CW. and Lammers, MO. 2012. 'Acoustic and behavioural changes by fin whales (*Balaenoptera physalus*) in response to shipping and airgun noise'. *Biological Conservation*, 147(1), 115-122.

Clark, CW. 1990. 'Acoustic behavior of mysticete whales.' in Sensory abilities of cetaceans. (Springer: US) 571-583.

Clark, CW Ellison, WT Southall, BL Hatch, L Van Parijs, SM Frankel, A. and Ponirakis, D. 2009. 'Acoustic masking in marine ecosystems: intuitions, analysis, and implication'. *Marine Ecology Progress Series,* 395, 201-222.

Corkeron, PJ. and Connor, RC. 1999. 'Why do baleen whales migrate?' *Marine Mammal Science* 15(4): 1228-1245.

Dunlop, RA Noad, MJ Cato, DH Kniest, E Miller, PJ Smith, JN and Stokes, MD. 2013. Multivariate analysis of behavioural response experiments in humpback whales (*Megaptera novaeangliae*). Journal of Experimental Biology, 216(5), 759-770.

Edds-Walton, PL. 1997. 'Acoustic communication signals of mysticet whales'. *Bioacoustics*, 8(1-2), 47-60.

Hildebrand, JA. 2009. 'Anthropogenic and natural sources of ambient noise in the ocean'. *Marine Ecology Progress Series,* 395(5).

Goldbogen, JA Southall, BL DeRuiter, SL Calambokidis, J Friedlaender, AS Hazen, EL Falcone, EA Schorr, GS Douglas, A Moretti, DJ. and Kyburg, C. 2013. 'Blue whales respond to simulated mid-frequency military sonar'. *Proceedings of the Royal Society of London B: Biological Sciences*, 280(1765), 20130657.

Hatch, LT Clark, CW Van Parijs, SM Frankel, AS. and Ponirakis, DW. 2012. 'Quantifying loss of acoustic communication space for right whales in and around a US National Marine Sanctuary'. *Conservation Biology*, 26(6), 983-994.

Hunt, KE Moore, MJ Rolland, RM Kellar, NM Hall, AJ Kershaw, J Raverty, SA Davis, CE Yeates, LC Fauquier, DA Rowles TK. 2013. 'Overcoming the challenges of studying conservation physiology in large whales: a review of available methods'. *Conservation Physiology*, 1(1), cot006.

Ketten, DR. 2000. 'Cetacean ears'. in Hearing by whales and dolphins' (Springer: New York) 43-108

Malme, CI Würsig, B Bird, JE. and Tyack, P. 1988. 'Observations of feeding gray whale responses to controlled industrial noise exposure'. *Port and ocean engineering under arctic conditions*, 2, 55-73.

McKeon, C Weber, MX Alter, SE Seavy, NE Crandall, ED Barshis, DJ Fechter-Leggett, ED. and Oleson, KL. 2015. 'Melting barriers to faunal exchange across ocean basins'. *Global Change Biology*, 22(2), 465-473.

Melcon, ML Cummins, AJ Kerosky, SM Roche, LK Wiggins, SM. and Hildebrand, JA. 2012. 'Blue whales respond to anthropogenic noise'. *PLoS ONE* 7, e32681.

Miller, PJ Biassoni, N Samuels, A. and Tyack, PL. 2000. 'Whale songs lengthen in response to sonar'. *Nature*, 405(6789), 903-903.

Mooney, TA Yamato, M. and Branstetter, BK. 2012. 'Hearing in cetaceans: from natural history to experimental biology'. *Adv. Mar. Biol,* 63(197-246).

NOAA. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

Nowacek, DP Johnson, MP. and Tyack, PL. 2004. 'North Atlantic right whales (*Eubalaena glacialis*) ignore ships but respond to alerting stimuli'. *Proceedings of the Royal Society of London B: Biological Sciences,* 271(1536), 227-231.

Nowacek, DP Thorne, LH Johnston, DW. and Tyack, PL. 2007. 'Responses of cetaceans to anthropogenic noise'. *Mammal Review*, 37(2), 81-115.

Parks, SE Johnson, M Nowacek, D. and Tyack, PL. 2011. 'Individual right whales call louder in increased environmental noise'. *Biology Letters*,7(1), 33-35.

Payne RS. and Webb D. 1971. 'Orientation by means of long range acoustic signaling in baleen whales'. *Annals of the New York Academy of Sciences* 188:110–141.

Richardson, WJ Greene, Jr. CR Malme, CI. And Thomson, DH. 1995. Marine Mammals and Noise (Academic, New York).

Rolland, RM Parks, SE Hunt, KE Castellote, M Corkeron, PJ Nowacek, DP Wasser, SK. and Kraus, SD. 2012. 'Evidence that ship noise increases stress in right whales'. *Proceedings of the Royal Society of London B: Biological Sciences*, 279(1737), 2363-2368.

Rugh, DJ Hobbs, RC Lerczak, JA. and Breiwick, JM. 2005. 'Estimates of abundance of the eastern North Pacific stock of gray whales (*Eschrichtius robustus*) 1997-2002'. *Journal of Cetacean Research and Management*, 7(1), 1-12.

Southall, BL Bowles, AE Ellison, WT Finneran, JJ Gentry, RL Greene, Jr. CR Kastak, D Ketten, DR Miller, JH Nachtigall PE. And Richardson WJ. 2007. 'Marine mammal noise exposure criteria: Initial Scientific Recommendations'. *Aquatic Mammals*, 33(4), 411-509.

Cummings, WC. and Thompson, PO. 1971. 'Gray whales, *Eschrichtius robustus*, avoid the underwater sounds of killer whales, *Orcinus orca'*. *Fishery Bulletin*, 69(3), 525-530.

Tyack, PL. 2008. 'Implications for marine mammals of large-scale changes in the marine acoustic environment'. *Journal of Mammalogy*, 89(3), 549-558.

Tyack, PL. 2009. 'Acoustic playback experiments to study behavioral responses of free-ranging marine animals to anthropogenic sound'. *Marine Ecology Progress Series*, 395: 187-200.

B.5. Pinnipeds

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Consider when assessing

- Military sonar
- Seismic surveys
- Civil high power sonar
- Coastal and offshore construction works
- Offshore platforms
- Playback and sound exposure experiments
- Vessel traffic greater than 100 metric tons
- Vessel traffic less than 100 metric tons
- Pingers and other noise-generating activities

Related CMS agreements

- Agreement on the Conservation of Seals in the Wadden Sea (Wadden Sea seals)
- MOU Concerning Conservation Measures for the Eastern Atlantic Populations of the Mediterranean Monk Seal (*Monachus monachus*) (Atlantic monk seals)

Related modules

- Refer also to modules B.10, B.12 and C when assessing impact to pinnipeds

B.5.1. Species Vulnerabilities

Pinnipeds are sensitive to sound in both air and under water, therefore, they are likely to be susceptible to the harmful effects of loud noise in both media. Recent research has revealed that many pinnipeds have a better hearing sensitivity in water than was previously believed. (Southall *et al* 2000, 2008, Reichmuth *et al* 2013)

In developing guidelines for underwater acoustic threshold levels for the onset of permanent and temporary threshold shifts in marine mammals, NOAA has been considering two pinniped families: Phocidae and Otariidae. Phocid species have consistently been found to have a more acute underwater acoustic sensitivity than otariids, especially in the higher frequency range. This reflects the fact that phocid ears are better adapted underwater for hearing than those of otariids, with larger, denser middle ear ossicles. (NOAA, 2016) The effective auditory bandwidth in water of typical Phocid pinnipeds (underwater) is thought to be 50 Hz to 86 kHz while for Otariid pinnipeds (underwater) it is 60 Hz to 39 kHz (NOAA, 2016). The draft NOAA guidelines do not pertain to marine mammal species under the U.S. Fish and Wildlife Service's jurisdiction, including the third family of pinnipeds: Odobenidae (walrus), which means there is no update on the auditory bandwidth of walrus.

Behavioural responses to anthropogenic noise have been documented in a number of different pinnipeds at considerable ranges indicating the need for precautionary mitigation (Kelly *et al* 1988) In addition to noise-induced threshold shifts, behavioural responses have included seals hauling out (possibly to avoid the noise) (Bohne *et al* 1985, 1986, Kastak *et al* 1999) and cessation of feeding (Harris *et al* 2001).

It is likely that pinniped foraging strategies also place them at risk from anthropogenic noise. Some pinnipeds forage at night, others transit to foraging locations by swimming along the bottom, and many dive to significant depths or forage over significant distances (Fowler *et al* 2007, Villegas-Amtmann *et al* 2013, Cronin *et al* 2013) with Australian sea lions foraging offshore out to 189 km (Lowther *et al* 2011).

In most respects, noise-induced threshold shifts in pinnipeds follow trends similar to those observed in odontocete cetaceans. Unique to pinnipeds are their vibrissae (whiskers), which are well supplied with nerves, blood vessels and muscles, functioning as a highly sensitive hydrodynamic receptor system (Miersch *et al* 2011). Vibrissae have been shown to be sufficiently sensitive to low frequency waterborne vibrations to be able to detect even the subtle movements of fish and other aquatic organisms (Renouf, 1979, Hanke *et al* 2012, Shatz and Groot, 2013). Ongoing masking through ensonification may impede the sensitivity of vibrissae and the animal's ability to forage.

It is possible that even if no behavioural reaction to anthropogenic noise is evident, masking of intraspecific signals may occur. (Kastak and Schusterman, 1998)

B.5.2. Habitat Considerations

Spatial displacement of pinnipeds by noise has been observed (e.g Harris *et al* 2001), however observations are too sparse and definitely require greater attention to be understood in ways that can inform management. Such displacement is likely to have serious consequences if affecting endangered species in their critical habitats, such as Mediterranean monk seals in Greece or Turkey. Displacement can cause the temporary loss of important habitat, such as feeding grounds, forcing individuals to either move to sub-optimal feeding location, or to abandon feeding altogether. Noise can also reduce the abundance of prey (refer to modules on fin-fish and cephalopods in these guidelines).

Displacement can also reduce breeding opportunities, especially during mating seasons. Foraging habitat and breeding seasons are therefore important lifecycle components of pinniped vulnerabilities. In particular, the periods of suckling and weaning are vulnerable times for both mothers and pups.

Many pinnipeds species exhibit high site fidelity. For some there is little or no interchange of females between breeding colonies, even between those separated by short distances, such as in Australian sea lions, *Neophoca cinerea* (Campbell *et al* 2008). The site fidelity of these animals increases their risk of local extinction, especially at sites with low population numbers (e.g monk seals).

Some species of pinnipeds can range far offshore and because they are difficult to sight and identify at sea their offshore foraging may only be revealed by telemetry studies. These studies usually involve tagging individuals that might come ashore hundreds or even thousands of miles from offshore foraging habitats.

Table 5: TTS and PTS from impulsive and non-impulsive noise sources for phocidae (from NOAA 2016)

Metric	TTS onset		PTS onset	
	Impulsive	Non-impulsive	Impulsive	Non-impulsive
SEL cum 24h	170dB	181dB	185dB	201dB
dB peak	212dB	n/a	218dB	218dB

Table 6: TTS and PTS from impulsive and non-impulsive noise sources for otariidae (from NOAA 2016)

Metric	TTS onset		PTS onset	
	Impulsive	Non-impulsive	Impulsive	Non-impulsive
SEL cum 24h	188dB	199dB	203dB	219dB
dB peak	226dB	n/a	232dB	232dB

Table 7: TTS and PTS from impulsive and non-impulsive noise sources for odobenidae (from Southall *et al* 2007)

Metric	TTS onset		PTS onset	
	Impulsive	Non-impulsive	Impulsive	Non-impulsive
SEL cum 24h	171dB	171dB	186dB	203dB
dB peak	212dB	212dB	218dB	218dB

B.5.3. Impact of Exposure Levels

Onset of temporary threshold shift (TTS) and permanent threshold shift (PTS) for impulsive and non-impulsive noise, and at peak levels (for instantaneous impact) as well as sound exposure levels (SEL) accumulated over a 24 hour period based on the latest updates of the NOAA acoustic guidelines (NOAA, 2016), are summarized in the tables that follow (right).

Walrus, *Odobenus rosmarus*, hearing is relatively sensitive to low frequency sound, thus the species is likely to be susceptible to anthropogenic noise. (Kastelein *et al* 2002) TTS and PTS levels can be inferred from Southall *et al* (2007) for Odobenidae.

Kastelein *et al* 2002 has drawn useful general observations by comparing hearing studies of the California sea lion, *Zalophus californianus*, harbour seal, *Phoca vitulina*, ringed seal, *Pusa hispida*, harp seal, *Pagophilus groenlandicus*, northern fur seal, *Callorhinus ursinus*, gray seal, *Halichoerus grypus*, Hawaiian monk seal, *Monachus schauinslandi* and northern elephant seal, *Mirounga angustirostris* to those of walrus. The high frequency cut-off of walrus hearing is much lower than other pinnipeds tested so far. The hearing sensitivity of the walrus *Odobenus rosmarus*, between 500 Hz and 12 kHz is similar to that of some phocids. The walrus, is much more sensitive to frequencies below 1 kHz than sea lion species tested. (Kastelein *et al* 2002) Other sensitive pinnipeds such as harbour seals (about 20 dB more sensitive to signals at 100 Hz than California sea lions) and elephant seal, *Mirounga angustirostris* and *Mirounga leonine*, are also more likely to hear low-frequency anthropogenic noise. (Kastak and Schusterman, 1998)

Assessment should consider that routine deep-divers, that dive to or below the deep sound channels, may be exposed to higher sound levels than would be predicted based on simple propagation models. Assessment should also consider convergence zones which may result in areas with higher sound levels at greater ranges.

B.5.4. Assessment Criteria

There have been surprisingly few studies of the effects of anthropogenic noise, particularly from seismic surveys, on pinnipeds (Gordon *et al* 2003).

The lack of evidence of dramatic effects of anthropogenic noise on pinnipeds, in contrast to the well-known mortality incidents with some cetaceans, does not necessarily mean that noise has negligible consequences on pinniped conservation, and more attention should be dedicated to achieving a better understanding of possible impacts. For instance, some pinnipeds may not appear to have been physically displaced by loud noise, moving instead to the sea surface, but these animals may be effectively prevented from foraging, due to an ensonified foraging environment.

It is important that assessment of impact for pinnipeds considers both the physiological impact (TTS and PTS) as well as the very real possibility of masking, causing both behavioural responses and making prey less available.

B.5.5. Species not listed on the CMS Appendices that should also be considered during assessments

The following species are also sensitive to anthropogenic marine noise:

- walrus, *Odobenus rosmarus*
- harbour seal, *Phoca vitulina*
- northern elephant seal, *Mirounga angustirostris*
- southern elephant seal, *Mirounga leonine*
- Caspian seal, *Phoca caspica*
- Australian sea lion, *Neophoca cinerea*
- Hawaiian monk seal, *Neomonachus schauinslandi*

References

Bohne, BA Thomas, JA Yohe, E. and Stone, S. 1985. ‘Examination of potential hearing damage in Weddell seals (*Leptonychotes weddellii*) in McMurdo Sound, Antarctica’, *Antarctica Journal of the United States*, 19(5), pp 174-176.

Campbell, RA Gales, NJ, Lento, GM. and Baker, CS. 2008. ‘Islands in the sea: extreme female natal site fidelity in the Australian sea lion, *Neophoca cinerea’*, *Biology Letters*, 23, pp139-142.

Cronin, M Pomeroy, P. and Jessopp M. 2013. ‘Size and seasonal influences on the foraging range of female grey seals in the northeast Atlantic’. *Marine Biology*. 2013 Mar 1,160(3):531-9.

Hanke, W Wieskotten, S Niesterok, B Miersch, L Witte, M Brede, M Leder, A. and Dehnhardt, G. 2012. ‘Hydrodynamic perception in pinnipeds’ in: Nature-inspired fluid mechanics. (Springer: Berlin Heidelberg) 255-270

Gordon, JCD Gillespie, D Potter, J Frantzis, A Simmonds, M.P Swift, R Thompson, D. 2003. ‘The effects of seismic surveys on marine mammals’. *Marine Technology Society Journal* 37(4):14-32.

Harris, RE Miller, GW. and Richardson, WJ. 2001. ‘Seal Responses to Airgun Sounds During Summer Seismic Surveys in the Alaskan Beaufort Sea’, *Marine Mammal Science*. 17:795–812.

Kastak, D. and Schusterman, RJ. 1998. ‘Low-frequency amphibious hearing in pinnipeds: Methods, measurements, noise, and ecology’. *The Journal of the Acoustical Society of America*. 103(4):2216-28.

Kastak, D Southall, BL Schusterman, RJ. and Kastak, CR. 2005. ‘Underwater temporary threshold shift in pinnipeds: Effects of noise level and duration’, *The Journal of the Acoustical Society of America*. 118, 3154.

Kastelein, RA Mosterd, P Van Santen, B Hagedoorn, M. and de Haan, D. 2002. ‘Underwater audiogram of a Pacific walrus (*Odobenus rosmarus divergens*) measured with narrow-band frequency-modulated signals’. *The Journal of the Acoustical Society of America*. 112(5):2173-82

Kelly, BP Burns, JJ. and Quakenbush, LT. 1988. ‘Responses of ringed seals (*Phoca hispida*) to noise disturbance’, *Port and Ocean Engineering Under Arctic Conditions*. 2:27-38.

Lowther, AD Harcourt, RG Hamer, DJ and Goldsworthy, SD. 2011. ‘Creatures of habit: foraging habitat fidelity of adult female Australian sea lions’, *Mar. Ecol. Prog. Ser*. 443:249-263.

Miersch, L Hanke, W Wieskotten, S Hanke, FD Oeffner, J Leder, A Brede, M Witte, M. and Dehnhardt, G. 2011. ‘Flow sensing by pinniped whiskers’. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*. 366(1581):3077-84.

NOAA. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

Reichmuth, C Holt, M Mulsow, J Sills, J. and Southall B. 2013. ‘Comparative assessment of amphibious hearing in pinnipeds’. *Journal of Comparative Physiology* A.199:491-507.

Renouf, D. 1979. ‘Preliminary measurements of the sensitivity of the vibrissae of Harbour seals (*Phoca vitulina*) to low frequency vibrations’, *Journal of Zoology*. 188:443-450.

Shatz, LF. and De Groot, T. 2013. ‘The frequency response of the vibrissae of harp seal, *Pagophilus groenlandicus*, to sound in air and water’. *PloS ONE*. 22,8(1):e54876.

Southall, B Schusterman, R. and Kastak. D. 2000. ‘Masking in three pinnipeds: Underwater, low-frequency critical ratios’. *The Journal of the Acoustical Society of America*. 108:1322-6.

Villegas-Amtmann, S Jeglinski, JW Costa, DP Robinson, PW. and Trillmich F. 2013. ‘Individual foraging strategies reveal niche overlap between endangered Galapagos pinnipeds’. *PloS ONE*. 15,8(8):e70748.

B.6. Polar Bears

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Consider when assessing

- Seismic surveys
- Civil high power sonar
- Coastal and offshore construction works
- Offshore platforms
- Playback and sound exposure experiments
- Pingers and other noise-generating activities

Related modules

- Refer also to modules B.1 and B.5 when assessing impact to polar bears

B.6.1. Species Vulnerabilities

There are two studies of polar bear hearing, showing that polar bears have hearing similar to humans, and that best sensitivity was shown between 11.2 – 22.5 kHz (Nachtigall *et al* 2007), and 8 – 14 kHz (Owen and Bowles 2011).

There have not been many specific studies of polar bears and noise. It has been shown that polar bears in Spitsbergen are disturbed by snowmobiles and can show strong behavioural reactions on a distance of 2-3 km, females with cubs showing stronger reactions at longer distance than adult males (Andersen and Aars 2008).

Polar bear would be highly vulnerable when hunting, as they are hunting for seals and depend on stealth, either by sneaking up on seals or by waiting at seal breathing holes in the ice (Stirling 1974, Stirling and Latour 1978). Studies indicate that denning females could be somewhat protected from noise from seismic air guns, although they could be vulnerable if sound sources are within close proximity of the den (less than 100 m) (Blix and Lentfer 1992).

B.6.2. Habitat Considerations

Polar bear's essential habitat is sea ice. Polar bears would prefer to stay on sea ice covering shallow and productive shelf areas (Durner *et al* 2009, Schliebe *et al* 2006). There would be particular concerns associated with all activities that have an impact in areas which resource selection functions have shown are preferred sea ice habitat for polar bears (Durner *et al* 2009).

Some models project an ice-free Arctic Basin in summer in just a few years from now, before 2020 (Maslowski *et al* 2012), and modelling studies have shown that most subpopulations will be reduced and experience large environmental stress (Amstrup *et al* 2008, Hamilton *et al* 2014).

Although not exclusively associated with specific habitats, there are certain activities that might be a concern. Some industrial activities are located in important habitat, of special concern is oil drilling activities on sea ice in productive sea areas, and the prospect of new developments of petroleum exploration in critical habitat, especially in North America. It must be noted that there are little or no specific studies of the effect of noise or manmade sound on polar bears, thus the level of impact is to a large degree inferred from general expert knowledge of the effect of disturbance on these animals.

Future impact from disturbance from sound exposure needs to be focused on denning areas in spring, and areas of sea ice and glacier fronts that are used by females with cubs-of-the-year to find food immediately after den emergence. Arctic areas in northern Canada, bordering to the Arctic Basin are generally the areas where one expects sea ice habitat to persist for the longest period (Amstrup *et al* 2007).

B.6.3. Impact of Exposure Levels

Given the specific vulnerability of polar bears to habitat loss, the exposure level of polar bears, especially in denning areas in spring and areas of sea ice and glacier fronts that are used by females with cubs-of-the-year to find food immediately after den emergence should be prioritized.

B.6.4. Assessment Criteria

An assessment of the future impact of noise would have to take into account the dramatically decreasing area of critical sea ice habitat, in some areas the length of the ice-free period from ice melt in spring till ice freeze-up in fall, has increased by more than 140 days in the period 1979-2015 (Laidre *et al* 2015).

A minimum would be that EIAs on impact of sound would assess to what extent sound exposure would be detrimental to reproductive success by directly considering the effect of sound in denning areas and productive sea ice areas in the vicinity of denning areas, and also areas of sea ice over productive shelf areas.

References

Amstrup, SC Marcot, BG. and Douglas, DC. 2007. Forecasting the range-wide status of polar bears at selected times in the 21st century. p. 126 pp.

Amstrup, SC Marcot, BG. and Douglas, DC 2008. 'A Bayesian network modelling approach to forecasting the 21st century worldwide status of polar bears'. Arctic sea ice decline: observations, projections, mechanisms, and implications (American Geophysical Union: Washington DC) 213-268

Andersen M. and Aars J. 2008. 'Short-term behavioural response of polar bears (*Ursus maritimus*) to snowmobile disturbance'. *Polar Biology* 31, 501-507.

Blix AS. and Lentfer JW. 1992. 'Noise and vibration levels in artificial polar bear dens as related to selected petroleum exploration and development activities'. *Arctic* 45, 20-24.

Durner, GM Douglas, DC Nielson, RM Amstrup, SC McDonald, TL Stirling, I Mauritzen, M Born, EW Wiig, Ø DeWeaver, E. and Serreze, MC. 2009. 'Predicting 21st century polar bear habitat distribution from global circulation models'. *Ecological Monographs* 79, 25-58.

Hamilton, SG de la Guardia, LC Derocher, AE Sahanatien, V Tremblay, B. and Huard, D. 2014. 'Projected polar bear sea ice habitat in the Canadian Arctic Archipelago'. *Plos One* 9, e113746.

Laidre, KL Stern, H Kovacs, KM Lowry, L Moore, SE Regehr, EV Ferguson, SH Wiig, Ø Boveng, P Angliss, RP. and Born, EW. 2015 'Arctic marine mammal population status, sea ice habitat loss, and conservation recommendations for the 21st century'. *Conservation Biology* 29, 724-737.

Maslowski, W Kinney, JC Higgins, M Roberts, A. 2012. 'The future of Arctic sea ice'. *Annual Review of Earth and Planetary Sciences* 40, 625-654.

Nachtigall, PE Supin, AY Amundin, M Röken, B Møller, T Mooney, TA Taylor. KA. and Yuen, M. 2007. 'Polar bear *Ursus maritimus* hearing measured with auditory evoked potentials'. *Journal of Experimental Biology* 210, 1116-1122.

Owen, MA. and Bowles, AE. 2011. 'In-air auditory psychophysics and the management of a threatened carivore, the polar bear (*Ursus maritimus*)'. *International Journal of Comparative Psychology* 24, 244-254.

Schliebe, S Evans, T Johnson, K Roy, M Miller, S Hamilton, C Meehan, R. and Jahrsdoerfer, S. 2006. 'Range-wide status review of the polar bear (*Ursus maritimus*)' (US Fish and Wildlife Service: Alaska) 262

Stirling, I. 1974. 'Midsummer observations on the behavior of wild polar bears (*Ursus maritimus*)'. *Canadian Journal of Zoology* 52, 1191-1198.

Stirling, I. and Latour, PB. 1978. 'Comparative hunting abilities of polar bear cubs of different ages'. *Canadian Journal of Zoology* 56, 1768-1772.

B.7. Sirenians

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Consider when assessing

- Military sonar
- Seismic surveys
- Civil high power sonar
- Coastal construction works
- Playback and sound exposure experiments
- Vessel traffic greater than 100 metric tons
- Vessel traffic less than 100 metric tons
- Pingers and other noise-generating activities

Related CMS agreements

- MOU Concerning the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia (West African Aquatic Mammals)
- MOU on the Conservation and Management of Dugongs (*Dugong dugon*) and their Habitats throughout their Range (Dugong)

B.7.1. Species Vulnerabilities

Even though traditional ecological knowledge and field observations (Marsh *et al* 1978, Hartman 1979) suggest that sirenians (manatees and dugongs) have 'exceptional acoustic sensitivity', scientific research on their hearing and reactions to marine noise is relatively sparse. Published hearing studies are based on the Florida manatee, *Trichechus manatus latirostis*, while behavioural studies on reactions to noise are limited to the Florida manatee, the Antillean manatee, *Trichechus manatus,* and the dugong, *Dugong dugon*. Although most of this research is limited to sounds in water, behavioural observations indicate that sirenians are capable of detecting some sounds in air above the surface (Hartman 1979).

Evoked potentials recorded for Florida manatees (Bullock *et al* 1982, Mann *et al* 2005) demonstrated variable sensitivity over a range of frequencies from about 200Hz to 35–40 kHz with greatest sensitivity in the lower range at 1–1.5 kHz. In-water behavioural audiograms of four captive Florida manatees identified the frequency range of best hearing as 6 to 32 kHz (Gerstein *et al* 1999, Gerstein 2002, Gaspard *et al* 2012), with individual variation within this range. Peak hearing sensitivity has been variously reported as 16-18 kHz (Gerstein *et al* 1999, Gerstein 2002) and 8 kHz (Gaspard *et al* 2012). Gaspard *et al* (2012) also reported that one of their test animals appeared to be able to hear loud sounds as low as 0.25 kHz and ultrasonic frequencies as high as 90.5 kHz. Gerstein *et al* (1999) speculated that the greater sensitivity to higher frequencies observed in their audiogram research may be an adaptation that enabled manatees to avoid the complications associated with perceiving sound reflections propagated from the water–air interface (Lloyd mirror effect) in the shallow depths typical of their habitats, raising the interesting question of what these animals can hear when at the surface.

Both Gerstein (1999) and Gaspard *et al* (2012) conducted in-water behavioural experiments on captive Florida manatees to measure critical ratios. The differences in their results likely reflect both their different experimental protocols and individual differences in the manatees' responses. Gaspard *et al* (2012) found that the manatees have relatively narrow auditory filters and struggle to hear lower and higher pitched sounds above background noise. However, manatee hearing was much sharper at 8 kHz – the frequency at which manatees communicate – where they could still distinguish tones that were only 18.3 dB louder than the background. This estimate of the manatee's critical ratio (8 kHz) is among the lowest measured in mammals (Gaspard *et al* 2012) suggesting that generic marine mammal impact guidelines may not be appropriate for sirenians.

Field studies show that both the Florida manatee (Miksis-Olds *et al* 2007) and the dugong (Hodgson and Marsh 2007) exhibit short-term behavioural responses to noise. Miksis-Olds and Wagner (2010) showed that elevated sound levels affect the patterns of behaviour of the Florida manatee and that the response is a function of the manatee's behavioural state. When ambient sounds were highest, the manatees spent more time feeding and less time milling. In contrast, Hodgson and Marsh's (2007) experimental and behavioural studies showed that the time that dugongs spent feeding and travelling was unaffected by boat presence, the number of boat passes and whether a pass included a stop and restart. However, focal dugongs were less likely to continue feeding if the boat passed within 50 m, than if the boat passed at a greater distance. Boats passing at a range of speeds, and at distances of less than 50 m to over 500 m evoked mass movements of dugong feeding herds, but such movements only lasted a couple of minutes. Castelblanco-Martínez and Arévalo-González (2015) experimentally studied the effects of side-scan sonar operating 455 kHz on the behaviour of 12 captive Antillean manatees. All the observed manatees variously showed behavioural changes including stopping foraging and feeding, significantly reducing displacement and remaining still at the bottom or at the surface, and increasing displacement behaviour. One male displayed continuous spinning movements for almost the entire experimental session. Most animals avoided the area nearest to the transducer.

Sirenians are not wilderness animals (Marsh *et al* 2011). Manatees occur in the inshore waters of Florida and have continued to use the intra-coastal waterway and residential canal estates, despite a high level of vessel activity (for references see Marsh *et al* 2011). Dugongs continue to use Johore Strait between Singapore and Peninsula area, one of the most heavily-used coastal waterways in the world, and are often detected in ports and military training areas along the Queensland east coast on the basis of their feeding trails and satellite tracking (Marsh *et al* 2011, Cleguer *et al* 2016). Hodgson *et al* (2007) experimentally tested the behavioural responses of dugongs to 4 and 10 kHz acoustic alarms (pingers). The rate of decline of the number of dugongs within the focal arena did not change significantly while pingers were activated. Dugongs passed between the pingers irrespective of whether the alarms were active or inactive, fed throughout the experiments and did not change their orientation to investigate pinger noise, or their likelihood of vocalizing. Thus despite the short-term behavioural responses noted above, there is no evidence that wild dugongs or Florida manatees are displaced by underwater noise, including side scan sonar (Gonzalez-Socoloske *et al* 2009). The reaction of dugongs and manatees to impulsive sounds does not appear to have been formally tested.

Both manatees and dugongs use underwater sound for communication. There have been numerous studies of sirenian communication sounds (see Marsh *et al* 2011) Characteristics of individual call notes seem fairly similar among the species of sirenians. Frequency ranges are typically from 1 to 18 kHz, often with harmonics and non-harmonically related overtones (e.g Anderson and Barclay 1995, Sousa-Lima *et al* 2002, O'Shea and Poche 2006).

Adults of both sexes produce vocalizations, but exchanges of communication calls are most common between cows and their nursing calves. Florida manatee calves vocalize at much greater rates than adults (Sousa-Lima *et al* 2002, O'Shea and Poche 2006). Manatees other than cows and calves vocalize at rates that vary with activity and behavioural context, and are lowest during resting, intermediate while travelling, and highest at nursing and other social situations (Reynolds 1981, Bengtson and Fitzgerald 1985, Williams 2005, O'Shea and Poche 2006, Miksis-Olds and Tyack 2009). Dugongs seem to vocalize more often during dark, early morning hours (Ichikawa *et al* 2006). No data are available on vocal communication in African manatees, *Trichechus senegalensis*, although recordings and sound spectrograms of calls of an isolated captive calf in Cote d'Ivoire were similar to those of some Florida and Amazonian manatee calves (TJ O'Shea unpublished). Florida manatees may alter vocalization parameters in response to environmental noise levels (Miksis-Olds and Tyack 2009). Sakamoto *et al* (2006) attempted to quantify the effect of vessel noise on the vocal characteristics of dugongs (number of call per minute, dominant frequency and call duration). None of the changes was significant.

We know of no information regarding PTS, TTS or noise-induced auditory damage in sirenians.

B.7.2. Habitat Considerations

In the marine environment, both manatees and dugongs mostly occur in shallow waters because of their dependence of seagrass communities (Marsh *et al* 2011). Antillean and African manatees are both riverine and estuarine and in the marine environment mainly occur in water less than 5 m deep. Dugongs are strictly marine, feeding in waters up to about 35 m deep. They may occasionally cross ocean trenches (see Marsh *et al* 2011), but typically spend most of their lives in much shallower inshore coastal and island waters often commuting with the tide to or from intertidal seagrass meadows (Marsh *et al* 2011). There is increasing evidence that dugong migration corridors follow topographic features such as coastlines (Zeh *et al* 2016 in press) or reef crests (Cleguer 2015).

B.7.3. Impact of Exposure Levels

Given that the available evidence suggests that manatees and dugongs are unlikely to be displaced by noise, the most practical approach to reducing the risk of impacts is avoidance of the overlap of acute sound impacts with seasonal aggregation sites and periods when the animals are likely to be under stress. Seasonal aggregation sites are most likely at the high latitude limits of the ranges of dugongs and manatees and typically occur as a behavioural repose to thermal conditions or prolonged periods of rough weather (see Marsh *et al* 2002 and 2011 for details of some well-known sites in Florida, Australia and the Arabian region). Site-specific information on this topic should be a focus of the Environmental Impact Assessment process. Extreme weather events such as cyclones or prolonged cold fronts can cause substantial increases in mortality (Marsh *et al* 2011, Meager and Limpus 2013) and noisy construction impacts should be planned to avoid times of likely environmental stress.

B.7.4. Assessment Criteria

We know of no field studies on the effects of anthropogenic noise, other than vessel noise on sirenians. The effect of vessel noise *per se* seems much less than that of vessel collisions. This lack of evidence does not prove that noise has negligible consequences for sirenian conservation, and more attention should be dedicated to a better understanding of possible impacts and ways to ameliorate them. A precautionary approach to the exposure of manatees and dugongs to noise, especially at key habitats and aggregation sites, is warranted.

References

Anderson, PK. and Barclay, RMR. 1995. 'Acoustic signals of solitary dugongs: physical characteristics and behavioral correlates'. Journal of Mammalogy, 76, 1226–1237.

Bengtson, JL. and Fitzgerald, SM. 1985. Potential role of vocalizations in West Indian manatees. Journal of Mammalogy, 66, 816–819.

Bullock, TH O'Shea, TJ. and McClune, MC. 1982. 'Auditory evoked potentials in the West Indian manatee (Sirenia: *Trichechus manatus*)'. Journal of Comparative Physiology A. Sensory, Neural, and Behavioral Physiology, 148, 547–554.

Castelblanco-Martínez , N. and Arévalo-González, K. 2015. 'Behavioral reaction of manatees to a side-scan sonar: preliminary results'. Abstract of presentation at 21st Biennial Meeting of the Society of Marine Mammalogy San Francisco, December 2015.

Cleguer, C. 2015. 'Informing dugong conservation at several spatial and temporal scales in New Caledonia'. PhD thesis, James Cook University, Australia.

Cleguer, C Limpus, C.G Gredzens, C Hamann, M Marsh, H. 2015. 'Annual report on dugong tracking and habitat use in Gladstone in 2014'. Report produced for the Ecosystem Research and Monitoring Program Advisory Panel as part of Gladstone Ports Corporation's Ecosystem Research and Monitoring Program.

Gaspard, I Joseph Bauer, G Reep, R Dziuk, K Cardwell, A Read, L Mann, D. 2012. 'Audiogram and auditory critical ratios of two Florida manatees (*Trichechus manatus latirostris*)'. Journal of Experimental Biology 215, 1442-1447

Gerstein, ER. 1999. 'Psychoacoustic evaluations of the West Indian manatee'. PhD dissertation, Florida Atlantic University, Boca Raton, FL USA.

Gerstein, E. 2002. 'Manatees, bioacoustics and boats'. American Scientist, 90, 154–163.

Gerstein, ER Gerstein, L Forsythe, SE. and Blue, JE. (1999). 'The underwater audiogram of the West Indian manatee (*Trichechus manatus*)'. Journal of the Acoustical Society of America, 105, 3575–3583.

Gonzalez-Socoloske, D Olivera-Gomez, DL. and Ford, RE. 2009. 'Detection of free-ranging West Indian manatees *Trichechus manatus* using side-scan sonar'. Endangered Species Research. 8: 249-257.

Hartman, DS. 1979. 'Ecology and behavior of the manatee (Trichechus manatus) in Florida'. American Society of Mammalogists Special Publication, 5, 1–153.

Hodgson, AJ. and Marsh, H. 2007. 'Response of dugongs to boat traffic: the risk of disturbance and displacement'. Journal of Experimental Marine Biology and Ecology, 340, 50–61.

Hodgson, AJ Marsh, H Delean, S. and Marcus, L. 2007. 'Is attempting to change marine mammal behaviour a generic solution to the bycatch problem? A dugong case study'. Animal Conservation, 10, 263–273.

Ichikawa, K Tsutsumi, C Arai, N. *et al* 2006. 'Dugong (*Dugong dugon*) vocalization patterns recorded by automatic underwater sound monitoring systems'. The Journal of the Acoustical Society of America, 119, 3726–3733.

Mann, DA O'Shea, TJ. and Nowacek, DP. 2006. 'Nonlinear dynamics in manatee vocalizations. Marine Mammal Science', 22, 548–555.

Marsh, H Spain, A. V. and Heinsohn, G. E. 1978. 'Minireview: physiology of the dugong. Comparative Biochemistry and Physiology', 61, 159–168.

Marsh, H Penrose, H Eros, C. and Hugues, J. 2002. 'The dugong (*Dugong dugon*) status reports and action plans for countries and territories in its range.' Early Warning and Assessment Reports. Nairobi: United Nations Environment Programme. 162 pp.

Marsh, H, O'Shea, TJ, Reynolds, JE III. 2011. 'The ecology and conservation of Sirenia: dugongs and manatees'. Cambridge University Press. 521pp.

Meager JJ, Limpus C. 2014. 'Mortality of Inshore Marine Mammals in Eastern Australia Is Predicted by Freshwater Discharge and Air Temperature'. PLoS ONE. 9(4):e94849.

Miksis-Olds, JL. and Tyack, PL. 2009. 'Manatee (*Trichechus manatus*) vocalization usage in relation to environmental noise levels'. Journal of the Acoustical Society of America, 125, 1806–1815.

Miksis-Olds, JL Donaghay, PL Miller, JH Tyack, PL. and Reynolds III, JE. 2007. 'Simulated vessel approaches elicit differential responses from manatees'. Marine Mammal Science, 23, 629–649.

Miksis-Olds, JL and Wagner, T. 2010. Behavioral response of manatees to environmental sounds levels. Marine Mammal Science, 27 130-148.

O'Shea, TJ. and Poche, LB. 2006. 'Aspects of underwater sound communication in Florida manatees (*Trichechus manatus latirostris*)'. Journal of Mammalogy, 87, 1061–1071.

Reynolds III, JE. 1981. 'Aspects of the social behaviour and herd structure of a semi-isolated colony of West Indian manatees, *Trichechus manatus*'. Mammalia, 45, 431–451.

Sakamoto, S Ichikawa, K Akamatsu, T Shinke, T Arai, N Hara, T Adulyanukosol, K. 2006. 'Effect of ship sound on the vocal behavior of dugongs'. Proceedings of the 3rd International Symposium on SEASTAR2000 and Asian Bio-logging Science (The 7th SEASTAR 2000 workshop) 69-75.

Sousa-Lima, RS Paglia, AP. and Da Fonseca, GAB. 2002. 'Signature information and individual recognition in the isolation calls of Amazonian manatees, *Trichechus inunguis* (Mammalia: Sirenia)'. Animal Behaviour, 63, 301–310.

Williams, LE. 2005. 'Individual distinctiveness, short- and long-term comparisons, and context specific rates of Florida manatee vocalizations'. MS Thesis, University of North Carolina, Wilmington.

Zeh . DR Michelle R. Heupel, MR Hamann, M Limpus, CJ Marsh, H. 2016. 'Quick Fix GPS technology highlights risk to marine animals moving between protected areas'. Endangered Species Research, 30, 37-44

B.8. Marine and Sea Otters

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Consider when assessing

- Seismic surveys
- Civil high power sonar
- Coastal and offshore construction works
- Playback and sound exposure experiments
- Vessel traffic greater than 100 metric tons
- Vessel traffic less than 100 metric tons
- Pingers and other noise-generating activities

Related modules

- Refer also to modules B.10, B.12 and C when assessing impact to marine and sea otters

B.8.1. Species Vulnerabilities

The marine otter, *Lontra feline,* and sea otter, *Enhydra lutris,* are amphibious marine mammals that may be vulnerable to coastal anthropogenic disturbance. Auditory thresholds for sea otters have been measured in air and underwater from 125 Hz to 40 kHz. Critical ratios data indicate that although sea otters can detect underwater sounds, their hearing appears to be primarily air adapted and not specialized for detecting signals in background noise. (Ghoul and Reichmuth 2012, 2014, 2016)

B.8.2. Habitat Considerations

There is little definitive research available about the specific anthropogenic noise vulnerabilities of this species group, but given the frequency range of hearing and the knowledge that these animals are social communicators and benthic foragers, (McShane *et al* 1995, Leuchtenberger *et al* 2014, Lemasson *et al* 2014, Thometz *et al* 2015) this species group should be considered. Their dependence on restricted nearshore habitats puts sea otters at risk from acoustic disturbance and activities occurring both on land and at sea. (Ghoul and Reichmuth 2016)

B.8.3. Impact of Exposure Levels

Ghoul and Reichmuth (2016) have conducted the only known assessment of sea otter hearing sensitivity. They found that hearing was most sensitive at 8 and 16 kHz, where measured thresholds were the lowest at 69 dB re 1 μPa. The range of best sensitivity in water spanned ~4.5 octaves, from 4 to 22.6 kHz. The roll-off in high-frequency hearing was typically steep and had a 28-dB increase within a half-octave frequency step. Low-frequency hearing (0.125–1 kHz) was notably poor. The sea otter was unable to detect signals below 100 dB re 1 μPa within this frequency range. Noise spectral density levels in the underwater testing enclosure were sufficiently low to ensure that the measured thresholds were not influenced by background noise, especially at frequencies above 0.5 kHz, where noise levels were below 60 dB re 1 μPa/√Hz. (Ghoul and Reichmuth 2016)

B.8.4. Assessment Criteria

Regulators estimating zones of auditory masking for sea otters should follow the guidance given for other marine mammals and opt for conservative estimates until additional data are available. (Southall *et al* 2000)

B.8.5. Species not listed on the CMS Appendices that should also be considered during assessments

Sea otters, *Enhydra lutris*, are classified by IUCN as Endangered, and should also be considered during assessments.

References

Ghoul, A and Reichmuth, C 2012. Sound production and reception in southern sea otters (*Enhydra lutris nereis*). In *The effects of noise on aquatic life.* Springer: 157-59.

Ghoul, A. and Reichmuth, C. 2014. Hearing in sea otters (*Enhydra lutris*): audible frequencies determined from a controlled exposure approach. *Aquatic mammals*. 40, 3: 243.

Ghoul, A. and Reichmuth, C. 2015. Auditory Sensitivity and Masking Profiles for the Sea Otter (*Enhydra lutris*). In *The Effects of Noise on Aquatic Life II*. Popper, AN. and Hawkins, A. (eds) Springer: 349-54.

Lemasson, A Mikus, M Blois-Heulin, C. and Lodé, T. 2014. Vocal repertoire, individual acoustic distinctiveness, and social networks in a group of captive Asian small-clawed otters (Aonyx cinerea). *Journal of Mammalogy*. 95, 1: 128-39.

Leuchtenberger, C Sousa-Lima, R Duplaix, N Magnusson, WE and Mourão, G. 2014. Vocal repertoire of the social giant otter. *The Journal of the Acoustical Society of America*. 136, 5: 2861-75.

McShane, LJ Estes, JA Riedman, ML. and Staedler, MM. 1995. Repertoire, structure, and individual variation of vocalizations in the sea otter. *Journal of Mammalogy*. 76, 2: 414-27.

Southall, BL Schusterman, RJ. and Kastak, D. 2000. Masking in three pinnipeds: Underwater, low-frequency critical ratios. *The Journal of the Acoustical Society of America*. 108, 3: 1322-26.

Thometz, NM Murray, MJ and Williams, TM. 2015. Ontogeny of oxygen storage capacity and diving ability in the Southern Sea Otter (*Enhydra lutris nereis*): costs and benefits of large lungs. *Physiological and Biochemical Zoology*. 88, 3: 311-27.

B.9. Marine Turtles

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Consider when assessing

- Military sonar
- Seismic surveys
- Civil high power sonar
- Coastal and offshore construction works
- Offshore platforms
- Playback and sound exposure experiments
- Vessel traffic greater than 100 metric tons
- Vessel traffic less than 100 metric tons
- Pingers and other noise-generating activities

Related CMS agreements

- MOU Concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa (Atlantic marine turtles)
- MOU on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA)

Related modules

- Refer also to modules B.12 and C when assessing impact to marine turtles

B.9.1. Species Vulnerabilities

Although the ecological role of hearing has not been well studied for sea turtles, hearing capacity has been inferred from morphological and electrophysiological studies. (Southwood *et al* 2008)

Sea turtles do not have an external ear, in fact, the tympanum is simply a continuation of the facial tissue. Researchers have speculated that the cochlea and saccule are not optimized for hearing in air, but rather are adapted for sound conduction through two media, bone and water. Recent imaging data strongly suggest that the fats adjacent to the tympanal plates in at least three sea turtle species are highly specialized for underwater sound conduction. (Moein Bartol and Musick, 2003)

Hearing range (50-1200 Hz: Viada *et al* 2008, Martin *et al* 2012, Popper *et al* 2014) coincides with the predominant frequencies of anthropogenic noise, increasing the likelihood that sea turtles might experience negative effects from noise exposure.

At present, sea turtles are known to sense low frequency sound, however, little is known about the extent of noise exposure from anthropogenic sources in their natural habitats, or the potential impacts of increased anthropogenic noise exposure on sea turtle biology. Behaviour responses have been clearly demonstrated. (Samuel *et al* 2005)

Prolonged exposure could be highly disruptive to the health and ecology of the animals, encouraging avoidance behaviour, increasing stress and aggression levels, causing physiological damage through either temporary or even permanent threshold shifts, altering surfacing and diving rates, or masking orientation cues. (Samuel *et al* 2005)

B.9.2. Habitat Considerations

Sea turtles have been shown to exhibit strong fidelity to fixed migratory corridors, habitual foraging grounds, and nesting areas (Avens *et al* 2003), and such apparent inflexibility could prevent sea turtles from selecting alternate, quieter habitats.

The potential of noise for displacing turtles from their favoured or optimal habitat is unknown, but if it were to occur it could have negative consequences on growth, orientation, etc.

B.9.3. Impact of Exposure Levels

Sea turtles are low frequency specialists, but their range appears to differ between populations. Animals belonging to one population of subadult green turtles have been shown to detect frequencies between 100-500 Hz with their most sensitive hearing between 200-400Hz. Another responded to sounds from 100-800 Hz, with their most sensitive range being 600-700Hz. Juvenile Kemp's ridley turtles had a range of 100-500Hz, with their most sensitive hearing been 110-200Hz. (Moein Bartol and Ketten, 2006)

B.9.4. Assessment Criteria

It is important that assessment of impact for sea turtles both considers the physiological impact (TTS and PTS) as well as the very real possibility of masking prey movements, and impacts to nesting behaviour, in particular during inter-nesting resting. Some sea turtles may not appear to noise-generating industries to have been physically displaced by loud noise but these animals may be effectively prevented from foraging, due to an ensonified foraging environment.

Possible effects of distribution (avoidance behaviour) orientation and even communication (e.g in the hatching phase) cannot be discounted.

References

Martin KJ, Alessi SC, Gaspard JC, Tucker AD, Bauer GB, Mann DA. 2012. Underwater hearing in the loggerhead turtle (*Caretta caretta*): a comparison of behavioral and auditory evoked potential audiograms. J Exp Biol 215:3001-3009

Moein Bartol, S. and Ketten, DR. 2006. Turtle and tuna hearing. Sea turtle and pelagic fish sensory biology: developing techniques to reduce sea turtle bycatch in longline fisheries.

Moein Bartol, S. and Musick, JA, 2003. Sensory biology of sea turtles. In: Lutz PL, Musick JA, Wyneken J (eds) The biology of sea turtles, Vol 2. CRC Press, Boca Raton, FL, 79–102

Popper AN, Hawkins AD, Fay RR, Mann D, Bartol S, Carlson T, Coombs S, Ellison WT, Gentry R, Halvorsen MB. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Springer

Samuel, Y, Morreale, SJ, Clark, CW, Greene, CH and Richmond, ME. 2005. Underwater, low-frequency noise in a coastal sea turtle habitat. The Journal of the Acoustical Society of America. 117, 3: 1465-72.

Southwood, A Fritsches, K Brill, R. and Swimmer, Y. 2008. Sound, chemical, and light detection in sea turtles and pelagic fishes: sensory-based approaches to bycatch reduction in longline fisheries. Endangered Species Research. 5, 2-3: 225-38.

Viada ST, Hammer RA, Racca R, Hannay D, Thompson MJ, Balcom BJ, Phillips NW. 2008. Review of potential impacts to sea turtles from underwater explosive removal of offshore structures. Environ Impact Assess Rev 28:267-285

B.10. Fin-fish

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Consider when assessing

- Seismic surveys
- Civil high power sonar
- Coastal and offshore construction works
- Vessel traffic greater than 100 metric tons
- Vessel traffic less than 100 metric tons

Related CMS agreements

- Agreement on the Conservation of Cetaceans of the Black Seas Mediterranean Seas and Contiguous Atlantic Area (ACCOBAMS)
- Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)
- MOU for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region (Pacific Islands Cetaceans)
- MOU Concerning the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia (West African Aquatic Mammals)
- Agreement on the Conservation of Seals in the Wadden Sea (Wadden Sea seals)
- MOU Concerning Conservation Measures for the Eastern Atlantic Populations of the Mediterranean Monk Seal (*Monachus monachus*) (Atlantic monk seals)
- MOU Concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa (Atlantic marine turtles)
- MOU on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA)
- MOU on the Conservation of Migratory Sharks (Sharks)

Related modules

- Refer also to modules B.12 when assessing impact to fish

B.10.1. Species Vulnerabilities

The use of explosives will kill fin-fish inside a certain range (Yelverton *et al* 1975), with impact zones given in Popper *et al* (2014). Intense non-explosive, impulse noise such as pile driving or seismic surveys may impact adult fin-fish by: a) creating physiological damage such as rupturing gas spaces (ie. Halverson *et al* 2012), b) damaging sensory systems (McCauley *et al* 2003), c) creating adverse behavioural responses (e.g. Pearson *et al* 1996, McCauley *et al* 2003, Slotte *et al* 2004, Fewtrell and McCauley 2012, Hawkings *et al* 2014), d) masking the reception of signals of interest, or e) disrupting prey physiology, behaviour or abundance. For fin-fish the sustained but less intense noise from vessels or offshore construction activities may commonly produce behavioural impacts or masking of communication signals as indicated above. Fin-fish exposed to lower level, man-made noise for suitable time periods may receive damage to hearing systems and so suffer a loss of fitness.

There is an enormous amount of variability in the degree of sophistication of fin-fish hearing systems and habits which may pre-dispose or protect them from impacts of man-made noise sources, thus it is difficult to generalize known impacts across all fin-fish species with a high degree of confidence. In general terms: explosives routinely cause fin-fish deaths out to some range and sub-lethal injuries beyond this, pile driving is known to produce serious physiological and organ damage to fin-fish at short range, in some cases marine seismic surveys with air guns have produced hearing damage to fin-fish while in other cases such damage has not been observed, and most man-made noise sources are capable of producing fin-fish behavioural or masking impacts to some degree. Behavioural response to an approaching noise source by fin-fish seems to be reasonably generic, pelagic fin-fish tend to move downwards to eventually lie close to the seabed or flee laterally while site-attached fish may initially seek shelter in refuges or flee. At least some species of fin-fish do habituate to continual and stationary low level noise as they readily colonize man-made offshore facilities. The longer-term implications of consistent behaviour changes or slight physiological impairment from intense signals produced by seismic surveys are not well understood.

Many fin-fish form aggregations at specific times and places to spawn and produce fertilized eggs. Such aggregations may be spaced across several months or may occur only on few occasions per season. Many fin-fish species produce communication sounds as part of such aggregations (ie. McCauley 2001). Disruptions to such fin-fish spawning aggregations by excessive noise causing physiological or behavioural changes and which overlaps a large fraction of the species' seasonal spawning period will have deleterious impacts on the following years reproductive output.

All fin-fish are dependent on smaller prey species which may be impacted by man-made noise sources. Prey may include fin-fish or invertebrates. In general terms small, common, fin-fish prey species, such as sardines, herring or pilchards, have well developed sensory systems thus may be equally or more vulnerable to exposure to intense man-made noise than the larger fin-fish which prey on them. The response of marine invertebrates to intense signals such as seismic survey noise, are poorly known so it is difficult to draw conclusions or comparisons on how invertebrate prey fields will be impacted by noise exposure. Any changes to prey fields induced by a man-made noise source will impact fauna, possibly negatively, higher up the food chain.

All impacts of man-made noise sources on fin-fish need to be gauged at the population level. Noise sources which produce short term impacts, localized impacts compared with a species range, or which do not overlap well with habitats or time and spatial overlap of spawning periods would be expected to be of low severity form a population perspective, and vice versa.

B.10.2. Habitat Considerations

Fin-fish occupy an enormous variety of habitats, from deep ocean depths, pelagic systems, reefs and shoals, estuarine waters to inland waterways. Some fish may utilize multiple habitats on a seasonal or life cycle basis. In general terms habitats which are enclosed, such as estuaries, bays or reefs for site attached fin-fish, may be more susceptible to exposure by intense sound sources as the fin-fish have little options to escape the source. By contrast fin-fish that occupy physically larger spaces, such as oceanic species, have more options of where to flee and may be less constrained by the implications of moving geographical regions to avoid a noise source.

B.10.3. Impact of Exposure Levels

Known impacts of intense impulse noise exposure on fin-fish include consistencies in fish behavioural response to sound, but many anomalies. For high-energy impulse signals, such as seismic survey signals, the following can be said:

Fish behaviour most often changes at some range near to an approaching seismic vessel and generalized changes include diving, lateral spread or fleeing an area (e.g. Pearson *et al* 1996, McCauley *et al* 2003, Slotte *et al* 2004, Fewtrell and McCauley 2012, Hawkings *et al* 2014).

Fish behaviour is strongly impacted by an approaching seismic source above received levels of 145–150 dB re 1 $\mu Pa^2.s$ (SEL) (McCauley *et al* 2003), which equates to around 2–10 km using measured air gun arrays > 2000 cui.

Avoidance to an approaching seismic vessel by fish may be partly driven by the fish behavioural state, with feeding fishes appearing to be more tolerant and in one instance not showing avoidance to an approaching seismic survey vessel (Penä *et al* 2013).

Catch rates in some fisheries are altered during and after seismic operations, prolonged seismic can cause large-scale displacement of fish resulting in decreased fish abundance in and near a seismic operations area and increased fish abundance at long range (tens of km) from the seismic operations area (Engås *et al* 1996, Slotte *et al* 2004),

Long-term monitoring of reef fish community structure before and after a seismic survey programme showed no large-scale change in community structure (Miller and Cripps 2013) and fish sound production behaviour (chorusing) continued after a seismic programme with no apparent long-term change (McCauley 2011),

Exposure to accurately emulated repeated pile driving signals suggest physical injury (organ damage) arises at levels equivalent to 1920 strikes at 179 dB re 1 $\mu Pa^2.s$ or 960 strikes at 182 dB re 1 $\mu Pa^2.s$, or an equivalent single strike SEL of 210–211 dB re 1 $\mu Pa^2.s$ (Halvorsen *et al* 2012).

In a review of experimental findings of sound on fishes Popper *et al* (2014) present sound exposure guidelines for fin-fish in the form of estimated levels at which the following occur: 1) mortality and potential mortal injury, 2) impairment – recoverable injury, 3) impairment – TTS, 4) impairment – masking, and 5) behavioural changes. They present these impacts for three categories of fin-fish, 1) no swim bladder, 2) swim bladder present but no links to otolith system, or 3) swim bladder present with links to otolith system, plus sea turtles and eggs/larvae. Popper *et al* (2014) present this data for sources of explosives, pile driving, air gun arrays, sonar and shipping. Given the lack of experimental evidence for most of these categories they were forced to: 1) either extrapolate from another exposure type, animal group or both, and 2) rather than presenting threshold levels often present the subjectively evaluated likelihood of an impact type occurring at 'near' (tens of m), 'intermediate' (hundreds of m) and 'far' (thousands of m) ranges. The thresholds listed for physical injury (mortality and impairment-recoverable injury) for pile driving and seismic air gun signals are the same, being primarily based on the pile driving work of Halverson *et al* (2012). Readers are referred to Popper *et al* (2014) for the particular thresholds for a fin-fish and sound exposure type as the reader should see their text for the reasoning and caveats behind the values presented.

B.10.4. Assessment Criteria

In assessing impacts of a noise source on fin-fish any EIA document should consider species which:

- are important for commercial fisheries,
- are listed as threatened, vulnerable or are endemic to an area,
- can be considered as important 'bait fish' or are important as prey species for higher order fauna,
- have limited ability to flee an intense noise source,
- utilize a noise impacted area for specific purposes such as feeding or spawning events.

In considering impacts of underwater noise on a species of fin-fish, factors which must be taken into account include:

- hearing capabilities of the species in question including knowledge of morphological adaptations to increase hearing capability, noting fin-fish primarily respond to motion of the water particles and less to measures of sound pressure. Fin-fish have a diverse range of morphological adaptations to improve hearing capability,
- studies of known impacts on this species,
- studies of known impacts on related species either taxonomically, morphologically or in general terms if no other comparison is available (ie. pelagic fishes, benthic fishes etc),
- particular spatial and temporal features which are critical to that fin-fish population's survival (ie. specific feeding areas or prey types, spawning locations and periods).

For migratory fin-fish impact assessment must consider if a noise producing action may cause a species to leave an area and if so, the consequences of this to the species in question, for other fauna and for commercial fisheries which target that species.

References

Engås, A Løkkeborg, S Ona, E and Soldal, A. V. 1996. Effects of seismic shooting on local abundance and catch rates of cod *Gadus morhua* and haddock *Melanogrammus aeglefinus*. Can. J. Fish. Aquat.Sci. 53:2238–2249.

Fewtrell JL McCauley RD. 2012. Impact of airgun noise on the behaviour of marine fish and squid. Marine Pollution Bulletin. 64: 984–993.

Halvorsen, MB Casper, BM Woodley, CM Carlson, TJ Popper, AN. 2012. Threshold for Onset of Injury in Chinook Salmon from Exposure to Impulsive Pile Driving Sounds. PLoS ONE. 7(6): e38968

Hawkins, AD Roberts, L and Cheesman, S. 2014. Responses of free-living coastal pelagic fish to impulsive sounds. J. Acoust. Soc. Am. 135(5)

McCauley, RD. 2001. Biological sea noise in northern Australia: Patterns of fish calling. PhD. Thesis, James Cook University Library

McCauley, RD Fewtrell, J Duncan, AJ Jenner, C Jenner, M-N Penrose, JD Prince, RIT Adhitya, A Murdoch, J McCabe, K. 2003. Marine seismic surveys: analysis and propagation of air-gun signals, and effects of exposure on humpback whales, sea turtles, fishes and squid. In (Anon) "Environmental implications of offshore oil and gas development in Australia: further research", Australian Petroleum Production Exploration Association, Canberra.

McCauley, RD. 2011. Woodside Kimberley sea noise logger program, September 2006 to June 2010: whales, fish and man-made noise. CMST R2010-50, Curtin University, Perth Australia. (http://www.woodside.com.au/OurBusiness/Browse/Documents/Draft%20EIS%202014/F29.PDF)

Miller, I. and Cripps, E. 2013. Three dimensional marine seismic survey has no measurable effect on species richness or abundance of a coral reef associated fish community. Marine Pollution Bulletin 77:63–70.

Pearson, WH Skalski, JR and Malme, CI. 1992. Effects of sounds from a geophysical survey device on behaviour of captive rockfish (*Sebastes* spp.). Can. J. Fish. Aquat. Sci. 49(7):1343-1356

Penä, H Handegard, NO Ona, E. 2013. Feeding herring schools do not react to seismic airgun surveys. ICES Journal of Marine Science, 70(6):1174–1180. doi:10.1093/icesjms/fst079

Popper, AN Hawkins, AD Fay, RF Mann, DA Bartol, S Thomas J. Carlson, TJ Coombs, S Ellison, WT Gentry, RG Halvorsen, MB Løkkeborg, S Rogers, PH Southall, BL Zeddies, DG Tavolga, WN. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. SpringerBriefs in Oceanography, ASA Press, ISSN 2196-1220, ISBN 978-3-319-06658-5 Springer Cham Heidelberg New York Dordrecht London

Slotte, A Hansen, K Dalen, D and Ona, E. 2004. Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. Fisheries Research 67: 143–150.

Yelverton, J. T Richmond, D. R Hicks, W Saunders, K. and Fletcher, E. R. 1975. The Relationship Between Fish Size and their Response to Underwater Blast, Report DNA 3677T, Director. Washington, DC: Defense Nuclear Agency.

B.11. Elasmobranchs

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Consider when assessing

- Military sonar
- Seismic surveys
- Civil high power sonar
- Coastal and offshore construction works
- Offshore platforms
- Playback and sound exposure experiments
- Vessel traffic greater than 100 metric tons
- Vessel traffic less than 100 metric tons
- Pingers and other noise-generating activities

Related CMS agreements

- MOU on the Conservation of Migratory Sharks (Sharks)

Related modules

- Refer also to modules B.10 and B.12 when assessing impact to elasmobranchs

B.11.1. Species Vulnerabilities

Elasmobranchs as a group are poorly studied in relation to the potential impact of anthropogenic sounds, although several studies over time have been directed at particular species of shark to improve knowledge of their hearing mechanisms, abilities and implications for management. From as early as the 1960s (e.g. Nelson and Gruber, 1963), studies have shown that large sharks (*Carcharhinidae, Sphyrnidae*), in their natural environment, were attracted to low-frequency (predominantly 20 to 60 Hz) pulsed sounds, but apparently not to higher frequency (400 to 600 Hz) pulsed sounds, or to low-frequency continuous sounds. More recent research has established the hearing range of sharks to be between 40 Hz to approximately 800 Hz (Myrberg 2001), with possible limits for elasmobranchs in general at 20–1000 Hz (Casper and Mann, 2006, 2010).

Noise within the sharks' audible range may be produced by several anthropogenic sources such as shipping, underwater construction, pile driving, dredging, power stations and sonic surveys. It has been suggested that loud sounds in their audible range may repel sharks whereas low sounds may attract them (Francis and Lyon, 2013), probably as these latter mimics sounds emitted by struggling prey. Response likely depends on its distance from the source and the volume of the source.

Although more recent research in elasmobranch hearing and impacts in the wild have been sparse at best, and nonexistent for most species, there is evidence of habituation or at least no negative reaction to noise levels and frequencies from small boats operating recreational diving or from SCUBA divers' noises, even when these are regularly present and arising from many sources (Lobel, 2009 and personal observations by the author of this summary).

It is likely that elasmobranchs might suffer more impacts from noise through the effects it has on its prey species (Popper and Hastings, 2009, Carlson, 2012), and perhaps through acute events that impact concentration sites such as social groupings of hammerhead sharks, *Sphyrna* spp., and white sharks, *Carcharodon carcharias,* around offshore islands, as well as those gathering at coral reef habitats, in these cases, displacement may occur, either temporary or permanent, although again lack of adequate field research prevents any definitive conclusions. Several studies (eg Klimley and Myrberg 1979, Banner 1972, Myrberg *et al* 1978) indicate that elasmobranchs show consistent withdrawal from sources that are at close range and when confronted with sudden onset of transmissions. However they may habituate to these too if events become frequent (Myrberg, 2001). Seismic activities, pylon-driving operations, explosive construction work and activities involving similar pulsed sound emissions are likely therefore to have the most impact on elasmobranch species directly.

B.11.2. Habitat Considerations

Several species of elasmobranchs exhibit some type of site-fidelity, either permanent or seasonal. This has been observed in particular regarding species of interest to the dive industry. Some species of shark (eg whitetip, *Triaenodon obesus*, blacktip, *Carcharinus melanopterus*, and grey reef, *Carcharhinus amblyrhynchos*) and the reef manta, *Manta alfredi,* are particularly attached to coral reef environments, while others exhibit seasonal concentration around offshore islands (eg hammerheads, *Sphyrna lewini,* at Galápagos, Cocos and Malpelo Islands, white sharks, *Carcharodon carcharias,* at Guadalupe and Farallon Islands, whale sharks, *Rhincodon typus,* at Holbox, Mexico, and several other sites). Giant mantas *Manta birostris* also can be found in seasonal concentrations such as in Revillagigedo Islands in Mexico, Laje de Santos in Brazil and La Plata in Ecuador.

Seasons for these aggregations vary from site to site and by species and need to be assessed on a case by case basis.

Acoustic impacts which might severely affect vulnerable or complex habitats such as coral reefs or mangrove forests (essential nursery areas for some shark and ray species) are certain to have an effect on its elasmobranch fauna if it includes displacement or damage to prey species and any physical disruption of the habitat. Seasonal concentration areas for sharks and rays can be particularly vulnerable to acute acoustic disturbance, which may result in abandonment of the area or disruption of gregarious behaviour whose implications are yet not fully understood. Acute acoustic disturbances such as seismic or sonic surveys and any activity involving explosives in or around these critical habitats (coral reefs, offshore islands and other known seasonal concentration sites, key feeding grounds) are likely to have serious impacts on elasmobranch populations.

Although migration paths are still poorly understood for most species, recent satellite tagging research (e.g. Domeier and Nasby-Lucas, 2008) has begun to reveal some consistent patterns and as yet unknown concentration areas away from above-water topographic features. These areas likely represent additional vulnerability corridors where protection from acute acoustic disturbance should be incorporated into management actions.

B.11.3. Impact of Exposure Levels

As a group, elasmobranchs have been poorly represented in field studies on acoustics, with most knowledge available for more "visible" species such as large sharks. For these, observed impacts refer mostly to short-term avoidance responses to loud, sudden bursts of sound in their audible range, although there´s evidence that the regularity of such sounds might lead to habituation (see references above).

Given that bony fish, which make the majority of prey species for most sharks, may be severely impacted by sound (Slabekoorn et al., 2010), especially in loud bursts (eg Carlson, 2012), it is perhaps this indirect effect on prey that holds the most severe potential for generating impacts on shark populations.

There is insufficient information to assess long-term impacts or behavioral changes in elasmobranchs from anthropogenic noise that might affect survivability of species. Existing studies indicate that the most direct negative impact on the animals seems to be displacement by sonic outbursts, while longer-term exposure often seems to lead to habituation (Lobel, 2009; Myrberg, 2001; Myrberg at al., 1972).

B.11.4. Assessment Criteria

From available data it seems that there are two main aspects of potential impacts on elasmobranchs that merit particular consideration: displacement or elimination of prey species and displacement or disruption of behaviour associated with specific sites by sound bursts. Given that detailed studies are mostly lacking, a precautionary approach to the exposure of elasmobranchs to noise, especially at key habitats and aggregation sites, is warranted. In particular activities involving the use of equipment or methods that generate loud sonic outbursts near known or estimated aggregation areas, or which might physically injure or displace prey, need to be carried out with adequate assessment (including baseline surveys for elasmobranch species and their prey) and mitigation measures as feasible and appropriate. Also, proposed activities that alter or impact key habitats such as coral reefs, mangroves or offshore islands with known aggregations of elasmobranch species should be carried out with extreme caution and this group of species should be explicitly considered in studies and proposed management measures to reduce potential impacts.

B.11.5. Species not listed on the CMS Appendices that should also be considered during assessments

In general, listed species include those for which several acoustic and hearing studies exist, but as for the entire group detailed acoustic impact studies are lacking. The development and collation of more detailed data on a species by species basis could greatly help improve our understanding of the impacts of anthropogenic noise on their physiology and life cycles. Lack of information on most elasmobranch species is an impediment to the provision of any meaningful advice on species not listed on the CMS Appendices,

References

Banner, A. 1972. Use of sound in predation by young lemon sharks, *Negaprion brevirostris* (Poey). Bulletin of Marine Science, 22(2):251-283

Carlson, TJ. 2012. Barotrauma in fish and barotrauma metrics. pp. 229-233 In: Popper, A.N. and A. Hawkins (eds.) The Effects of Noise in Aquatic Life. New York, Springer

Casper, BM. and Mann. DA. 2006. Evoked potential audiograms of the nurse shark (*Ginglymostoma cirratum*) and the yellow stingray (*Urobatis jamaicensis*). Environ Biol Fish 76: 101–108

Casper, BM. and Mann, DA. 2010. Field hearing measurements of the Atlantic sharpnose shark *Rhizoprionodon terraenovae*. J Fish Biol 75: 2768–2776,

Domeier, ML and Nasby-Lucas, N. 2008. Migration patterns of white sharks *Carcharodon carcharias* tagged at Guadalupe Island, Mexico, and identification of an eastern Pacific shared offshore foraging area. Mar Ecol Prog Ser, 370: 221-237

Francis, MP and Lyon, WS. 2013. Review of anthropogenic impacts other than fishing on cartilaginous fishes. New Zealand Aquatic Environment and Biodiversity Report No. 107. 17 p

Klimley, AP. and Myrberg Jr., AA. 1979. Acoustic stimuli underlying withdrawal from a sound source by adult lemon sharks, *Negaprion brevirostris* (Poey). Bulletin of Marine Science, 29(4):447-458

Lobel, PS. 2009. Underwater acoustic ecology: boat noises and fish behavior. pp. 31-42 In: Pollock NW, ed. Diving for Science 2009: Proceedings of the American Academy of Underwater Sciences 28th Symposium. Dauphin Island, AL: AAUS.

Myrberg, Jr AA. 2001. The acoustical biology of elasmobranchs. Environ Biol Fish 60: 31-45.

Myrberg, AA. Ha, SJ.; Alewski, SW. & Banbury, JC. 1972. Effectiveness of acoustic signals in attracting epipelagic sharks to an underwater sound source. Bull. Marine Science 22(4):926-49.

Myrberg Jr, AA. Gordon, CR. and Klimley, AP. 1978. Rapid withdrawal from a sound source by open-ocean sharks. The Journal of the Acoustical Society of America 64(5):1289-1297

Nelson, DR. and Gruber, SH. 1963. Sharks: Attraction by Low-Frequency Sounds. Science 142(3594):975-977

Popper, AN. and Hastings, MC. 2009. The effects of human-generated sound on fish. Integrative Zoology 4: 43–52

Slabbekoorn, Hans; Bouton, N.; van Opzeeland, I.; Coers, A.; ten Cate, C. & Popper, A.N. 2010. A noisy spring: the impact of globally rising underwater sound levels on fish. Trends Ecol Evol. 25(7):419-27.

B.12. Marine Invertebrates

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Consider when assessing

- Seismic surveys
- Civil high power sonar
- Coastal and offshore construction works
- Offshore platforms
- Vessel traffic greater than 100 metric tons
- Vessel traffic less than 100 metric tons
- Pingers and other noise-generating activities

Related CMS agreements

- Agreement on the Conservation of Cetaceans of the Black Seas Mediterranean Seas and Contiguous Atlantic Area (ACCOBAMS)
- Agreement on the Conservation of Small Cetaceans in the Baltic, North East Atlantic, Irish and North Seas (ASCOBANS)
- MOU for the Conservation of Cetaceans and their Habitats in the Pacific Islands Region (Pacific Islands Cetaceans)
- MOU Concerning the Conservation of the Manatee and Small Cetaceans of Western Africa and Macaronesia (West African Aquatic Mammals)
- Agreement on the Conservation of Seals in the Wadden Sea (Wadden Sea seals)
- MOU Concerning Conservation Measures for the Eastern Atlantic Populations of the Mediterranean Monk Seal (*Monachus monachus*) (Atlantic monk seals)
- MOU Concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa (Atlantic marine turtles)
- MOU on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA)
- MOU on the Conservation of Migratory Sharks (Sharks)

Related modules

- Refer also to modules B.10 when assessing impact to marine invertebrates

B.12.1. Species Vulnerabilities

Very little is known about effects of anthropogenic noise on invertebrates (Morley *et al* 2014). This includes more than 170,000 described species of multicellular marine invertebrates in spite of their ecological and economic importance worldwide (Anderson *et al* 2011). Most research targets molluscs (e.g. cephalopods, shellfish) and crustaceans (e.g. crabs, shrimps, barnacles) (reviewed in Aguilar de Soto, 2016).

Molluscs:

Two atypical mass-strandings involving nine giant squids, *Architeuthis dux*, were associated with seismic surveys co-occurring in nearby underwater canyons where this species concentrates (Guerra *et al* 2004, 2011). Two specimens suffered extensive multiorganic damage to internal muscle fibres, gills, ovaries, stomach and digestive tract. Other squids were probably disoriented due to extensive damage in their statocysts. Damage to the sensory epithelium was also observed in four species of coastal cephalopods (*Sepia officinalis*, *Loligo vulgaris*, *Illex coindetii* and *Octopus vulgaris*) by exposure to two hours of low-frequency sweeps at 100 per cent duty cycle (André *et al* 2011, Solé, 2012, Solé *et al* 2013). Fewtrell and McCauley (2012) reported that squid, *Sepioteuthis australis*, exposed to seismic pulses from a single air gun showed signs of stress such as significant increases in the number of startle and alarm responses, with ink ejection in many cases, increased activity and changing position in the water column.

Delayed and abnormal development as well as an increase in mortality rates in eggs and larvae of shellfish exposed to noise has been recorded in two species. New Zealand scallop larvae, *Pecten novaezelandiae*, exposed to playbacks of low frequency pulses in the laboratory showed significant developmental delays and developed body abnormalities (Aguilar de Soto *et al* 2013). The number of eggs of sea hares, *Stylocheilus striatus*, that failed to develop at the cleavage stage, as well as the number that died shortly after hatching, were significantly higher in a group exposed to boat noise playback at sea compared with playback of ambient noise (Nedelec *et al* 2014). In contrast, playbacks of ship-noise enhanced larval settlement in the mussel, *Perna canaliculus* (Wilkens *et al* 2012) while seemed to increase biochemical indicators of stress in adult mussels (*Mytilus edulis*) (Wale *et al* 2016).

Crustaceans:

Stress responses were observed in aquarium-dwelling brown shrimp, *Crangon crangon*, exposed to ambient noise of some 30 dB higher than normal at 25–400 Hz (Lagardere, 1982, Regnault and Lagardere, 1983). Shrimps did not seem to habituate throughout the experiment. Similarly, shore crabs, *Carcinus maenas*, increased metabolic consumption and showed signals of stress when exposed to playbacks of ship noise in the laboratory. Crustacean larvae seem to differ in their sensitivity to noise: larval dungeness crabs, *Metacarcinus magister*, did not show significant differences in survival nor in time-to-moult when exposed to a single pulse from a seven air gun array, even at the higher received level of 231 dB re 1µPa (Pearson *et al* 1994). In contrast, larvae of other crab species, *Austrohelice crassa* and *Hemigrapsus crenulatus* megalopae, exposed to playbacks of noise from tidal turbines tended to suffer significant delays in time-to-moult (Pine *et al* 2012) and low-frequency noise exposure inhibited settlement of early larvae of barnacle, *Balanus amphitrite* (Branscomb and Rittschof, 1984). The apparent contradiction in the larval responses from different species of crustaceans may be due, among other things, to the experimental set-up (wild versus laboratory, one pulse versus a continuous exposure), the biology of the species, or the characteristics of the sound treatment. Cellular and humoral immune responses of marine invertebrates to noise have also been examined. In the European spiny lobster, *Palinurus elephas*, exposure to sounds resembling shipping noise in the laboratory affected various haematological and immunological parameters considered to be potential health or disease markers in crustaceans (Celi *et al* 2014).

B.12.2. Habitat Considerations

Marine invertebrates inhabit a range of habitats. Mainly, they may live associated to the seafloor (benthic or bentho-pelagic species) or free in the water column (pelagic). Many species have an initial pelagic phase as larvae, useful for dispersion, before finding suitable habitat for settling into their adult life. Sound from preferred habitats is one of the cues used by larvae to find a suitable location to settle (Stanley *et al* 2012). Once they settle, many species have limited capabilities to move fast enough at distances required to avoid noise exposure, due to morphological constrains or to territorial behaviour.

Species associated to the seafloor will be more exposed to ground-transmission of noise. This is especially relevant for intense low frequency sounds directed towards the seafloor, typical of seismic surveys. Seismic pulses coupled with the seafloor and low frequency vibrations can travel long distances through the ground and can re-radiate to the water depending on the structure and composition of the seafloor. Marine invertebrates are sensitive to the particle motion component of sound, more than to the pressure wave, they are well suited to detect low frequency vibrations because these are used, for example, to identify predators and prey.

The variability in the extent of barotrauma experienced by different giant squid stranding at the same time, in coincidence with the same seismic survey (Guerra *et al* 2004, 2011), underlines the difficulties inherent in predicting noise-induced damage to animals in the wild. Here, some giant squid suffered direct mortality from barotrauma, while the death of others seemed to be caused by indirect effects of physiological and behavioural responses to noise exposure. Direct injury (barotrauma) can be explained by some animals being exposed to higher sound levels due to complex patterns of sound radiation creating zones of convergence (Urick, 1983) of the seismic sound waves reflected by the sea surface/sea floor, and possibly by the walls of the steep underwater canyons in the area where the seismic survey took place.

Marine invertebrates often have discrete spawning periods. It is unknown if eggs/larvae have a greater vulnerability to sound-mediated physiological or mechanical stress, or even particular phases of larval development when larvae undergo metamorphosis.

Metamorphosis involves selective expression of genes mediating changes in body arrangement, gene expression is susceptible to stress, including from noise. Spawning periods are key for the recruitment of marine invertebrates and thus should be considered when planning activities.

B.12.3. Impact of Exposure Levels

There are no data about thresholds of pressure or particle motion initiating noise impacts on marine invertebrates. Studies have found a range of physiological effects (reviewed in Aguilar de Soto and Kight 2016) but there are no dose-response curves identifying levels of impact onset. Moreover, most studies report only sound pressure level, while particle motion is relevant for the effects of noise on these species. At a distance from an acoustic source (in the far-field) the pressure and particle motion components of sound are easily predicted in a free homogeneous environment such as the water column. In contrast, in the near-field animals may experience higher particle motions than would be expected for the same pressure level in the far-field. Intense underwater sound sources such as air guns, pile driving, sonar and blasting have back-calculated peak source levels ranging from 230 to, in the case of blasting, >300 dB re 1 µPa at 1m. These activities routinely ensonify large areas with sound pressure levels higher than the thresholds of response observed in different studies of noise-impacts on marine invertebrates. For example, a seismic array with an equivalent source level of 260 dB pk-p re 1 µPa at 1m will produce levels in excess of 160 dB_{rms} over hundreds of km-squared. This level was measured in an experiment reporting noise-induced developmental delays and malformations in scallop larvae (Aguilar de Soto *et al* 2013). But the particle velocities experienced by the larvae in the experiment (about 4-6 mm s^{-1} RMS) imply higher far-field pressure levels of some 195-200 dB_{rms} re 1 µPa, reducing the potential impact zone to only short ranges from the source. However, there are several reasons why larvae in the wild may be impacted over larger distances than these approximate levels suggest. Given the strong disruption of larval development reported, weaker but still significant effects can be expected at lower exposure levels and shorter exposure durations. Moreover, low frequency sounds propagate in complex sound fields in which convergence zones and re-radiation of sound transmitted through the sea-floor can create regions with high sound levels far from the source (Madsen *et al* 2006). The sound field experienced by an organism is a complex function of its location with respect to the sound source and acoustic boundaries in the ocean necessitating *in situ* measurements to establish the precise exposure level.

B.12.4. Assessment Criteria

Benthic marine invertebrates often have little movement capabilities further than a few metres, limiting their options to avoid exposure to anthropogenic noise. In the case of intense low frequency noise, e.g. seismic or pile driving, it is essential to consider ground-transmission. For example, during a seismic survey animals will be exposed to sound received from the air gun array passing over the location of the animals, but these invertebrates will be receiving at the same time ground-transmitted vibrations originated by previous seismic pulses. Thus, animals will experience waves arising from the water and from the ground, differing in phase and other parameters. Complex patterns of wave addition mean that in some cases vibrations will sum, increasing the levels of sound exposure to the animals. Because ground vibrations may travel tens of kilometres or more, the time that benthic invertebrates will be exposed to a given threshold of pressure or particle motion will be increased when we consider seafloor transmission. An alternative source for seismic surveys (©Vibroseis) is currently being tested. In contrast to usual seismic surveys transmitting pulses every 6 to 15 s from an air gun array towed by a ship near the sea-surface, Vibroseis is towed near the seafloor and emits continuously, but at lower peak level. Thus, duty cycle increases to 100 per cent. EIA of Vibroseis and other low frequency sound sources should include modelling particle motion in the target area and consider exposures to benthic fauna.

Results of experiments about effects of noise on catch rates of marine invertebrates have not shown significant effects: Andriguetto-Filho *et al* (2005) did not find changes on catches of shrimps after the passage of a small air gun array. No effects of seismic activities on catches of rock-lobsters were found either by Parry *et al* (2006) performing a long-term analysis of commercial data. In contrast, fishermen have blamed seismic sources for mortalities of scallops and economic losses due to reduced catch rates.

Despite uncertainties about how noise may affect marine fauna and fisheries, several countries have already implemented regulations that reduce overlap between seismic surveys and fishing activities (mainly of fin-fish). However, these regulations do not address concerns of noise effects on eggs and larvae, i.e. that noise might affect stock recruitment and thereby cause delayed reductions in catch rates.

Marine invertebrates form the base of the trophic-web in the oceans, providing an important food source for fish, marine mammals and humans. In addition to direct effects to adults, noise exposure during critical growth intervals may contribute to stock vulnerability, underlining the urgency to investigate potential effects of acoustic pollution on marine invertebrates at different ontogenetic stages. Moreover, recent results investigating the effects of noise on a range of marine invertebrate species call for applying the precautionary principle when planning activities involving high-intensity sound sources, such as explosions, construction, pile driving or seismic exploration, in spawning areas/times of marine invertebrates with high natural and economic value.

B.12.5. Species not listed on the CMS Appendices that should also be considered during assessments

Some large cephalopods are migratory, including the giant squid, *Architeuthis sp* (Winkelmann *et al* 2013). Given the vulnerability of this species to acoustic sources, it should also be considered during assessments.

References

Aguilar de Soto, N Delorme, N Atkins, J Howard, S Williams, J. and Johnson, M. 2013. Anthropogenic noise causes body malformations and delays development in marine larvae. *Scientific Reports*, 3: 2831.

Aguilar de Soto, N. and Kight, C. 2016. Physiological effects of noise. Ch. 8 in Solan, M. and Whiteley, N. (Eds) Stressors in the Marine Environment. Physiological and Ecological Responses and Soci*et al* Implications. Oxford University Press. 350 pp.

Aguilar de Soto, N. 2015. Peer-Reviewed Studies on the Effects of Anthropogenic Noise on Marine Invertebrates: From Scallop Larvae to Giant Squid. Advances in Experimental Medicine and Biology. Springer. DOI: 10.1007/978-1-4939-2981-8_3,

Anderson, S Flemming, J Watson, R Lotze H 2011. Rapid global expansion of invertebrate fisheries: trends, drivers, and ecosystem effects. PLoS ONE 6(3) doi:10.1 371/journal.pone.0014735

André, M Solé, M Lenoir, M Durfort, M Quero, C. and Mas, A. 2011. Low-frequency sounds induce acoustic trauma in cephalopods. *Frontiers in Ecology and the Environment*. 9 (9), 489–493.

Andriguetto-Filho, J.M Ostrensky, A Pie, M.R Silva, U.A Boeger, W.A. 2005. Evaluating the impact of seismic prospecting on artisanal shrimp fisheries. Cont Shelf Res 25 (14):1720-1727.

Branscomb, E.S Rittschof, D. 1984. An investigation of low frequency sound waves as a means of inhibiting barnacle settlement. J Exp Mar Biol Ecol 79:149–154.

Fewtrell, J.L. and McCauley, R.D. 2012. Impact of air gun noise on the behaviour of marine fish and squid. *Marine Pollution Bulletin*, 64(5), 984–993.

Guerra, Á González, Á.F Pascual, S. and Dawe, E.G. 2011. The giant squid *Architeuthis*: An emblematic invertebrate that can represent concern for the conservation of marine biodiversity. *Biological Conservation*, 144 (7), 1989–1997.

Guerra, Á González, Á.F Rocha, F. 2004. A review of records of giant squid in the northeastern atlantic and severe injuries in *Architeuthis dux* stranded after acoustic exploration. *ICES*, 29, 1–17.

Lagardere, J.P. 1982. Effects of noise on growth and reproduction of *Crangon crangon* in rearing tanks. *Marine Biology*, 71,177–185.

Nedelec, S.L Radford, A.N Simpson, S.D Nedelec, B Lecchini, D. and Mills, S.C. 2014. Anthropogenic noise playback impairs embryonic development and increases mortality in a marine invertebrate. *Scientific Reports*, 4:5891.

Madsen PT Johnson M Miller PJO Aguilar de Soto N Lynch J Tyack P. (2006). Quantitative measures of air-gun pulses recorded on sperm whales (*Physeter macrocephalus)* using acoustic tags during controlled exposure experiments. *The Journal of the Acoustical Society of America* 120:2366–2379. DOI: 10.1121/1.2229287.

Morley, E.L Jones, G Radford, A.N. 2014. The importance of invertebrates when considering the impacts of anthropogenic noise. Proc. Biol. Soc Lond. B.281(1776)

Parry, G.D Gason, A. 2006. The effect of seismic surveys on catch rates of rock lobsters in western Victoria, Australia. Fish Res 79: 272–284.

Pearson, W.H Skalski, J.R Sulkin, S.D. and Malme, C.I. 1994. Effects of seismic energy releases on the survival and development of zoeal larvae of dungeness crab (*Cancer magister*). *Marine Environmental Research*, 38(2), 93–113.

Pine, M.K Jeffs, A.G. and Radford, C.A. 2012. Turbine sound may influence the metamorphosis behaviour of estuarine crab *megalopae*. *PLoS ONE*, e51790. doi:10.1371/journal.pone.0051790.

Regnault, M Lagardère, J. 1983. Effects of ambient noise on the metabolic level of *Crangon crangon* (Decapoda, Natantia). Mar. Ecol. Prog. Ser. 11: 71–78. (doi:10.3354/m*eps011071)*

Solé Carbonell, M. 2012. Statocyst sensory epithelia ultrastructural analysis of Cephalopods exposed to noise. PhD. University of Cataluña. 183 pp.

Solé, M Lenoir, M Durfort, M López-Bejar, M Lombarte, A van der Schaar, M. and André, M. 2013. Does exposure to noise from human activities compromise sensory information from cephalopod statocysts? *Deep Sea Research Part II: Topical Studies in Oceanography* 95, 160–181. doi:10.1016/j.dsr2.2012.10.006

Stanley, J.A Radford, C.A Jeffs, A.G. 2012. Location, location, location: finding a suitable home among the noise. *Proceedings of the Royal Society B: Biological Sciences* 279:3622–3631. DOI: 10.1098/rspb.2012.0697.

Urick, R.J. 1983. Principles of Underwater Sound. McGraw-Hill, New York, 423 pp.

Wale, M.A Simpson, S.D Radford, A.N. 2013 Size-dependent physiological responses of shore crabs to single and repeated playback of ship noise. Biol Lett 9:2.

Wale, M.A Simpson, S.D Radford, A.N. 2013. Noise negatively affects foraging and antipredator behaviour in shore crabs. Anim. Behav. 86(1):111-118.

Wilkens, S.L Stanley, J.A Jeffs, A.G. (2012). Induction of settlement in mussel (*Perna canaliculus*) larvae by vessel noise. *Biofouling* 28:65–72. DOI: 10.1080/08927014.2011.651717.

Winkelmann I Campos PF Strugnell J Cherel Y Smith PJ Kubodera T Allcock L Kampmann M-L Schroeder H Guerra A Norman M Finn J Ingrao D Clarke M Gilbert MTP. 2013. Mitochondrial genome diversity and population structure of the giant squid Architeuthis: genetics sheds new light on one of the most enigmatic marine species. *Proceedings of the Royal Society of London B: Biological Sciences* 280:20130273. DOI: 10.1098/rspb.2013.0273.

C. Decompression Stress

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Decompression sickness (DCS, 'the bends') is a disease associated with gas uptake at pressure. As hydrostatic pressure increases with depth, the amount of nitrogen (N_2) that is absorbed by the blood and tissues increases, resulting in higher dissolved gas tensions that could at maximum reach equilibrium with the partial pressure of N_2 in the lungs. This is a long-known problem for human divers breathing pressurized air, but has often been discounted as a problem for breath-hold divers since they dive on only a single inhalation (Scholander 1940). However, for free-diving humans and other air-breathing animals, tissues can become highly saturated under certain circumstances depending on the iterative process of loading during diving and washout at the surface (Paulev 1967, Lemaitre *et al* 2009). During decompression, if the dissolved gas tension in the tissues cannot equilibrate fast enough with the reducing partial pressure of N_2 in the lungs, tissues will become supersaturated, with the potential for gas-bubble formation (Francis and Mitchell 2003).

Breath-hold diving vertebrates were previously thought to be relatively immune to DCS due to their multiple anatomical, physiological and behavioural adaptations (Fahlman *et al* 2006, Fahlman *et al* 2009, Hooker *et al* 2012). However, recent observations have shown that marine mammals and turtles may be affected by decompression sickness under certain circumstances (Jepson *et al* 2005, Dennison *et al* 2012, Van Bonn *et al* 2013, Garcia-Parraga *et al* 2014). Of most concern, however, are the beaked whales, which appear to be particularly vulnerable to anthropogenic stressors that may cause decompression sickness (Jepson *et al* 2003, Cox *et al* 2006, D'Amico *et al* 2009, Hooker *et al* 2009, Hooker *et al* 2012).

C.1.1. Bubble Formation

Among marine mammals, both acute and chronic gas emboli have been observed. The formation of bubbles has been suggested as a potential explanation for lesions coincident with intravascular and major organ gas emboli in beaked whales that mass stranded in conjunction with military exercises deploying sonar (Jepson *et al* 2003, Fernandez *et al* 2005). There is some controversy about the exact behaviour leading to the gas emboli (Hooker *et al* 2012). However it is widely agreed that this outcome was linked to man-made acoustic disturbance. These types of lesions have also been reported in some single-stranded cetaceans for which they do not appear to have been immediately fatal (Jepson *et al* 2005, Bernaldo de Quirós *et al* 2012, Bernaldo de Quirós *et al* 2013). Looking at species-specific variability in bubble presence among stranded animals, the deeper divers (Kogia, Physeter, Ziphius, Mesoplodon, Globicephala, and Grampus) appeared to have higher abundances of bubbles, suggesting that deep-diving behaviour may lead to a higher likelihood of decompression stress (Bernaldo de Quirós *et al* 2012).

In addition, osteonecrosis-type surface lesions have been reported in sperm whales (Moore and Early 2004). These were hypothesized to have been caused by repetitive formation of asymptomatic N_2 emboli over time and suggest that sperm whales live with sub-lethal decompression induced bubbles on a regular basis, but with long-term impacts on bone health. Bubbles have also been observed from marine mammals bycaught in fishing nets, which died at depth (Moore *et al* 2009, Bernaldo de Quirós *et al* 2013). These bubbles suggested the animals' tissues were supersaturated sufficiently to cause bubble formation when depressurized (as nets were hauled). B-mode ultrasound has detected bubbles in stranded (common and white-sided) dolphins, which showed normal behaviour after release and did not re-strand, and so appeared to tolerate this bubble formation (Dennison *et al* 2012). Cerebral gas lesions have also been observed using Magnetic Resonance Imaging in California sea lions, *Zalophus californianus*, admitted to a rehabilitation facility (Van Bonn *et al* 2011, Van Bonn *et al* 2013). It therefore appears that gas supersaturation and bubble formation may occur more routinely than previously thought. These cases highlight a growing body of evidence that marine mammals are living with blood and tissue N_2 tensions that exceed ambient levels (Moore *et al* 2009, Bernaldo de Quirós *et al* 2013). However, our understanding of how marine mammals manage their blood gases during diving, and the mechanism causing these levels to become dangerous is very rudimentary (Hooker *et al* 2012). Some perceived threats appear to cause a behavioural response that may override normal N_2 management, resulting in decompression sickness, stranding and death.

C.1.2. Sources of Decompression Stress

Most evidence for both beaked whale fatalities and for behavioural modification (thought to be the precursor to further effects) has suggested an anthropogenic sound source. There is a documented association between naval active sonar exercises (particularly mid-frequency active sonar) and beaked whale mass strandings (Frantzis 1998, Evans and England 2001, Jepson *et al* 2003). Spatial and temporal correlations between active sonar and beaked whale strandings support this conclusion but suggest a role for specific bathymetric topography leading some areas to show correlations while others do not (Filadelfo *et al* 2009). A comprehensive review of beaked whale mass strandings (D'Amico *et al* 2009) suggested that some strandings might be associated with other source events. However, the evidence is less comprehensive in support for high-intensity underwater sounds other than mid-frequency sonar causing fatalities for these species (Taylor *et al* 2004; Barlow and Gisiner 2006). In terms of other sources causing behavioural modification, ship-noise appears to cause a behavioural response disrupting foraging behaviour in Cuvier's beaked whales, *Ziphius cavirostris* (Soto *et al* 2006).

Another form of decompression stress is the oxidative stress caused by diving (Hermes-Lima and Zenteno-Savin 2002). Episodic regional lack of oxygen and abrupt reperfusion upon re-surfacing creates a situation where post-ischemic reactive oxygen species (ROS) and physiological oxidative stress are likely to occur. Decompression sickness likely has a multifactorial origin, but this oxidative stress could be a contributor (Wang *et al* 2015).

C.1.3. Source Frequency, Level and Duration

Understanding the responses of cetaceans to noise is a two-stage process: (1) understanding the noise required to cause the behavioural modification and (2) understanding the physiological mechanism by which that behavioural modification causes harm to the animal. At present, almost all research has focussed on the first of these, i.e. work evaluating playback and response, and almost nothing is known about how this response then leads to decompression stress.

Several recent studies have found similar behavioural responses of a small number of beaked whales to sonar signals (Tyack *et al* 2011, DeRuiter *et al* 2013, Stimpert *et al* 2014, Miller *et al* 2015). These studies have shown that beaked whales respond behaviourally to sonar and other human and natural stimuli, typically showing a combination of avoidance and cessation of noise-production associated with foraging (Table 8). Responses to simulated sonar have started at low received levels. These types of behavioural changes were also documented in work monitoring vocal activity using Navy range hydrophones (Tyack *et al* 2011, Moretti *et al* 2014).

C.1.4. Assessment Criteria

At the planning stage, the primary mitigation method to reduce issues of decompression stress would be to reduce the interactions of stressor and animals (i.e. to reduce the number of "takes"). Acknowledging that there might be other planning issues that limit flexibility, this could be done by placing high-intensity noise into areas without high densities of species of concern. Thus proposals should take account of all survey and modelling information sources to predict areas of likelihood of high/low species density, and attempt to reduce the number of impacted animals by designing operations within areas of lower animal density.

To supplement this, or in areas in which such species densities are unknown, baseline studies will be needed. Beaked whales are particularly difficult to monitor visually (surfacing for as little as 8 per cent of the time), but have more reliable detection acoustically (vocalising for 20 per cent of the time, de Soto *et al* 2012). Hydrophone arrays can detect animals at 2-6km distances (eg Moretti *et al* 2010, Von Benda-Beckmann *et al* 2010).

During the activity, real-time monitoring of animal presence should be conducted using visual and acoustic monitoring, with detections within a specified range of the activity

resulting in cessation of the sound source. Mitigation measures such as 'ramp-up' may be effective, although some beaked whale species show curiosity toward novel sounds which may increase the likelihood of impact (Miller et al. 2015).
Monitoring over a wider area can sometimes be achieved using hydrophone arrays on the seafloor (Moretti *et al* 2010). Such hydrophone arrays allow detection over a wide but static area. Dynamic monitoring over a wide area is not currently feasible.

Modelling of animal likelihood and distance from the source should be carried out in order to minimize received levels (Table 8), thus reducing the risk of animals receiving too high a dose which might incur DCS/death.

Table 8: Responses of beaked whales to sound sources

Species	Sound source	Response observed at received level (dB re. 1µPa)
Cuvier's beaked whale, *Ziphius cavirostris* (DeRuiter *et al* 2013)	30 min playback of 1.6s MFA sonar signal repeated every 25 sec. Initial source level of 160 dB re 1 mPa-m was increased ('ramped up') by 3 dB per transmission to a maximum of 210 dB re 1 mPa-m.	89-127
Cuvier's beaked whale, *Ziphius cavirostris* (Soto *et al* 2006)	Maximum broadband (356 Hz–44.8 kHz) level received during the ship passage was 136 dB $_{rms}$ re 1 µPa, approx. 700m away.	106 (in click frequency range)
Northern bottlenose whale, *Hyperoodon ampullatus* (Miller *et al* 2015)	104 1-s duration 1–2 kHz upsweep pulses (naval sonar signals) at 20s intervals. The source level of the sonar pulses increased by 1 dB per pulse from 152 to 214 dB re 1 µPam over 20min (61 pulses), and the remaining pulses were transmitted for 15min at a source level of 214 dB re 1 µPa m.	107
Baird's beaked whale, *Berardius bairdii* (Stimpert *et al* 2014)	Simulated mid-frequency active (MFA) military sonar signal at 3.5-4 kHz, transmitting 1.6 s signal every 25 s. The initial source level of 160 dB re: 1 mPa was increased by 3 dB per transmission for the first 8 minutes to a maximum of 210 dB for 22 additional minutes (72 transmissions total over 30 minutes).	127
Blainville's beaked whale, *Mesoplodon densirostris* (Tyack *et al* 2011)	Simulated 1.4 s MFA sonar, killer whale and noise signals. MFA sonar had both constant frequency and frequency modulated tonal components in the 3–4 kHz band repeated every 25 s. Initial source level of 160 dB re 1 mPa-m was increased ('ramped up') by 3 dB per transmission to a maximum of 210 dB re 1 mPa-m.	138

C.1.5. Species not listed on the CMS Appendices that should also be considered during assessments

Beaked whales, *Ziphius cavirostris* (Appendix I) and *Hyperoodon* spp and *Berardius* spp (Appendix II) require additional consideration. These species appear particularly vulnerable to noise impacts. 20 species of *Mesoplodon* are currently missing from the CMS Appendices and yet are likely to also be vulnerable to noise impacts. All of these species are likely to be particularly sensitive to decompression stress.

Of other deep diving species which may potentially be at increased risk of decompression stress, *Kogia* are currently not listed on either of the CMS Appendices, *Physeter* is listed on Appendices I and II, *Globicephala* on Appendix II, and Grampus should also be considered during assessments.

References

Barlow J, Gisiner R. 2006. Mitigating, monitoring and assessing the effects of anthropogenic sound on beaked whales. J Cetacean Res Manage 7:239-249

Bernaldo de Quirós Y, González-Díaz Ó, Arbelo M, Sierra E, Sacchini S, Fernández A. 2012. Decompression versus decomposition: distribution, quantity and gas composition of bubbles in stranded marine mammals. Frontiers in Physiology 3

Bernaldo de Quirós Y, Seewald JS, Sylva SP, Greer B, Niemeyer M, Bogomolni AL, Moore MJ. 2013.Compositional discrimination of decompression and decomposition gas bubbles in bycaught seals and dolphins. PLoS One 8:12

Cox TM, Ragen TJ, Read AJ, Vos E, Baird RW, Balcomb K, Barlow J, Caldwell J, Cranford T, Crum L, D'Amico A, D'Spain G, Fernandez A, Finneran J, Gentry R, Gerth W, Gulland F, Hildebrand J, Houser D, Hullar T, Jepson PD, Ketten D, MacLeod CD, Miller P, Moore S, Mountain DC, Palka D, Ponganis P, Rommel S, Rowles T, Taylor B, Tyack P, Wartzok D, Gisiner R, Mead J, Benner L. 2006. Understanding the impacts of anthropogenic sound on beaked whales. J Cetacean Res Manage 7:177-187

D'Amico A, Gisiner RC, Ketten DR, Hammock JA, Johnson C, Tyack PL, Mead J. 2009. Beaked whale strandings and naval exercises. Aq Mamm 35:452-472

de Soto NA, Madsen PT, Tyack P, Arranz P, Marrero J, Fais A, Revelli E, Johnson M. 2012. No shallow talk: Cryptic strategy in the vocal communication of Blainville's beaked whales. Mar Mamm Sci 28:E75-E92

Dennison S, Moore MJ, Fahlman A, Moore K, Sharp S, Harry CT, Hoppe J, Niemeyer M, Lentell B, Wells RS. 2012. Bubbles in live-stranded dolphins. P Roy Soc Lond B Bio 279:1396-1404

DeRuiter SL, Southall BL, Calambokidis J, Zimmer WMX, Sadykova D, Falcone EA, Friedlaender AS, Joseph JE, Moretti D, Schorr GS, Thomas L, Tyack PL. 2013. First direct measurements of behavioural responses by Cuvier's beaked whales to mid-frequency active sonar. Biol Lett 9:1-5

Evans DL, England GR. 2001. Joint interim report Bahamas marine mammal stranding event of 15–16 March 2000 US Department of Commerce and US Navy, Washington, D.C.

Fahlman A, Hooker SK, Szowka A, Bostrom BL, Jones DR. 2009. Estimating the effect of lung collapse and pulmonary shunt on gas exchange during breath-hold diving: The Scholander and Kooyman legacy. Resp Physiol Neurobiol 165:28-39

Fahlman A, Olszowka A, Bostrom B, Jones DR. 2006. Deep diving mammals: Dive behavior and circulatory adjustments contribute to bends avoidance. Resp Physiol Neurobiol 153:66-77

Fernandez A, Edwards JF, Rodriguez F, Espinosa de los Monteros A, Herraez P, Castro P, Jaber JR, Martin V, Arbelo M. 2005. "Gas and fat embolic syndrome" involving a mass stranding of beaked whales (*family Ziphiidae)* exposed to anthropogenic sonar signals. Vet Pathol 42:446-457

Filadelfo R, Mintz J, Michlovich E, D'Amico A, Tyack PL, Ketten DR. 2009. Correlating military sonar use with beaked whale mass strandings: what do the historical data show? Aq Mamm 35:435-444

Francis TJR, Mitchell SJ. 2003. Pathophysiology of decompression sickness. In: Brubakk AO, Neuman TS (eds) Bennett and Elliott's physiology and medicine of diving. Elsevier Science Ltd, Saunders

Frantzis A. 1998. Does acoustic testing strand whales? Nature 392:29

Garcia-Parraga D, Crespo-Picazo JL, de Quiros YB, Cervera V, Marti-Bonmati L, Diaz-Delgado J, Arbelo M, Moore MJ, Jepson PD, Fernandez A. 2014. Decompression sickness ('the bends') in sea turtles. Dis Aquat Organ 111:191-205

Hermes-Lima M, Zenteno-Savin T. 2002.Animal response to drastic changes in oxygen availability and physiological oxidative stress. Comp Biochem Physiol C 133:537-556

Hooker SK, Baird RW, Fahlman A. 2009. Could beaked whales get the bends? Effect of diving behaviour and physiology on modelled gas exchange for three species: *Ziphius cavirostris*, Mesoplodon densirostris and Hyperoodon ampullatus. Resp Physiol Neurobiol 167:235-246

Hooker SK, Fahlman A, Moore MJ, De Soto NA, de Quiros YB, Brubakk AO, Costa DP, Costidis AM, Dennison S, Falke KJ, Fernandez A, Ferrigno M, Fitz-Clarke JR, Garner MM, Houser DS, Jepson PD, Ketten DR, Kvadsheim PH, Madsen PT, Pollock NW, Rotstein DS, Rowles TK, Simmons SE, Van Bonn W, Weathersby PK, Weise MJ, Williams TM, Tyack PL. 2012. Deadly diving? Physiological and behavioural management of decompression stress in diving mammals. P Roy Soc Lond B Bio 279:1041-1050

Jepson PD, Arbelo M, Deaville R, Patterson IAP, Castro P, Baker JR, Degollada E, Ross HM, Herraez P, Pocknell AM, Rodriguez F, Howie FE, Espinosa A, Reid RJ, Jaber JR, Martin V, Cunningham AA, Fernandez A. 2003. Gas-bubble lesions in stranded cetaceans. Nature 425:575-576

Jepson PD, Deaville R, Patterson IAP, Pocknell AM, Ross HM, Baker JR, Howie FE, Reid RJ, Colloff A, Cunningham AA. 2005. Acute and chronic gas bubble lesions in cetaceans stranded in the United Kingdom. Vet Pathol 42:291-305

Lemaitre F, Fahlman A, Gardette B, Kohshi K. 2009. Decompression sickness in breath-hold divers: A review. J Sports Sci 27:1519-1534

Miller PJO, Kvadsheim PH, Lam FPA, Tyack PL, Cure C, DeRuiter SL, Kleivane L, Sivle LD, van Ijsselmuide SP, Visser F, Wensveen PJ, von Benda-Beckmann AM, Martin Lopez LM, Narazaki T, Hooker SK. 2015. First indications that northern bottlenose whales are sensitive to behavioural disturbance from anthropogenic noise. Royal Society open science 2:140484

Moore MJ, Bogomolni AL, Dennison SE, Early G, Garner MM, Hayward BA, Lentell BJ, Rotstein DS. 2009. Gas bubbles in seals, dolphins, entangled and drowned at depth in gillnets. Vet Pathol 46:536-547

Moore MJ, Early GA. 2004. Cumulative sperm whale bone damage and the bends. Science 306:2215

Moretti D, Marques TA, Thomas L, DiMarzio N, Dilley A, Morrissey R, McCarthy E, Ward J, Jarvis S. 2010. A dive counting density estimation method for Blainville's beaked whale (*Mesoplodon densirostris*) using a bottom-mounted hydrophone field as applied to a Mid-Frequency Active (MFA) sonar operation. Appl Acoust 71:1036-1042

Moretti D, Thomas L, Marques T, Harwood J, Dilley A, Neales B, Shaffer J, McCarthy E, New L, Jarvis S, Morrissey R. 2014. A risk function for behavioral disruption of Blainville's beaked whales (*Mesoplodon densirostris*) from mid-frequency active sonar. PLoS One 9:e85064

Paulev P. 1967. Nitrogen tissue tensions following repeated breath-hold dives. J Appl Physiol 22:714-718

Scholander PF. 1940. Experimental investigations on the respiratory function in diving mammals and birds. Hvalradets Skrifter 22:1-131

Soto NA, Johnson M, Madsen PT, Tyack PL, Bocconcelli A, Borsani JF (2006) Does intense ship noise disrupt foraging in deep-diving Cuvier's beaked whales (*Ziphius cavirostris*)? Mar Mamm Sci 22:690-699

Stimpert AK, DeRuiter SL, Southall BL, Moretti DJ, Falcone EA, Goldbogen JA, Friedlaender A, Schorr GS, Calambokidis J. 2014. Acoustic and foraging behavior of a Baird's beaked whale, *Berardius bairdii*, exposed to simulated sonar. Sci Rep 4:7031

Taylor BL, Barlow J, Pitman R, Ballance L, Klinger T, Demaster D, Hildebrand J, Urban J, Palacios D, Mead J. 2004. A call for research to assess risk of acoustic impact on beaked whale populations, Sorrento, Italy

Tyack PL, Zimmer WMX, Moretti D, Southall BL, Claridge DE, Durban JW, Clark CW, D'Amico A, DiMarzio N, Jarvis S, McCarthy E, Morrissey R, Ward J, Boyd IL. 2011. Beaked whales respond to simulated and actual navy sonar. PLoS One 6:Article No.: e17009

Van Bonn W, Dennison S, Cook P, Fahlman A. 2013. Gas bubble disease in the brain of a living California sea lion (*Zalophus californianus*). Frontiers in Physiology 4:6

Van Bonn W, Montie E, Dennison S, Pussini N, Cook P, Greig D, Barakos J, Colegrove K, Gulland F. 2011. Evidence of injury caused by gas bubbles in a live marine mammal: barotrauma in a California sea lion Zalophus californianus. Dis Aquat Organ 96:89-96

Von Benda-Beckmann AM, Lam FPA, Moretti DJ, Fulkerson K, Ainslie MA, van Ijsselmuide SP, Theriault J, Beerens SP. 2010. Detection of Blainville's beaked whales with towed arrays. Appl Acoust 71:1027-1035

Wang Q, Mazur A, Guerrero F, Lambrechts K, Buzzacott P, Belhomme M, Theron M. 2015. Antioxidants, endothelial dysfunction, and DCS: in vitro and in vivo study. J Appl Physiol 119:1355-1362

D. Exposure Levels

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D.1. Impact of Exposure Levels and Exposure Duration

One of the first comprehensive definitions of exposure criteria for noise impact on marine mammals considering two types of impacts, namely auditory injury and behavioural disturbances by three sound types (single pulse, multiple pulse and nonpulse) has been published by Southall *et al* (2007). Just recently, the National Oceanic and Atmospheric Administration (NOAA) compiled and synthesized best available science to guide the assessment of effects of anthropogenic noise on marine mammals (NOAA, 2016). Both guidance documents consider cetaceans and pinnipeds assigned to five functional hearing groups (i.e. low-frequency cetaceans, mid-frequency cetaceans, high-frequency cetaceans, pinniped in water, pinnipeds in air and low-frequency cetaceans, mid-frequency cetaceans, high-frequency cetaceans, phocid pinnipeds underwater, otariid pinnipeds underwater respectively). The assignment to functional hearing groups was based on functional hearing characteristics of the species (e.g. frequency range of hearing, auditory morphology) and with reference to Southall *et al* as well the medium in which the amphibious living pinnipeds were exposed to sound. The developed noise exposure criteria do not address polar bears, sirenians, and sea otters due to the absence of necessary data in these species. To account for different hearing bandwidths and thus differences in impacts of identical noise exposure frequency-weighting functions were developed for each functional hearing group and considered in the formulation of the noise exposure criteria. Southall *et al* and NOAA applied dual criteria for noise exposure using peak sound pressure level (SPL) and sound exposure level (SEL) in each of the considered functional hearing groups in order to account for all relevant acoustic features such as sound level, sound energy, and exposure duration that influence the impacts of noise on marine mammals.

The onset of a permanent threshold shift (PTS-onset) has been considered as the onset of auditory injury (Southall *et al* 2007, NOAA 2016, Finneran 2015). PTS-onset estimates are applied in order to formulate dual noise exposure levels. The PTS-onset thresholds were estimated from measured TTS-onset thresholds (=threshold where temporary change in auditory sensitivity occurs without tissue damage) in very few mid-frequency odontocetes (i.e. bottlenose dolphin and beluga) and pinnipeds (i.e. California sea lion, northern elephant seal, and harbour seal) and extrapolated to other marine mammals due to the scarcity of available TTS data. It has been noted, that this extrapolation from mid-frequency cetaceans and the subsequent formulation of exposure criteria may be delicate in particular for high-frequency cetaceans due to their generally lower hearing threshold as compared to other cetaceans. The growth rates of TTS were estimated based on data in terrestrial and marine mammals exposed to increasing noise levels. Noise exposure levels for single pulse, multipulse and nonpulse sounds were expressed for SPL and SEL whereby the latter has been frequency weighted to compensate for the differential frequency sensitivity in each functional marine mammal hearing group as described above. No noise exposure criteria were developed by Southall *et al* (2007) or NOAA (2016) for the occurrence of non-auditory injuries (e.g. altered immune response, energy reserves, reproductive efforts due to stress, tissue injury by gas and fat emboli), due to a lack of conclusive scientific data to formulate quantitative criteria for any other than auditory injuries caused by noise.

Additionally to auditory injuries Southall *et al* (2007) presented also explicit sound exposure levels for noise impacts on behaviour resulting in significant biological responses (e.g. altered survival, growth, reproduction) for single pulse noise. For the latter it has been assumed that given the nature (high peak and short duration) of a single pulse behavioural disturbance may result from transient effects on hearing (i.e. TTS). Therefore, TTS values for SPL and SEL were proposed as noise exposure levels. In contrast, for multiple and nonpulse sounds it has been taken into account that behavioural reactions to sounds are highly context-dependent (e.g. activity animals are engaged at the time of noise exposure, habituation to sound) and depending also among others on environmental conditions and physiological characteristics such as age and sex. Thus noise impact on behaviour is less predictable and quantifiable than effects of noise on hearing. Moreover, adverse behavioural effects are expected to occur below noise exposure levels causing temporary loss of hearing sensitivity. Therefore, a descriptive method has been developed by Southall et.al. (2007) to assess the severity of behavioural responses to multipulse and nonpulse sound. This method encompasses a quantitative scoring paradigm which numerically ranks (scores) the severity of behavioural responses. Noise exposure levels have been identified in a scoring analysis based on a thorough review of empirical studies on behavioural responses of marine mammals to noise. Reviewed cases with adequate information on measured noise levels and behavioural effects were then considered in a severity scoring table with the two dimensions, severity score and received SPL.

In contrast to former sound exposure assessment attempts Southall *et al* (2007) and NOAA (2016) account for differences in functional hearing bandwidth between marine mammal groups through the developed frequency-weighting functions. Thus, this approach allows assessing the effects of intense sounds on marine mammals under the consideration of existing differences in auditory capabilities across species and groups respectively. Furthermore, as compared to the widely used RMS sound pressure Southall *et al* (2007) and NOAA (2016) propose dual criteria sound metrics (SPL and SEL) to assess the impact of noise on marine mammals, accounting not only for sound pressure but also for sound energy, duration and high-energy transients.

All these aspects are certainly major accomplishment as compared to earlier attempts to assess noise effects on marine mammals. However, it has also to be noted that due to the absence of data noise exposure criteria had to be based on extrapolations and assumptions and therefore, as Southall *et al* (2007) and Finneran (2015) pointed out, caution is needed regarding the direct application of the criteria presented and that it is expected that criteria would change as better data basis becomes available.

D.2. Species Vulnerabilities

The best documented vulnerabilities to noise in marine mammals in terms of number of studies and species involved are certainly behavioural responses to noise. Only a few studies considering a few species exist regarding noise impacts on hearing and hearing sensitivity and physiology in marine mammals and therefore the respective knowledge on specific vulnerabilities of noise is rather scarce.

Auditory effects resulting from intense noise exposure comprise temporary threshold shift (TTS) and permanent threshold shift (PTS) in hearing sensitivity. For marine mammals TTS measurements exist for only a few species and individuals whereas for PTS no such data exist (Southall *et al* 2007, Finneran 2015). Furthermore, noise may cause auditory masking, the reduction in audibility of biological important signals, as has been shown for pinniped species in air and water (Southall *et al* 2000, 2003) and in killer whales (Foote *et al* 2004) for example.

Physiological stress reactions induced by noise may occur in cetaceans as has been shown for few odontocete species where altered neuro-endocrine and cardiovascular functions occurred after high level noise exposure (Romano *et al* 2004, Thomas *et al* 1990c). Furthermore, regarding noise-related physiological effects it has to be noted that scientific evidence indicates that in particular beaked whales experience physiological trauma after military sonar exposure (Jepson *et al* 2003, Fernandez *et al* 2004, 2005) due to in vivo nitrogen gas bubble formation.

The magnitude of the effects of noise on behaviour may differ from biological insignificant to significant (= potential to affect vital activities such as foraging and reproduction). Noise-induced behaviour response may not only vary between individuals but also intra-individually and depends on a great variety of contextual (e.g. biological activity animals are engaged in such as feeding, mating), physiological (e.g. fitness, age, sex), sensory (e.g. hearing sensitivity), psychological (e.g. motivation, previous history with the sound) environmental (e.g. season, habitat type, sound transmission characteristics) and operational (e.g. sound type, sound source is moving / stationary, sound level, duration of exposure) variables (Wartzok *et al* 2004).

Observable behavioural responses to noise include orientation reaction, change in vocal behaviour or respiration rates, changes in locomotion (speed, direction, dive profile), changes in group composition (aggregation, separation), aggressive behaviour related to noise exposure and/or towards conspecifics, cessation of reproductive behaviour, feeding or social interaction, startle response, separation of females and offspring, anti-predator response, avoidance of sound source, attraction by sound source, panic, flight, stampede, stranding, long term avoidance of area, habituation, sensitization, and tolerance (Richardson *et al* 1995, Gordon *et al* 2004, Nowacek *et al* 2007, Wartzok *et al* 2004).

Studies have shown that in mysticetes the reaction to the same received level of noise depends on the activity in which whales are engaged in at the time of exposure. For migrating bowhead whales strong avoidance behaviour to seismic air gun noise has been observed at received levels of noise around 120 dB re 1 µPa while engaged in migration. In contrast, strong behavioural disturbance in other mysticetes such as gray and humpback whales as well as feeding bowhead whales has been observed at higher received levels around 150-160 dB re 1 µPa (Richardson *et al* 1985, 1999, Malme *et al* 1983, 1984, Ljungblad *et al* 1988, Todd *et al* 1996, McCauley *et al* 1998, Miller *et al* 2005). Furthermore, in different dolphin species reactions to boat noise varied from avoidance, ignorance and attraction dependant on the activity state during exposure (Richardson *et al* 1995).

Noise-induced vocal modulation may include cessation of vocalization as observed in right whales (Watkins 1986), sperm whales and pilot whales (Watkins and Schevill 1975, Bowles *et al* 1994) for example. Furthermore, vocal response may include changes in output frequency and sound level as well as in signal duration (Au *et al* 1985, Miller *et al* 2000, Biassoni *et al* 2000).

Noise-induced behaviour depends on the characteristics of the area where animals are during exposure and/or of prior history with that sound. In belugas for example a series of strong responses to ship noise such as flight, abandonment of pod structure and vocal modifications, changes in surfacing, diving and respiration patterns has been observed at relatively low received sound levels of 94-105 dB re 1 µPa in a partially confined area but the animals returned after some days while ship noise was higher than before (LGL and Greeneridge 1986, Finley *et al* 1990).

The distance of a noise source or its movement pattern influences the nature of behavioural responses. For instance, in sperm whales, changes in respiration and surfacing rates has been observed in the vicinity of ships (Gordon *et al* 1992) and dependant on whether a ship is moving or not different reactions of bowhead whales and other cetaceans have been observed (Richardson *et al* 1995, Wartzok *et al* 2004)

D.2.1. Species not listed on the CMS Appendices that should also be considered during assessments

- Deep-diving cetaceans, in particular beaked whales need special consideration regarding noise exposure levels due to the risk for tissue trauma due to gas and fat emboli under certain noise conditions.
- Due to their lower overall hearing thresholds, high-frequency hearing cetaceans (true porpoises, river dolphins, *Pontoporia blainvillei, Kogia breviceps, Kogia sima, cephalorhynchids*) may need additional consideration as their sensitivity to absolute levels of noise exposure may be higher than other cetacean hearing groups.
- Southall *et al* pointed out that due to a lack of data they could not formulate noise exposure levels for polar bears, sea otters, and sirenians. Certainly a point which needs consideration when dealing with areas where these marine mammal taxa occur.

References

Au WWL Carder DA, Penner RH and Scronce BL. 1985, 'Demonstration of adaptation in beluga whale echolocation signals, J Acoust Soc Am. 77:726-730.

Biassoni N Miller P J and Tyack PL. 2000, 'Preliminary results of the effects of SURTASS-LFA sonar on singing humpback whales (Technical Report #2000-06)', Woods Hole, MA: Woods Hole Oceanographic Institute, 23 pp.

Bowles AE Smultea M Würsig B DeMaster DP and Palka D. 1994, 'Relative abundance and behavior of marine mammals exposed to transmissions from the Heard Island Feasibility Test', J Acoust Soc Am. 96:2469-2484.

Fernández A Arbelo M Deaville R Patterson IAP Castro P Baker JR *et al* 2004, 'Pathology: Whales, sonar and decompression sickness (reply)', [Brief Communications], Nature, 428(6984), U1-2.

Fernández A Edwards JF Rodríguez F Espinosa de los Monteros,A Herráez,P Castro P *et al* 2005, 'Gas and fat embolic syndrome involving a mass stranding of beaked whales (Family Ziphiidae) exposed to anthropogenic sonar signals', Veterinary Pathology, 42, 446-457.

Finley KJ Miller GW Davis RA and Greene CR Jr. 1990, 'Reactions of belugas, *Delphinapterus leucas*, and narwhals, Monodon monoceros, to ice-breaking ships in the Canadian high arctic', Canadian Bulletin of Fisheries and Aquatic Sciences, 224, 97-117.

Finneran JJ. 2015, 'Noise-induced hearing loss in marine mammals: A review of temporary threshold shift studies from 1996 to 2015', The Journal of the Acoustical Society of America, 138 (3), 1702-1726.

Finneran JJ. 2015. Auditory weighting functions and TTS/PTS exposure functions for 39 cetaceans and marine carnivores. July 2015. San Diego: SSC Pacific.

Foote AD Osborne RW and Hoelzel AR. 2004, 'Whale-call response to masking boat noise', Nature, 428, 910.

Gordon J Leaper R Hartley FG and Chappell O. 1992, 'Effects of whale-watching vessels on the surface and underwater acoustic behaviour of sperm whales off Kaikoura, New Zealand', In Science and research series (p. 64). Wellington: New Zealand Department of Conservation.

Gordon J Gillespie D Potter J Frantzis A Simmonds MP Swift R *et al* 2004, 'A review of the effects of seismic surveys on marine mammals', Marine Technology Society Journal, 37, 16-34.

Jepson PD Arbelo M Deaville R Patterson IAP Castro P Baker JR *et al* 2003, 'Gas-bubble lesions in stranded cetaceans', Nature, 425, 575-576.

LGL Ltd. and Greeneridge Sciences 1986, 'Reactions of beluga whales and narwhals to ship traffic and icebreaking along ice edges in the eastern Canadian High Arctic: 1982-1984', In Environmental studies, 37. Ottawa, ON, Canada: Indian and Northern Affairs Canada. 301 pp.

Ljungblad DK Würsig B Swartz SL and Keene JM. 1988, 'Observations on the behavioral responses of bowhead whales (*Balaena mysticetus*) to active geophysical vessels in the Alaskan Beaufort Sea', Arctic, 41, 183-194.

Malme CI Miles PR Clark CW Tyack P and Bird JE. 1983, 'Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior (BBN Report No. 5366, NTIS PB86-174174)', Report from Bolt Beranek and Newman Inc. for U.S. Minerals Management Service, Anchorage, AK.

Malme CI Miles PR Clark CW Tyack P and Bird JE. 1984, 'Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II: January 1984 migration (BBN Report No. 5586, NTIS PB86-218377)', Report from Bolt Beranek and Newman Inc. for U.S. Minerals Management Service, Anchorage, AK.

McCauley RD Jenner M-N Jenner C McCabe KA and Murdoch J. 1998, 'The response of humpback whales (*Megaptera novaeangliae*) to offshore seismic survey noise: Preliminary results of observations about a working seismic vessel and experimental exposures', Australian Petroleum Production and Exploration Association Journal, 38, 692-707.

Miller PJO Biassoni N Samuels A and Tyack PL. 2000, 'Whale songs lengthen in response to sonar', Nature, 405, 903.

Miller GW Moulton VD Davis RA Holst M Millman P MacGillivray A *et al* 2005, 'Monitoring seismic effects on marine mammals – southeastern Beaufort Sea, 2001-2002', In S. L. Armsworthy, P. J. Cranford, and K. Lee (Eds.), Offshore oil and gas environmental effects monitoring: Approaches and technologies (pp. 511-542). Columbus, OH: Battelle Press.

NOAA. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

Nowacek DP Thorne LH Johnston DW and Tyack PL. 2007, 'Responses of cetaceans to anthropogenic noise', Mammal Review, 37, 81-115.

Richardson WJ. 1985, 'Behavior, disturbance responses and distribution of bowhead whales (*Balaena mysticetus*) in the eastern Beaufort Sea, 1980-84 (OCS Study MMS 85-0034, NTIS PB87-124376)', Report from LGL Ecological Research Associates, Inc for U.S. Minerals Management Service, Reston, VA. 306 pp.

Richardson WJ Greene CR. Jr Malme CI and Thomson DH. 1995, 'Marine mammals and noise', New York: Academic Press. 576 pp.

Richardson WJ Miller GW and Greene CR. Jr. 1999, 'Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea', Journal of the Acoustical Society of America, 106, 2281.

Romano TA Keogh MJ Kelly C Feng P Berk L Schlundt CE *et al* 2004, 'Anthropogenic sound and marine mammal health: Measures of the nervous and immune systems before and after intense sound exposure', Canadian Journal of Fisheries and Aquatic Sciences, 61, 1124-1134.

Southall BL Schusterman RJ and Kastak D. 2000, 'Masking in three pinnipeds: Underwater, low-frequency critical ratios', Journal of the Acoustical Society of America, 108, 1322-1326.

Southall BL Schusterman RJ and Kastak D. 2003, 'Auditory masking in three pinnipeds: Aerial critical ratios and direct critical bandwidth measurements', Journal of the Acoustical Society of America, 114, 16601666.

Southall BL Bowles AE Ellison WT Finneran JJ Gentry RL Greene Jr CR Kastak D Ketten DR Miller JH Nachtigall PE Richardson WJ Thomas JA and Tyack PL. 2007, 'Marine mammal noise-exposure criteria: initial scientific recommendations', Aquatic Mammals, 33 (4), 411-522.

Thomas JA Kastelein RA and Awbrey FT. 1990c, 'Behavior and blood catecholamines of captive belugas during playbacks of noise from an oil drilling platform', Zoo Biology, 9, 393-402.

Todd S Stevick P Lien J Marques F and Ketten D. 1996, 'Behavioral effects of exposure to underwater explosions in humpback whales (*Megaptera novaeangliae*)', Canadian Journal of Zoology, 74, 1661-1672.

Wartzok D Popper AN Gordon J and Merrill J. 2004, 'Factors affecting the responses of marine mammals to acoustic disturbance', Marine Technology Society Journal, 37, 6-15.

Watkins WA. and Schevill WE. 1975, 'Sperm whales (*Physeter catodon*) react to pingers', Deep Sea Research I, 22, 123-129.

Watkins, WA. 1986, 'Whale reactions to human activities in Cape Cod waters', Marine Mammal Science. 2:251-262.

E. Marine Noise-generating Activities

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Wild Migration

E.1. Military Sonar

E.1.1. Low-Frequency Active Sonar

The evolution of lower frequency active (LFA) sonar came from two needs. First, to increase detection ranges to overcome passive sonar systems and second, to compensate for the improvements of stealth designs in submarine hulls, part of which was an anechoic coating that absorbed incident waves. It was discovered this coating was less efficient when exposed to longer wave lengths.

LFA sonars work below the 1kHz range. For transmitting long distances efficiently, high-powered modulated signals, typically 240 dB in water at 1m, peak value, (240 dB re 1µPa @ 1m peak) are produced lasting from tens of seconds to sometimes minutes. An example of this technology is the SURTASS-LFA of the US navy that operates within 100-500Hz range. (Lurton, 2010)

E.1.2. Mid-Frequency Active Sonar

Mid-frequency active (MFA) sonar is used for detecting submarines at moderate range, typically less than 10km.

MFA operates between 1-5 KHz range, with a sound intensity level typically 235 dB in water at 1m, peak value, (235 dB re 1µPa @ 1m peak) with a pulse duration of 1-2 seconds. (Hildebrand, 2009, Fildelfo *et al* 2009)

E.1.3. Continuous Active Sonar

The concept of continuous active sonar (CAS) is generating interest in the anti-submarine warfare community, largely due to its 100 per cent duty cycle offering the potential for rapid, continuous detection updates. CAS operates between 500Hz to 3KHz range with sound intensity levels typically 182 dB in water at 1m, peak value, (182 dB re 1µPa @ 1m peak) with a signal duration of 18 seconds (Murphy and Hines, 2015)

E.1.4. Mine Counter Measures Sonar

Underwater mines have proven, over time, to be very effective. Their prevalence led to the development of the Mine Counter Measures (MCM) sonar. This system works at very high frequency, usually between 100-500kHz, to achieve high-quality acoustic imaging of the sea floor and water column. Targets, semi-buried or suspended from the sea floor, are easily identified. (Lurton, 2010)

E.1.5. Acoustic Minesweeping Systems

Acoustic Minesweeping Systems are another mine counter-measure that produces a low-frequency broadband transmission, mimicking the sound produced by certain vessels whereby detonating the mine. (Lurton, 2010)

E.2. Seismic Surveys

The commonly used surveying method for offshore petroleum exploration is 'seismic reflection'. This is simply sound energy emitted from a sound source (air gun array) several metres below the sea surface that penetrates subsurface layers of the seabed and is reflected and refracted to the surface where it is detected by acoustic receivers (accelerometers and geophones).

These surveys are typically conducted using specially equipped vessels that tow one or more cables (streamers) with geophones at constant intervals. Air guns vary in size, and in conjunction with the charge pressure, determine the sound intensity level and frequency.

Frequencies used for seismic surveys are between 10-200Hz and down to 4-5Hz for the larger air guns. However, there are unused high-frequency components up to 150kHz, with a very high discharge at the onset of the pulse. (Goold and Coates, 2006)

The typical discharge sound intensity level of each pulse of an air gun array is around 260-262 dB in water at 1m, peak to peak value, (260-262 dB re 1µPa @ 1m p-p)

(OSPAR, 2009) every 10-15 seconds, and surveys typically run more or less continuously over many weeks. (Urick, 1983, Clay and Medwin, 1997, Caldwell and Dragoset, 2000, Dragoset, 2000, Lurton, 2010, Prideaux and Prideaux, 2015)

E.3. Civil High Power Sonar

Seafloor mapping sonar systems are probably one of the most prolific forms of underwater noise generation. The main application is coastal navigation for the production of bathymetric charts. Other applications include geology, geophysics, underwater cables and oil industry exploration. Three examples are Single Beam Sounders (SBES), Sidescan Sonars and Multibeam Echosounders (MBES).

E.3.1. Single Beam Sounders

Single beam sounders point vertically below the vessel and transmit a short signal, typically 0.1ms. The frequencies vary on their application. For deep water, the frequency would be around 12kHz and increase to 200, 400 and even 700KHz for shallow water. The sound intensity level is usually around 240 dB in water at 1m, peak value (240 dB *re* 1µPa @ 1m peak). (Lurton, 2010)

E.3.2. Sidescan Sonar

Sidescan sonar system structures are similar to single-beam sonars. This sonar differs as it is installed on a platform or “towfish” and towed behind a vessel close to the seabed. Two antennae are placed perpendicularly to the body of the towfish, pointing fractionally to the sea floor. The transmission of the sidescan sonar insonifies the sea floor with a very narrow perpendicular band. The echo received along time reflects the irregularities of the sea floor. A simple analogy is the scan mechanism of a photo copier. The operating frequency is usually in the range of many hundreds of kHz with the pulse duration 0.1ms or less. (Lurton, 2010)

E.3.3. Multibeam Echosounder

Multibeam echosounders are the major tool for seafloor mapping, for hydrography and offshore industry applications. The transmission and receiving arrays are mounted on the vessel to create a narrow beam, fan-like 150º spread, and perpendicular to the keel.

Multibeam sounders can be put into three main categories depending on their system structure and varied uses:

- deep water systems, designed for regional mapping, 12khz for deep ocean, 30khz for continental slopes;
- shallow water systems designed for mapping continental shelves, 70-200kHz; and
- high-resolution systems for hydrography, shipwreck location and underwater structural inspection, 300-500khz.

The attraction for multibeam systems is the scale of area that can be covered over time. For instance, a deep water configured multibeam sounder with a 20km fan/spread can cover 10,000km² per day. (Lurton, 2010)

E.3.4. Boomers, Sparkers and Chirps

Sparkers and boomers are devices used to determine shallow features in sediments. These devices may also be towed behind a survey vessel, with their signals penetrating several tens (boomer) or hundred (sparker) of metres of sediments. Typical sound intensity levels of sparkers are approximately 204-210 dB in water at 1m, rms value (204-210 dB re 1 µPa @ 1 m). Deep-tow boomer sound intensity levels are approximately 220 dB in water at 1m, rms value (220 dB re 1 µPa @ 1 m). The frequency range of both is 80Hz-10kHz, and the pulse length is 0.2 ms. (Aiello *et al* 2012, OSPAR, 2009)

Chirps produce sound in the upper-frequency range around 20Hz-20 kHz. (Mosher and Simpkin, 1999) The sound intensity level for these devices is about 210-230 dB in water at 1m, peak value, (210-230 dB re 1 µPa @ 1 m) and the pulse length is 250ms. (Dybedal and Boe, 1994, Lee *et al* 2008, OSPAR, 2009)

E.4. Coastal and Offshore Construction Works

E.4.1. Explosions

Explosions are used in construction and for the removal of unwanted seabed structures. Underwater explosions are one the strongest anthropogenic sound sources and can travel great distances. (Richardson *et al* 1995) Sound intensity levels vary with the type and amount of explosive used and the depth to which it is detonated. TNT, 1-100lbs, can produce a sound intensity level from 272-287 dB in water at 1m, zero to peak value, (272-287 dB re 1µPa 0 to peak @ 1m) with a frequency range of 2-~1000Hz for a duration of <1-10ms. The core energy is between 6-21Hz. (Richardson *et al* 1995, NRC, 2003)

E.4.2. Pile driving

Pile driving is associated with harbour work, bridge construction and wind farm foundations. Sound intensity levels vary depending on pile size and type of hammer. There are two types of hammers, an impact type (diesel or hydraulic) and vibratory type. Vibratory type hammers generate lower source levels, but the signal is continuous, where impact hammers are louder and impulsive. The upper range is around 228 dB in water at 1m, peak value or 248-257 dB in water at 1m, peak to peak value, (228 dB re 1µPa peak @ 1 m/248-257 dB re 1µPa peak to peak @ 1m) with frequencies ranging within 20Hz-20kHz and a duration of 50ms. (Nedwell *et al* 2003, Nedwell and Howell, 2004, Thomsen *et al* 2006, OSPAR, 2009)

E.4.3. Dredging

Dredging is used to extract sand and gravel, to maintain shipping lanes and to route pipelines. The sound intensity level produced is approximately 168-186 dB in water at 1m, rms value, (168-186 dB re 1µPa @ 1m $_{rms}$) with frequencies ranging from 20Hz->1kHz with the main concentration below 500Hz.

The majority of this sound is constant and non-impulsive. (Richardson *et al* 1995, OSPAR, 2009)

E.5. Offshore Platforms

E.5.1. Drilling

Drilling can be done from natural or manmade islands, platforms, drilling vessels, semi-submersibles or drill ships.

For natural or manmade islands, the underwater sound intensity level has been measured at 145 dB in water at 1m, rms value, (145 dB re 1µPa @1m $_{rms}$) with frequencies below 100Hz. (Richardson *et al* 1995)

The sound intensity level transmitted down the caissons with platform drilling has been measured at approximately 150 dB in water at 1m, rms value, (150 dB re 1µPa $_{rms}$ @ 1m) at 30-40Hz frequency. (Richardson *et al* 1995)

Drill ships seem to emit the highest sound intensity level, 190 dB in water at 1m, rms value, (190 dB re 1µPa @ 1m $_{rms}$) with the frequencies ranging between 10Hz-10kHz, due to the efficient transmission of sound through the ship's hull. Additionally, ships use their location thrusters to keep them on target, combining propeller, dynamic positioning transponder (placed on the hull and sea floor) pingers (see below), and drill noise. (Richardson *et al* 1995, OSPAR, 2009, Kyhn *et al* 2014)

E.5.2. Positioning Transponders

Positioning transponders are used to dynamically position drill ships and other offshore platforms. Each system uses a concatenation of master and slave transponders. These systems have been recorded to have a sound intensity level of 100 dB in water at 2km, rms value (100 dB re 1µPa @ 2km $_{rms}$) with the frequencies ranging between 20kHz to 35kHz. (Kyhn *et al* 2014)

E.5.3. Related Production Activities

During production, noise sources include seafloor equipment such as separators, injectors and multi-phase pumps operating at very high pressures.

There have also been studies to measure the sound intensity levels during production maintenance operations. Sound intensity levels of 190dB rms from the drill ship (distance unknown) with a frequency range between 20Hz-10kHz were recorded. (Kyhn *et al* 2014) In another instance, well head (choke valves) were recorded as producing continuous noise 159 dB re 1 µPa @ 1m from the source (RMS) (McCauley, 2002)

There have been few systematic studies to measure the source levels of production maintenance. It is likely the sound intensity level is high. This is an area that needs focused attention.

E.6. Playback and Sound Exposure Experiments

Ocean science uses a variety of sound sources. These include explosives, air guns and underwater sound projectors.

Where studies involve the intentional exposure of animals to a particular noise source, the impact assessments (and ethics requirements) should refer to the information available in this Technical Background Information about the noise-generating activity and the species concerned (Modules B-D).

E.6.1. Ocean Tomography

Ocean tomography measures the physical properties of the ocean using frequencies between 50-200Hz with a sound intensity level of 165-220 dB in water at 1m (165-220 dB re 1µPa @ 1m). The *Acoustic Thermometry of Ocean Climate* research programme emitted a sound source of 195 dB in water at 1m, peak value, (195 dB re 1µPa @ 1m peak) at a frequency of 75Hz.

Geophysical research activities, one of which is the study of sediments in shallow water, also use typical mid or low-frequency sonar systems or echo-sounders. (OSPAR, 2009) These are discussed under Civil High Power Sonar.

E.7. Shipping and Vessel Traffic

Marine vessels, small to large, contribute significantly to anthropogenic noise in the oceans. The trend is usually, the larger the vessel, the lower the frequencies produced resulting in the noise emitted travelling greater distances. The sound characteristics produced by individual vessels are determined by the vessels class/type, size, power plant, propulsion type/design and hull shape with relation to speed. Also, the vessel's age regarding mechanical condition and the cleanliness of the hull: Less drag means less noise.

E.7.1. Small Vessels

Small vessels (leisure and commercial) for this paper are vessels up to 50m in length. These include planing hull designs such as jet skis, speed boats, light commercial runabouts as well as displacement hull designs like motor yachts, fishing vessels and small trawlers.

The greater portion of sound produced by these vessels is mainly above 1kHz mostly from propeller cavitation. Factors that generate frequencies below 1kHz are engine and gearbox noise as well as propeller resonance. The sound intensity level produced is approximately 160-180 dB in water at 1m, rms value, (160-180 dB re 1µPa @ 1m $_{rms}$) with frequencies ranging 20Hz ->10kHz. This, however, is dependent on the vessel's speed in relation to hull efficiency and economic speed to power settings. (Richardson *et al* 1995, OSPAR, 2009)

E.7.2. Medium Vessels

Medium vessels for this paper are vessels between 50-100m, such as tugboats, crew-boats, larger fishing/trawler and research vessels. These vessels tend to have slower revving engines and power trains. The frequencies produced tend to mimic large vessels with the majority of sound energy below 1kHz. The sound intensity level produced is approximately 165-180 dB in water at 1m, rms value (165-180 dB re 1µPa @ 1m $_{rms}$). (Richardson *et al* 1995, OSPAR, 2009)

E.7.3. Large Vessels

Large vessels for this paper are vessel lengths greater than 100m, such as container/cargo ships, super-tankers and cruise liners.

Large vessels, depending on type, size and operational mode, produce their strongest sound intensity level of approximately 180-190 dB in water at 1m, rms value, (180-190 dB re 1µPa @ 1m $_{rms}$) at a few hundred Hz. (Richardson *et al* 1995, Arvenson and Vendittis, 2000) In addition, a significant amount of high-frequency sound, 150 dB in water @ 1m, rms value, (150 dB re 1µPa @ 1m $_{rms}$) or broadband frequencies, 0.354-44.8 kHz of 136 dB in water at 700m distance, rms value, (136 dB re: 1µPa @ >700m $_{rms}$) can be generated through propeller cavitation. This near-field source of high-frequency sound is of concern particularly within shipping corridors, shallow coastal waters, waterways/canals and/or ports. (Arveson and Vendettis, 2000, Aguilar Soto *et al* 2006, OSPAR, 2009)

E.8. Pingers

E.8.1. Acoustic Navigation Beacons

Acoustic navigation beacons mark the position of an object and measure its height above the seabed. Most underwater beacons emit a short continuous wave tone, commonly 8-16 kHz octave band, with a stable ping rate. Typical sound intensity levels are around 160-190 dB in water at 1m, peak value (160-190 dB *re* 1µPa @ 1m peak). They are designed to be omnidirectional to be heard from any direction. Simple systems are programmed to transmit a fixed ping rate while more sophisticated systems transmit after receiving an interrogating signal. (Lurton, 2010)

E.8.2. Acoustic Deterrent Devices

Acoustic Deterrent Devices (ADDs) are a low powered device, 130-135 dB in water at 1m, peak value, (130-135 dB *re* 1µPa @ 1m peak) designed to deter fish from entering places of harm such as water inlets to power stations. The frequencies range from 9-15kHz for a duration 100-300ms every 3-4 seconds. (Carretta *et al* 2008, Lepper *et al* 2004, Lurton, 2010, OSPAR Commission, 2009)

E.8.3. Acoustic harassment devices

Acoustic Harassment Devices (AHDs) are a higher powered device, 190 dB in water at 1m, peak value, (190 dB *re* 1µPa @ 1m peak) originally designed to keep marine mammals away from fish farms by causing them pain. Frequencies range from 5-20kHz for repelling pinnipeds and 30-160KHz for delphinids. (Carretta *et al* 2008, Lepper *et al* 2004, Lurton, 2010, OSPAR, 2009)

E.9. Other Noise-generating Activities

E.9.1. Acoustic Data Transmission

Acoustic modems are used as an interface for subsurface data transmission. Frequencies range around 18-40kHz with a sound intensity level around 185-196dB in water at 1m (185-196 dB re 1µPa @ 1m). (OSPAR, 2009)

E.9.2. Offshore Tidal and Wave Energy Turbines

Offshore tidal and wave energy turbines are new, so acoustic information is limited. However, they appear to emit a frequency range of 10Hz-50kHz and a sound intensity level between 165-175dB in water at 1m, rms value, (165-175 dB re 1μPa @ 1m $_{rms}$) depending on size. (OSPAR, 2009)

E.9.3. Wind turbines

The operational sound intensity levels for wind generators depend on construction type, size, environmental conditions, type of foundation, wind speed and the accumulative effect from neighbouring turbines. A 1.5MW turbine in 5-10m of water with a wind speed of 12m/s has been recorded producing 90-112 dB in water at 110m, rms value, (90-112 dB re 1μPa @ 110m $_{rms}$) with frequencies ranging 50Hz-20kHz. (Thomsen *et al* 2006, OSPAR, 2009)

References

Aiello, G Marsella, E Giordano, L. and Passaro, S. 2012. Seismic stratigraphy and marine magnetics of the Naples Bay (Southern Tyrrhenian sea, Italy): the onset of new technologies in marine data acquisition, processing and interpretation. INTECH Open Access Publisher.

Aguilar Soto, N Johnson, M Madsen, PT Tyack, PL Bocconcelli, A Fabrizio Borsani, J. 2006. Does intense ship noise disrupt foraging in deep-diving Cuvier's beaked whales (*Ziphius cavirostris*)? Marine Mammal Science 22, 690–699.

Arveson, PT. and Vendittis. DJ. 2000. Radiated noise characteristics of a modern cargoship. Journal of the Acoustical Society of America 107, 118-129.

Caldwell, J. and Dragoset, W. 2000. A brief overview of seismic air-gun arrays. The leading edge. 19, 8: 898-902.

Carretta, JV Barlow, J. and Enriquez, L. 2008. Acoustic pingers eliminate beaked whale bycatch in a gill net fishery. Marine Mammal Science. 24, 4: 956-61.

Clay, CS. and Medwin, H. 1997. Acoustical Oceanography. New York, Wiley Interscience.

Dragoset, B. 2000. Introduction to air guns and air-gun arrays. The Leading Edge. 19, 8: 892-97.

Dybedal, J. and Boe, R. 1994. Ultra high resolution sub-bottom profiling for detection of thin layers and objects in OCEANS '94. Oceans Engineering for Today's Technology and Tomorrow's Preservation. Proceedings, Vol. 1, pp. I-634. IEEE

Filadelfo, R Mintz, J Michlovich, E D'Amico, A Tyack, PL. and Ketten, DR. 2009. Correlating military sonar use with beaked whale mass strandings: what do the historical data show?. Aquatic mammals, 35(4), p.435.

Goold, JC. and Coates, RF. 2006. Near source, high frequency air-gun signatures. International Whaling Commission Scientific Committee document SC/58 E, 30.

Hildebrand JA. 2009. 'Anthropogenic and natural sources of ambient noise in the ocean', *Marine Ecology Progress Series,* 395 (5).

Kipple, B. and Gabriele, C. 2004. Underwater noise from skiffs to ships. Proc. of Glacier Bay Science Symposium.

Kyhn, LA Sveegard, S. And Tougaard, J. 2014. Underwater noise emissions from a drillship in the Arctic, Marine Pollutions Bulletin, 86 (1), 424-433

Lee, GH Kim, HJ Kim, DC Yi, BY Nam, SM Khim, BK. And Lim, MS. 2008. The acoustic diversity of the seabed based on the similarity indes computer from Chirp seismic data, ICES Journal of Marine Science: Journal du Conseil, 66(2), pp.227-236.

Lepper, PA Turner, VLG Goodson, AD. and Black. KD. 2004. Presented at the Seventh European Conference on Underwater Acoustics, ECUA, Delft, Netherlands, 5-8 July, 2004.

Lurton, X. 2010. An Introduction to Underwater Acoustics, Principles and Applications, Second Edition. Springer: London.

McCauley, RD. 2002. Underwater noise generated by the Cossack Pioneer FPSO and its translation to the proposed Vincent Petroleum Field. Report produced for Woodside Energy Limited. 24 pp, cited in Woodside Energy Ltd. 2013. Browse FLNG Development EPBC Referral, Canberra

Mosher, DC. and Simpkin PG. 1999. Environmental Marine Geoscience 1. Status and Trends of Marine High-Resolution Seismic Reflection Profiling: Data Acquistion. Geoscience Canada. 26(4).

Murphy, SM. and Hines, PC. 2015. May. Sub-band processing of continuous active sonar signals in shallow water. in OCEANS 2015-Genova (pp. 1-4). IEEE.

Nedwell, JR. and Howell, D. 2004. A review of offshore windfarm related underwater noise sources. COWRI report No. 544 R 0308, 57 pp.

Nedwell, JR Langworthy, J. and Howell, D. 2003. Assessment of sub-sea acoustic noise and vibration from offshore wind turbines and its impact on marine wildlife, initial measurements of underwater noise during construction of offshore windfarms, and comparison with background noise. COWRIE report No. 544 R 0424, 68 pp.

NRC/National Research Council. 2003. Ocean Noise and Marine Mammals. The National Academies Press. 192 pp.

OSPAR. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment OSPAR Commission: Publication number 441/2009.

Prideaux, G. and Prideaux, M. 2015. Environmental impact assessment guidelines for offshore petroleum exploration seismic surveys. Impact Assessment and Project Appraisal: Published online December 2015.

Richardson, WJ Malme, CI Green, CR. and Thomson, DH. 1995.Marine Mammals and Noise. Academic Press, San Diego, CA 576 pp.

Thomsen, F Lüdemann, K Kafemann, R. and Piper, W. 2006. Effects of offshore wind farm noise on marine mammals and fish, COWRIE Ltd, Newbury, U.K.

Urick, RJ. 1983. Principles of Underwater Sound. New York: McGraw-Hill Co.

Table 9: Noise-generating activity, sound intensity level, bandwidth, major amplitude, duration and directionality (summary of E.1-E.9)

Sound	Sound Intensity Level (dB re 1μPa)	Bandwidth	Major Amplitude	Duration	Directionality
Military					
Military Low-Frequency Active Sonar	240 Peak @ 1m	<1kHz- 1khz	[unknown]	600-1,000ms	Horizontally focused
Military Mid-Frequency Active Sonar	235 Peak @ 1m	1-5kHz	[unknown]	1-2s	Horizontally focused (3 degrees down)
Continuous Active Sonar	182 Peak @ 1m	500Hz – 3kHz	[unknown]	18 seconds	Horizontally focused
Military Mine Counter Measures Sonar	[unknown]	100kHz-500kHz	[unknown]	[unknown]	[unknown]
Seismic Surveys					
Seismic Surveys	260-262 Peak to Peak @ 1m	10Hz-150kHz	10-120Hz also 120dB up to 100kHz	30-60ms	Vertically focused
Civil High Power Sonar					
Single Beam Sounders	240 Peak @ 1m	12kHz-700kHz depending on the application	[unknown]	0.1ms	Vertically focused
Sidescan Sonar	240 Peak @ 1m	12kHz-700kHz depending on the application	[unknown]	0.1ms	Vertically focused fan spread
Multibeam Echosounders	240 Peak @ 1m	12kHz-30kHz, 70kHz-200kHz, 300kHz-500kHz depending on the application	[unknown]	0.1ms	Vertically focused fan spread
Sparkers and Boomers	204-220$_{rms}$ @ 1m	80Hz-10kHz	[unknown]	0.2ms	[unknown]
Chirps	210-230 Peak @ 1m	20Hz-20kHz	[unknown]	250ms	[unknown]
Coastal and Offshore Construction Works					
Explosions, TNT 1-100lbs	272-287 Peak @ 1m	2Hz-~1,000Hz	6-21Hz	<1-10ms	Omnidirectional
Pile Driving	248-257 Peak to Peak @ 1m	20Hz-20kHz	100Hz-500Hz	50ms	Omnidirectional
Dredging	168-186 $_{rms}$ @ 1m	20Hz-1kHz	500Hz	Continuous	Omnidirectional
Offshore Platforms					
Platform Drilling	150 $_{rms}$ @1m	30Hz-40Hz	[unknown]	Continuous	Omnidirectional
Drill Ships (including maintenance)	190 $_{rms}$ @ 1m	10Hz-10kHz	[unknown]	Continuous	Omnidirectional
Positioning transponders	100 $_{rms}$ @ 2km	20kHz – 35kHz	[unknown]	Continuous	Omnidirectional

Sound	Sound Intensity Level (dB re1 ìPa)	Bandwidth	Major Amplitude	Duration	Directionality
Playback and Sound Exposure Experiments					
Ocean Tomography	165-220 Peak @ 1m	50Hz-200Hz	[unknown]	[unknown]	Omnidirectional
Shipping and Vessel Traffic					
Small Vessels	160-180 $_{rms}$ @ 1m	20Hz-10kHz	[unknown]	Continuous	Omnidirectional
Medium Vessels	165-180 $_{rms}$ @1m	Below 1kHz	[unknown]	Continuous	Omnidirectional
Large Vessels	Low Frequency 180-190 $_{rms}$ @ 1m High Frequency 136 $_{rms}$ @ 700m	Low Frequency A few hundred Hz High Frequency 0.354khz-44.8khz	[unknown]	Continuous	Omnidirectional
Pingers					
Acoustic Navigation Beacons	160-190 Peak @ 1m	8kHz-16kHz	[unknown]	[unknown]	Omnidirectional
Acoustic Deterrent Devices	130-135 Peak @ 1m	9kHz-15kHz	[unknown]	100-300ms	Omnidirectional
Acoustic Harassment Devices	190 Peak @ 1m	5khz-20kHz, 30kHz-160kHz depending on the application	[unknown]	[unknown]	Omnidirectional
Other Noise-generating Activities					
Acoustic Data Transmission	185-196 @ 1m	18kHz-40kHz	[unknown]	[unknown]	Omnidirectional
Offshore Tidal and Wave Energy Turbines	165-175 $_{rms}$ @ 1m	10Hz-50kHz	[unknown]	Continuous	Omnidirectional
Wind Turbines	90-112 $_{rms}$ @ 110m	50Hz-20kHz	[unknown]	Continuous	Omnidirectional

F. Related Decisions of Intergovernmental Bodies or Regional Economic Organisations

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A series of relevant intergovernmental decisions have already determined the direction for regulating anthropogenic marine noise through EIAs. The following decisions are the latest from each of Multi-lateral Environment Agreement (MEA).

F.1.1. CMS

'CMS Resolution 9.19: Adverse Anthropogenic Marine/Ocean Noise Impacts on Cetaceans and Other Biota' encourages Parties to:

> *'…to endeavour to control the impact of emission of man-made noise pollution in habitat of vulnerable species and in areas where marine mammals or other endangered species may be concentrated, and where appropriate, to undertake relevant environmental assessments on the introduction of systems which may lead to noise associated risks for marine mammals.'*

'CMS Resolution 10.24: Further Steps to Abate Underwater Noise Pollution for the Protection of Cetaceans and Other Migratory Species' encourages CMS Parties to:

> *'…prevent adverse effects on cetaceans and on other migratory marine species by restricting the emission of underwater noise, understood as keeping it to the lowest necessary level with particular priority given to situations where the impacts on cetaceans are known to be heavy"* and
> *"[u]rges Parties to ensure that Environmental Impact Assessments take full account of the effects of activities on cetaceans and to consider potential impacts on marine biota and their migration routes ...'*

'Resolution 10.24' further articulates that CMS Parties should ensure that Environmental Impact Assessments take full account of the impact of anthropogenic marine noise on marine species, apply Best Available Techniques (BAT) and Best Environmental Practice (BEP), and integrate the issue of anthropogenic noise into the management plans of marine protected areas. 'Resolution 10.24' also 'invites the private sector to assist in developing …alternative techniques and technologies for coastal, offshore and maritime activities'.

F.1.2. ACCOBAMS

'ACCOBAMS Resolution 5.13: Conservation of Cuvier's beaked whales in the Mediterranean' and 'Resolution 5.15: Addressing the impact of anthropogenic noise' reinforces the commitments made in 'Resolution 4.17: Guidelines to Address the Impact of Anthropogenic Noise on Cetaceans in the ACCOBAMS Area (ACCOBAMS Noise Guidelines)' that urges ACCOBAMS Parties to:

> *'[r]ecogniz[e] that anthropogenic ocean noise is a form of pollution, caused by the introduction of energy into the marine environment, that can have adverse effects on marine life, ranging from disturbance to injury and death.'*

This Resolution also encourages ACCOBAMS Parties to:

> *' ... address fully the issue of anthropogenic noise in the marine environment, including cumulative effects, in the light of the best scientific information available and taking into consideration the applicable legislation of the Parties, particularly as regards the need for thorough environmental impact assessments being undertaken before granting approval to proposed noise-producing activities.'*

The ACCOBAMS Noise Guidelines provide further comprehensive detail-specific considerations relating to military sonar, seismic surveys and offshore drilling, shipping and offshore renewable energy developments.

F.1.3. ASCOBANS

'ASCOBANS Resolution 5.4: Adverse Effects of Sound, Vessels and other Forms of Disturbance on Small Cetaceans', urges ASCOBANS Parties to:

> *'… develop, with military and other relevant authorities, effective mitigation measures including environmental impact assessments and relevant standing orders to reduce disturbance of, and potential physical damage to, small cetaceans, and to develop and implement procedures to assess the effectiveness of any guidelines or management measures introduced.'*

'ASCOBANS Resolution 6.2: Adverse Effects of Underwater Noise on Marine Mammals during Offshore Construction Activities for Renewable Energy Production', further recommends that Parties:

> *'… include Strategic Environmental Assessments and Environmental Impact Assessments carried out prior to the construction of marine renewable energy developments and taking into account the construction phase and cumulative impacts'*

and to:

'… introduce precautionary guidance on measures and procedures for all activities surrounding the development of renewable energy production in order to minimise risks to populations … [that include] *measures for avoiding construction activities with high underwater noise source levels during the periods of the year with the highest densities of small cetaceans, and in so doing limiting the number of animals exposed, if potentially significant adverse effects on small cetaceans cannot be avoided by other measures;* [to include] *Measures for avoiding construction activities with high underwater noise source levels when small cetaceans are present in the vicinity of the construction site;* [and] *technical measures for reducing the sound emission during construction works, if potentially significant adverse effects on small cetaceans cannot be avoided by other measures.'*

F.1.4. CBD

'CBD Decisions VIII/28: CBD Voluntary Guidelines on Biodiversity-inclusive Impact Assessment'provides detailed guidance on whether, when and how to consider biodiversity in both project level and strategic levels assessments. The document articulates screening, scoping, assessment and evaluation of impacts, development and alternatives; transparency and consultation, reporting, review and decision-making. The guidelines suggest that environmental impact assessments should be mandatory for activities in habitats for threatened species and activities resulting in noise emissions in areas that provide key ecosystem services.

'CBD Decision XII/23: Marine and coastal biodiversity: Impacts on marine and coastal biodiversity of anthropogenic underwater noise' encourages CBD Parties and others:

> *'… to take appropriate measures, as appropriate and within competencies and in accordance with national and international laws, such as gathering additional data about noise intensity and noise types; and building capacity in developing regions where scientific capacity can be strengthened.'*

In 'Decision XII/23' CBD Parties have agreed to a significant list of technical commitments, including gathering additional data about noise intensity and noise types, and building capacity in developing regions where scientific capacity can be strengthened.

The CBD Parties also encouraged Parties to take appropriate measures, including:

> *'… (e) Combining acoustic mapping with habitat mapping of sound-sensitive species with regard to spatial risk assessments in order to identify areas where those species may be exposed to noise impacts,*
> *(f) Mitigating and managing anthropogenic underwater noise through the use of spatio-temporal management of activities, relying on sufficiently detailed temporal and spatial knowledge of species or population distribution patterns combined with the ability to avoid generating noise in the area at those times,*
> *(g) Conducting impact assessments, where appropriate, for activities that may have significant adverse impacts on noise-sensitive species, and carrying out monitoring, where appropriate.'*

'Decision XII/23' urges the transfer to quieter technologies and applying the best available practice in all relevant activities.

F.1.5. IMO

The International Maritime Organization (IMO), through 'Resolution A 28/Res.1061', has requested that the Marine Environment Protection Committee (MEPC) keep under review measures to reduce adverse impact on the marine environment by ships, including developing:

> *'[g]uidance for the reduction of noise from commercial shipping and its adverse impacts on marine life'*

F.1.6. IWC

The Scientific Committee of the International Whaling Commission (IWC) continues to monitor and discuss the impacts of noise on cetaceans.

F.1.7. OSPAR

The Convention for the Protection of the Marine Environment of the North-East-Atlantic (OSPAR) has reached agreement on an 'OSPAR Monitoring Strategy for Ambient Underwater Noise'.

The OSPAR Intersessional Correspondence Group on Noise (ICG-NOISE) is currently working closely with the International Council for the Exploration of the Sea (ICES) data team to produce the 2017 OSPAR Intermediate Assessment for impulsive noise. This is the first regional assessment of its kind and will give policy-makers and regulators a regional overview of cumulative impulsive noise activity in the Northeast Atlantic, including the noise source type (e.g. pile driver, explosion) and intensity. The 2017 Intermediate Assessment will serve as a 'roof report' to inform the subsequent 2018 MSFD assessments of EU Member States within the OSPAR region.

F.1.8. Espoo (EIA) Convention

In 'Decision II/8' Espoo Parties endorsed the Good Practice Recommendations on Public Participation in Strategic Environmental Assessment set out in document 'ECE/MP.EIA/SEA/2014/2', including and requirement that

> *'… the public to be given an opportunity to comment on draft plans or programmes and the associated environmental reports,'*

and that:

> *'[p]eople who are affected by a plan or programme and are interested in participating must be given access to all necessary information and be able to participate in meetings and hearings related to the SEA process.'*

This applies during the different stages of the assessment, including screening, scoping, availability of the draft plan/programme and environmental report, opportunity for the public to express its opinions and decision.

F.1.9. HELCOM

The Baltic Marine Environment Protection Commission - Helsinki Commission (HELCOM) has two important programmes in development. The Baltic Sea Information on the Acoustic Soundscape Project surveyed national needs and requirements of information on noise and will recommend monitoring of ambient noise in the Baltic Sea. A registry of impulsive sounds project is also being considered.

F.1.10. Regional Seas Programmes

Most of the six UNEP administered Regional Seas Programmes including the Wider Caribbean Region, East Asian Seas, Eastern Africa Region, Mediterranean Region, North-West Pacific Region and the Western Africa Region and seven non-UNEP Administered Regional Seas Programmes including the Black Sea Region, North-East Pacific Region, Red Sea and the Gulf of Aden, ROPME Sea Area, South Asian Seas, South-East Pacific Region and the Pacific Islands Region suggest some form of impact assessment should be conducted to mitigate threats to the marine environment.

F.1.11. European Union Legislation and Implementation

Some pieces of EU legislation on environmental impact assessment and nature protection are relevant and contain specific references to the marine environment and wildlife and noise.

Recital 12 of Directive 2014/52/EU of the European Parliament and the Council, which amends Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment specifically mentions the marine environment and gives the example of one source of noise-generating activity:

> *'With a view to ensuring a high level of protection of the marine environment, especially species and habitats, environmental impact assessment and screening procedures for projects in the marine[1] environment should take into account the characteristics of those projects with particular regard to the technologies used (for example seismic surveys using active sonars).'*

In addition, Recital 33 of this Directive also requires that:

> *'Experts involved in the preparation of environmental impact assessment reports should be qualified and competent. Sufficient expertise, in the relevant field of the project concerned, is required for the purpose of its examination by the competent authorities in order to ensure that the information provided by the developer is complete and of a high level of quality.'*

The marine environment is mentioned in Annex III paragraph 2 (ii) related to legal article 4(3), and noise and vibration are listed in Annex IV paragraphs 1 (d) and 5 (c) among information to be supplied according to Article 5 (1).

The EIA Directive applies to all Member States and requires that, for certain types of projects listed in its Annexes, public and private projects likely to have significant effects on the environment by virtue *inter alia* of their size, nature or location are made subject to an assessment of their environmental effects.

Under the EIA Directive "project" means '*the execution of construction works or of other installations or schemes*' and '*other interventions in the natural surroundings and landscape including those involving the extraction of mineral resources*'.

For projects listed in Annex I of the EIA Directive an assessment should always be carried out, whereas, for projects listed in Annex II, Member States have to determine whether an assessment is to be carried out through a case-by-case examination or according to thresholds or criteria set by the Member State.

The so-called EU nature directives (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and Council and European Parliament Directive 2009/147/EC on the conservation of wild birds (Birds Directive) are also relevant. For the Natura 2000 sites designated for the protection of features such as marine animal species listed in Annex II of the Habitats Directive, measures are required under Art. 6(2) to avoid any significant disturbance of those species, while different human activities that are likely to have a significant effect on Natura 2000 sites need to be properly assessed and authorized in accordance with the provisions of article 6 (3) and (4) of the Habitats Directive. This provision also includes the obligation to assess the cumulative impacts of different activities on the conservation objectives of the site. Furthermore, the provisions of Article 12 of the Habitats Directive, which includes an obligation to prohibit deliberate disturbance of strictly protected species, are also particularly relevant in such situation, as all species of cetaceans and a number of marine vertebrates and invertebrates listed in Annex IV(a) benefit from a system of strict protection.

The Commission guidance document on *'establishing Natura 2000 sites in the marine environment'*[1] contains a specific section on noise pollution.

There is specific legislation on the marine environment. In 2008 the European Parliament and the Council adopted the Marine Strategy Framework Directive[2] which requires the Member States to achieve or maintain 'good environmental status' of European Union marine waters by 2020, by developing marine strategies. Marine strategies contain five main elements: the initial assessment, the determination of good environmental status, the establishment of environmental targets, the monitoring programmes and the programme of measures.

When determining 'good environmental status', the Member States shall determine a set of characteristics on the basis of 11 qualitative descriptors. One of these descriptors state:

[1] Guidelines for the establishment of the Natura 2000 network in the marine environment: Application of the Habitats and Birds Directives (pp. 94-96)

[2] Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive); Commission Directive (EU) 2017/845 of 17 May 2017 amending Directive 2008/56/EC of the European Parliament and of the Council as regards the indicative lists of elements to be taken into account for the preparation of marine strategies

"*Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment.*"

This is further specified in Commission Decision (EU) 2017 /848[3]. Two types of criteria elements are defined for Descriptor 11: (a) anthropogenic impulsive sound in water and (b) anthropogenic continuous low-frequency sound in water. The primary criteria for both types are that the spatial distribution, temporal extent, and the levels of anthropogenic impulsive sound or continuous low-frequency sound sources do not affect populations of marine animals. In both cases the Member States shall establish threshold values for these levels through cooperation at Union level, taking into account regional and subregional specificities.

Methodological standards, as well as specifications and standardised methods for monitoring and assessment, are given in detail for both types of sound sources.

Within the context of the Marine Strategy Framework Directive, the Member States sharing a marine region or sub-region are also encouraged to cooperate to deliver on the objectives of the Directive.

[3] Commission Decision (EU) 2017/848 of 17 May 2017 laying down criteria and methodological standards on good environmental status of marine waters and specifications and standardised methods for monitoring and assessment, and repealing Decision 2010/477/EU.

G. Principles of EIAs

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The principle of Environmental Impact Assessment (EIA) was developed and introduced in the 1960s during a time where there was a growth of modern environmental concern, a drive for more rational, scientific and objective environmental decision-making and a desire for more public involvement in environmental decision-making. (Weston, 2002)

Conducting EIAs is now a well-established governance and environmental management process, institutionalised in most of the 193 United Nations Member States (Glasson *et al* 2013, Morrison-Saunders and Retief, 2012).

Some intergovernmental bodies have elaborated the principles of what EIAs should present (see Module F).

Through the process of their adoption, governments have individually committed to reflecting these decisions in their domestic law. The 'weight' of these decisions taken by governments at an international level is considerable and provides significant clarity about the expectations to conduct EIAs and effectively manage impacts of marine noise-generating activities.

Some jurisdictions have already developed national and regional operational guidelines about mitigating anthropogenic noise on marine fauna during activities. These began with the United Kingdom's Joint Nature Conservation Committee guidelines. Similar guidelines have been iteratively developed in the United States of America, Brazil, Canada, Australia and New Zealand (Castellote 2007, Weir and Dolman 2007). The European Espoo Convention also provides guidance. These are important and necessary operational guidelines. They form a part of but are not the totality of what should be considered within an EIA.

This Module provides some general principles to ensure environmental impacts (broadly defined to include the physical, life and social sciences) are an explicit and fundamental consideration both during the design of an activity and in the project authorisation by a regulator. (Cashmaore, 2004)

It is clear that there is sufficient international agreement that EIAs should be conducted. There are widespread national legal commitment and some detail in a few jurisdictions. What is now required is a change of practice: by regulators to insist thorough EIAs are presented, and by proponents to accept the same. (Morrison-Saunders and Retief, 2012, Prideaux and Prideaux, 2015)

G.1. The importance of early Strategic Environmental Assessment

There is strong value in governments' undergoing a level of assessment before inviting proponents to propose activities. Conducting proactive and early assessment of groups of activities, in the context of broader governmental vision, goals or objectives, can serve as a decision-support instrument that shapes as a process. (Morgan, 2012) Commonly called Strategic Environmental Assessments (SEA), these exercises can highlight the likely outcomes of anticipated activities and reduce stakeholder conflict by restricting or directing activity development before any commercial investment has been made. (Alshuwaikhat, 2005, Fundingsland Tetlow and Hanusch, 2012).

SEAs have the potential to act as a mediating instrument, bridging problem perceptions with technical solutions and steering the assessment to facilitate the integration of environmental values into decision-making processes. (Therivel, 2012, Fundingsland Tetlow and Hanusch, 2012)

SEA can enhance communication between different stakeholders, enabling discussion and agreement independently of different beliefs, convictions, social roles, values, accumulated experiences, individual needs or other factors. (Vicente and Partidário, 2006) SEAs can also guide regulators about the institutional requirements needed to assess proposals properly. This will include their internal organisational structure, staffing and capacity. (Therivel, 2012, Fundingsland Tetlow and Hanusch, 2012)

SEA design should reflect the core principles of the EIAs and the 'CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities'.

G.2. Basic Principles of EIAs

It is broadly accepted that the basic intent of EIAs is to anticipate the significant environmental impacts of development proposals before any commitment to a particular course of action. Often, the detail required within EIAs is poorly defined. Many legislative provisions for EIAs have been introduced without consideration of the institutional requirements, organizational structure, staffing and capacity development (Cashmore *et al* 2004, Devlin and Yap 2008, Jay *et al* 2007). Often the scientific basis and methods need sophisticated understanding.

Defensible EIAs, representing the Best Available Techniques (BAT) and Best Environmental Practice (BEP), should provide regulators with decision-making certainty by ensuring:

- Appropriate transparency
- Natural justice
- Independent peer-review
- Appropriate consultation

Each of these elements complements and supports the others.

G.2.1. Transparency and Commercial Sensitivity

Transparency is necessary for well-informed consultation, natural justice and independent peer-review.

The extent of transparency should complement the goals of natural justice and consultation, but does not need to provide information that is genuinely commercially or personally sensitive. However, far too often commercial sensitivity is a veil that industry proponents hide behind. (DiMento and Ingram, 2005, Sheaves *et al* 2015) Currently, a large body of data about public resources (the marine environment) is claimed as commercial-in-confidence with little justification. (Costanza *et al* 2006, Sheaves *et al* 2015)

The technical details of proposal for activities that generate noise should be fully and transparently available for comment before plans are submitted for approval to regulators.

Broadly, the information provided should include:

- a comprehensive description of the noise to be generated and the equipment to be used, including elements of the sound that is auxiliary to the need,
- a comprehensive description of the direct and surrounding area where the noise-generating activity is proposed and the species within this area,
- independent, scientific modelling of sound propagation of expected sound intensity levels and sound dispersal, the timeframe of the noise-generation,
- scientific monitoring programmes conducted during and after noise-generating activity.

The full extent of information that should be transparently available is detailed in the 'CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities'.

While there is some information that is, and should remain, commercially sensitive, none of the information listed above should be considered commercially sensitive, and proponents should not seek to hide it from view.

G.2.2. Natural Justice

Natural justice is both a legal and common concept with two parts: it ensures there is no bias, increasing public confidence, and enshrines a right to a fair hearing so that individuals are not unfairly impacted (penalised) by decisions that affect their rights or legitimate expectations.

In the case of decisions for activities in the marine environment, confidence that there is no hidden bias can be developed by ensuring there is full transparency and that all stakeholders are given reasonable notice of the plans, a fair opportunity to present their concerns and that these concerns will factor in the final decision that is made. (DiMento and Ingram, 2005)

Stakeholders with a rightful interest in the marine environment include: traditional communities with cultural or spiritual connections, marine users such as fishermen (commercial and recreational), shipping and boating and tourism operators, scientists, conservation organizations, and general marine users such as tourism and recreation, who advocate for the conservation of marine wildlife or marine ecosystems. Their interest must be considered.

G.2.3. Independent Peer-review

There is a concern in many countries over the poor quality of EIA information. Depending on the circumstance, this might reflect problems with institutional arrangements, low levels of commitment by proponents, or issues with the nature, extent and quality of training and capacity-building in the impact assessment, or elements of all of these. (Morgan, 2012) There is often a significant gap between the best practice thinking represented in the research and practice literature and the application of EIAs on the ground. (Morgan, 2012)

Proponent-funded independent peer-review of EIA proposals, before submission to regulators for assessment, is an important tool of BEP. (Sheaves *et al* 2015) Comprehensive, independent peer-review is a logical requirement for ensuring alignment of EIAs with scientific understanding and standards and ensuring that scientific understanding takes precedence over short-term benefits and political considerations. (Morrison-Saunders and Bailey, 2003, DiMento and Ingram, 2005, Sheaves *et al* 2015)

In the case of marine noise-generating activities, independent peer-reviewers should include species experts and expert sound modellers and acousticians, who can declare full and verifiable independence from the proposal. Their peer-review reports should be fully transparent and submitted to regulators, without influence from proponents.

G.2.4. Consultation and burden of proof

True consultation has two key components: participation in the outcome of a decision and that the burden of proof rests with the proponent.

Development actions may have wide-ranging impacts on the environment, affecting many different groups in society. There is increasing emphasis by governments at many levels on the importance of consultation and participation by key stakeholders in the planning and development of projects.

An EIA is an important vehicle for engaging with communities and stakeholders, helping those potentially affected by a proposed development to be much better informed and to influence the direction and precautions put in place by the proponent. This requires an appropriate exchange of information and a willingness by the proponent to be transparent about their likely impact. (O'Faircheallaigh, 2010, Glasson *et al* 2013)

The burden of proof is often associated with the Latin maxim *semper necessitas probandi incumbit ei qui agit,* which broadly means "*the necessity for proof always lies with the person who makes the claim*". In the case of proponents of marine noise-generating activities, they claim that the activities they propose to undertake – in a shared marine environment – will cause minimal harm. To satisfy the burden of proof, the proponent must provide sufficient evidence to demonstrate that there is a limited danger of damaging the marine environment or any species that have been highlighted as having importance.

Other stakeholders do not carry the burden of proof but instead carry the benefit of assumption, meaning they need no evidence to support their position of concern. It is up to the proponent to provide the assurance and bear all financial costs for doing so.

Despite the international concensus for robust EIA described in Module F, in many circumstances the burden of proof has been shifted to stakeholders. The CMS Family Guidelines on Environmental Impact Assessment for Marine Noise-generating Activities and these Modules of Technical Support Information provide regulators with the needed information to redress this imbalance.

References

Alshuwaikhat, Habib M. 2005. Strategic environmental assessment can help solve environmental impact assessment failures in developing countries. Environmental Impact Assessment Review. 25, 4: 307-17.

Cashmore M Gwilliam R Morgan R Cobb D. and Bond A. 2004. 'The interminable issue of effectiveness: substantive purposes, outcomes and research challenges in the advancement of environmental impact assessment theory', *Impact Assessment and Project Appraisal,* 22 (4), 295-310.

Cashmore, Matthew. 2004. The role of science in environmental impact assessment: process and procedure versus purpose in the development of theory. *Environmental Impact Assessment Review*. 24, 4: 403-26.

Castellote M. 2007.'General review of protocols and guidelines for minimizing acoustic disturbance to marine mammals from seismic surveys', Journal of International Wildlife Law and Policy, 10(3-4), 273-288.

Costanza, Robert, Wilson, Matthew A, Troy, Austin, Voinov, Alexey, Liu, Shang and D'Agostino, John. 2006. The value of New Jersey's ecosystem services and natural capital. Portland, Institute for Sustainable Solutions, Portland State University

Devlin JF. and Yap NT. 2008. 'Contentious politics in environmental assessment: blocked projects and winning coalitions', *Impact Assessment and Project Appraisal*, 26 (1), 17-27.

DiMento, Joseph FC and Ingram, Helen. 2005. Science and environmental decision making: the potential role of environmental impact assessment in the pursuit of appropriate information. *Nat. Resources J.* 45: 283-309.

Fundingsland Tetlow, M. and Hanusch, M. 2012. Strategic environmental assessment: the state of the art. *Impact Assessment and Project Appraisal*. 30, 1: 15-24.

Glasson, John, Therivel, Riki and Chadwick, Andrew. 2013. *Introduction to environmental impact assessment*. London: Routledge.

Jay S Jones C Slinn P. and Wood C. 2007. 'Environmental impact assessment: Retrospect and prospect', *Environmental Impact Assessment Review,* 27 (4), 287-300.

Morgan, RK. 2012. Environmental impact assessment: the state of the art. Impact Assessment and Project Appraisal. 30, 1: 5-14.

Morrison-Saunders, A. and Retief, F. 2012. Walking the sustainability assessment talk—Progressing the practice of environmental impact assessment (EIA). *Environmental Impact Assessment Review*. 36: 34-41.

Morrison-Saunders, A. and Bailey, J. 2003. Practitioner Perspectives on the Role of Science in Environmental Impact Assessment. Environmental Management. 31, 6: 683-95.

O'Faircheallaigh, Ciaran. 2010. Public participation and environmental impact assessment: Purposes, implications, and lessons for public policy making. Environmental Impact Assessment Review. 30, 1: 19-27.

Sheaves, Marcus, Coles, Rob, Dale, Pat, Grech, Alana, Pressey, Robert L. and Waltham, Nathan J. 2015. Enhancing the Value and Validity of EIA: Serious Science to Protect Australia's Great Barrier Reef. *Conservation Letters*: n/a-n/a.

Therivel, R. 2012. *Strategic environmental assessment in action*. Earthscan: London

Vicente, Gustavo and Partidário, Maria R. 2006. SEA – Enhancing communication for better environmental decisions. *Environmental Impact Assessment Review*. 26, 8: 696-706.

Weir CR. and Dolman SJ. 2007, 'Comparative Review of the Regional Marine Mammal Mitigation Guidelines Implemented During Industrial Seismic Surveys, and Guidance Towards a Worldwide Standard', *Journal of International Wildlife Law* and *Policy*. 10 (1), 1-27.

Weston, J. 2004. EIA in a risk society. *Journal of Environmental Planning and Management*. 47, 2: 313-25.

H. CMS-Listed Species Potentially Impacted by Anthropogenic Marine Noise

Revised as of CMS CoP12

Pinnipeds				
Scientific name	**Common name**	**App I**	**II**	**CMS Instruments**
Arctocephalus australis	South American fur seal		1979	CMS
Halichoerus grypus	Grey seal		1985	CMS
Monachus monachus	Mediterranean monk seal	1979	1979	CMS, Monk Seal in the Atlantic
Otaria flavescens	South American sea lion		1979	CMS
Phoca vitulina	Harbour seal		1985	CMS, Wadden Sea Seals
Pusa caspica	Caspian Seal	2017	2017	CMS

Cetaceans				
Scientific name	**Common name**	**App I**	**II**	**CMS Instruments**
Balaena mysticetus	Bowhead whale	1979		CMS
Balaenoptera bonaerensis	Antarctic minke whale		2002	CMS, Pacific Cetaceans
Balaenoptera borealis	Sei whale	2002	2002	CMS , ACCOBAMS , Pacific Cetaceans
Balaenoptera edeni	Bryde's whale		2002	CMS , Pacific Cetaceans
Balaenoptera musculus	Blue whale	1979		CMS, ACCOBAMS, Pacific Cetaceans
Balaenoptera physalus	Fin whale	2002	2002	ACCOBAMS, CMS, Pacific Cetaceans
Berardius bairdii	Baird's beaked whale		1991	CMS, Pacific Cetaceans
Caperea marginata	Pygmy right whale		1979	CMS, Pacific Cetaceans
Cephalorhynchus commersonii	Commerson's dolphin		1991	CMS
Cephalorhynchus eutropia	Chilean dolphin		1979	CMS
Cephalorhynchus heavisidii	Heaviside's dolphin		1991	CMS, Western African Aquatic Mammals
Cephalorhynchus hectori	Hector's dolphin			Pacific Cetaceans
Delphinapterus leucas	Beluga		1979	CMS
Delphinus capensis	Long-beaked common dolphin			Western African Aquatic Mammals, Pacific Cetaceans
Delphinus delphis	Common dolphin	2005	1988	CMS, ASCOBANS, ACCOBAMS, Western African Aquatic Mammals, Pacific Cetaceans
Eubalaena australis	Southern right whale	1979		CMS, Pacific Cetaceans
Eubalaena glacialis	Northern right whale	1979		CMS, ACCOBAMS
Eubalaena japonica	North Pacific right whale	1979		CMS
Globicephala melas	Long-finned pilot whale		1988	CMS, ACCOBAMS, ASCOBANS, Pacific Cetaceans, Western African Aquatic Mammals
Grampus griseus	Risso's dolphin		1988	CMS, ACCOBAMS, ASCOBANS, Western African Aquatic Mammals, Pacific Cetaceans
Hyperoodon ampullatus	Northern bottlenose whale		1991	CMS, ASCOBANS, Western African Aquatic Mammals
Lagenodelphis hosei	Fraser's dolphin		1979	CMS , Western African Aquatic Mammals, Pacific Cetaceans
Lagenorhynchus acutus	Atlantic white-sided dolphin		1988	CMS , ASCOBANS
Lagenorhynchus albirostris	White-beaked dolphin		1988	CMS , ASCOBANS
Lagenorhynchus australis	Peale's dolphin		1991	CMS
Lagenorhynchus obscurus	Dusky dolphin		1979	CMS, Western African Aquatic Mammals, Pacific Cetaceans
Megaptera novaeangliae	Humpback whale	1979		CMS, ACCOBAMS, Pacific Cetaceans
Monodon monoceros	Narwhal		1991	CMS
Neophocaena phocaenoides	Finless porpoise		1979	CMS, Pacific Cetaceans
Orcaella brevirostris	Irrawaddy dolphin	2009	1991	CMS, Pacific Cetaceans

Orcaella heinsohni	Australian snubfin dolphin		1979	CMS, Pacific Cetaceans
Orcinus orca	Killer whale		1991	CMS, ACCOBAMS, ASCOBANS, Western African Aquatic Mammals, Pacific Cetaceans
Phocoena dioptrica	Spectacled porpoise		1979	CMS, Pacific Cetaceans
Phocoena phocoena	Harbour porpoise		1988	CMS, ASCOBANS, ACCOBAMS, Western African Aquatic Mammals
Phocoena spinipinnis	Burmeister porpoise		1979	CMS
Phocoenoides dalli	Dall's porpoise		1991	CMS
Physeter macrocephalus	Sperm whale	2002	2002	CMS, ACCOBAMS, Pacific Cetaceans
Platanista gangetica	Ganges River dolphin	2002	1991	CMS
Pontoporia blainvillei	Franciscana	1997	1991	CMS
Sotalia fluviatilis	Tucuxi		1979	CMS
Sousa chinensis	Indo-Pacific hump-backed dolphin		1991	CMS, Pacific Cetaceans
Sousa teuszii	Atlantic hump-backed dolphin	2009	1991	CMS, Western African Aquatic Mammals
Stenella attenuata	Pantropical spotted dolphin		1999	CMS, Western African Aquatic Mammals, Pacific Cetaceans
Stenella clymene	Clymene dolphin		2009	CMS , Western African Aquatic Mammals
Stenella coeruleoalba	Striped dolphin		2001	CMS, ASCOBANS, ACCOBAMS, Western African Aquatic Mammals, Pacific Cetaceans
Stenella longirostris	Spinner dolphin		1999	CMS, Western African Aquatic Mammals, Pacific Cetaceans
Tursiops aduncus	Indian bottlenose dolphin		1979	CMS
Tursiops truncatus	Bottlenose dolphin	2009	1991	CMS, ASCOBANS, ACCOBAMS, Western African Aquatic Mammals, Pacific Cetaceans
Ziphius cavirostris	Cuvier's Beaked whale	2014		CMS, ACCOBAMS

Sirenians

Scientific name	**Common name**	**App I**	**II**	**CMS Instruments**
Dugong dugon	Dugong		1979	CMS, Dugong
Trichechus manatus	Manatee	1999	1999	CMS
Trichechus senegalensis	West African manatee	2009	2002	CMS, Western African Aquatic Mammals

Sea turtles

Scientific name	**Common name**	**App I**	**II**	**CMS Instruments**
Caretta caretta	Loggerhead turtle	1985	1979	CMS, IOSEA Marine Turtles , Atlantic Turtles
Chelonia mydas	Green turtle	1979	1979	CMS, IOSEA Marine Turtles, Atlantic Turtles
Dermochelys coriacea	Leatherback turtle	1979	1979	CMS, IOSEA Marine Turtles, Atlantic Turtles
Eretmochelys imbricata	Hawksbill turtle	1985	1979	CMS, IOSEA Marine Turtles, Atlantic Turtles
Lepidochelys kempii	Kemp's ridley turtle	1979	1979	CMS, Atlantic Turtles
Lepidochelys olivacea	Olive ridley turtle	1985	1979	CMS, IOSEA Marine Turtles, Atlantic Turtles
Natator depressus	Flatback turtle		1979	CMS, IOSEA Marine Turtles

Fish, Crustaceans and Cephalopods

Fish, crustaceans and cephalopods are considered as listed CMS species as well as prey to CMS listed species.

Scientific name	**Common name**	**App I**	**II**	**CMS Instruments**
Carcharhinus obscurus	Dusky Shark		2017	CMS
Carcharodon carcharias	Great white shark	2002	2002	CMS, Sharks
Cetorhinus maximus	Basking shark	2005	2005	CMS, Sharks
Isurus oxyrinchus	Shortfin mako shark		2008	CMS, Sharks
Isurus paucus	Longfin mako shark		2008	CMS, Sharks
Lamna nasus	Porbeagle		2008	CMS, Sharks
Alopias pelagicus	Pelagic thresher shark		2014	CMS
Alopias superciliosus	Bigeye thresher shark		2014	CMS
Alopias vulpinus	Common thresher shark		2014	CMS
Carcharhinus falciformis	Silky shark		2014	CMS
Sphyrna lewini	Scalloped hammerhead shark		2014	CMS
Sphyrna mokarran	Great hammerhead shark		2014	CMS
Manta alfredi	Reef manta ray	2014	2014	CMS
Manta birostris	Manta ray	2011	2011	CMS
Manta alfredi	Reef manta ray	2014	2014	CMS

Mobula eregoodootenkee	Pygmy devil ray	2014	2014	CMS
Mobula hypostoma	Atlantic devil ray	2014	2014	CMS
Mobula japanica	Spinetail mobula	2014	2014	CMS
Mobula kuhlii	Shortfin devil ray	2014	2014	CMS
Mobula mobular	Giant devil ray	2014	2014	CMS
Mobula munkiana	Munk's devil ray	2014	2014	CMS
Mobula rochebrunei	Lesser Guinean devil ray	2014	2014	CMS
Mobula tarapacana	Box ray	2014	2014	CMS
Mobula thurstoni	Bentfin devil ray	2014	2014	CMS
Prionace glauca	Blue Shark		2017	CMS
Pristis pristis	Largetooth Sawfish	2014	2014	CMS
Rhinobatos rhinobatos	Common Guitarfish, Violinfish	2017	2017	CMS
Rhynchobatus australiae	White-spotted Wedgefish, Bottlenose Wedgefish		2017	CMS
Squatina squatina	Angelshark, Monkfish	2017	2017	CMS
Squalus acanthias	Spiny dogfish		2008	CMS, Sharks

Otters				
Scientific name	**Common name**	**App I**	**II**	**CMS Instruments**
Lontra felina	Marine otter	1979		CMS

Polar bear				
Scientific name	**Common name**	**App I**	**II**	**CMS Instruments**
Ursus maritimus	Polar bear		2002	CMS

Ben Robinson

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via email to: majordevadmin@sa.gov.au

Re: Proposed timber port at Smith Bay, Kangaroo Island

Dear Mr Kleeman,

I am involved in the transport and trucking industry on Kangaroo Island and I write in support of the Smith Bay Wharf facility.

The economy of Kangaroo Island needs this development and the jobs it will provide. While tourism and farming have made substantial contributions over many years, they are seasonal industries, and constrained by the limited freight and transport options now available.

Development of an export wharf facility at Smith Bay will finally provide much-needed alternative freight options for Kangaroo Island.

Independent economic analysis shows the forestry industry will create 234 FTE jobs, including 174 direct jobs. These are permanent jobs, not seasonal jobs like many of those in tourism and farming.

The forestry industry will add $42 million a year to the Gross Regional Product of Kangaroo Island and an extra $16 million in household income.

This injection of jobs, money and new residents into the Kangaroo Island economy will create critical mass for a number of businesses which are marginal at the moment. This includes those who might be directly involved in forestry, such as mechanics, fuel suppliers and trucking companies.

The increased economic activity will provide extra rates to the Kangaroo Island Council and an incentive for State Government to assist in roadworks, which will benefit all road users on Kangaroo Island.

Smith Bay is an ideal site for the proposed export facility. It is already an industrialized area with little attraction for tourists or locals to visit. The traffic routes proposed are designed to keep trucking separate to the tourism industry.

I urge you to approve the export facility development by Kangaroo Island Plantation Timbers, which will enable the establishment of the forestry business - a new, sustainable and profitable industry for Kangaroo Island.

Yours sincerely,

BR.

Michelle Barrett

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Yours sincerely,

JANNES BOERS

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Yours sincerely,

Shane Bradley.

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S Bradley.

Phillip Baker

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Yours sincerely,

Trevor Linnett.

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Yours sincerely,

From:	Michael Raymount
To:	DPTI:State Commission Assessment Panel
Subject:	Concerns about KPT"s Seaport development at Smith Bay
Date:	Tuesday, 28 May 2019 2:31:12 PM

Dear Minister,

RE: **Matters of National Environment Significance concerns, Kangaroo Island Plantation Timbers Seaport proposal**

I write to lodge a formal objection to Kangaroo Island Plantation Timbers' proposed Seaport at Smith Bay on Kangaroo Island, which the previous State Government deemed worthy of Major Project Status.

After a very long wait, I have now had brief opportunity to review the Environmental Impact Statement (EIS) prepared by the proponent.

Following that, I strongly believe this development should not proceed at Smith Bay.

More specific responses to EIS guidelines appear below, but the unresolved question remains:

- Why was this company privileged with Major Development Status for a deliberately destructive proposal for Smith Bay, when it's abundantly clear there are multiple, more suitable site options available on Kangaroo Island – including a former industrial wharf the company already owns?

A proposal like this elsewhere on Kangaroo Island will deliver the same jobs and economic benefit as those it speculates for Smith Bay but without wholesale destruction of the marine and terrestrial environment, public infrastructure, social amenity and long-term sustainable businesses.

With regard to the EIS, my major concerns relate to the potential destruction of Smith Bay's native flora and fauna protected under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC).

Environment Protection and Biodiversity Conservation Act 1999 - Matters of National Environment Significance

- Smith Bay is fortunate to be regularly visited by southern right whales. Over recent years the shallow bay has emerged as a biologically important area for these threatened marine mammals and their calves.
- Southern right whales are listed as endangered under the EPBC mainly thanks to the impacts of commercial whaling.
- The whales that call Smith Bay home for large periods of the year are at grave risk from the inevitable debilitating noise, dredging and vessel disturbance, vessel strike, pollution, leachate and consequent toxicity the development of the Seaport will bring to the bay.
- Proposed dredging activities to gouge 100,000 cubic metres from the floor of Smith Bay, ongoing port operations and an inevitable future dredging program. This will have a significant impact on the marine environment by disturbing and smothering benthic biota and habitats, degrading water quality through elevated turbidity, bioavailability of pollutants and reducing dissolved oxygen in the water column.
- The proponent's means to address this assault are inadequate at best and are

presented in a careless manner.

- Smith Bay is host to a number of threatened and endangered species that will be impacted by this proposal, including white bellied sea eagles, southern brown bandicoots and echidnas.
- The construction of the proponent's Seaport and on-land infrastructure will force those that survive the construction phase, away from Smith Bay – to where?
- The operation of the Seaport - including B-double truck movements around the clock - will inevitably contribute to unacceptable mortality rates.
- Although South Australia's koalas are not listed in the EPBC, the proponent must reveal how it intends to simultaneously manage the local koala population while destroying its habitat.
- On my reading, the proponent's EIS fails to adequately address any of these risks in sufficient detail, or provide credible mitigation.

Native Vegetation and Fauna

- The proponent admits its industrial facility at Smith Bay will result in a significant loss of seagrass in Smith Bay.
- It estimates - and on past record, we are certain underestimates – it will destroy 100,000 square metres (10 hectares!) of seagrass in the bay.
- Noise and light emissions from dredging will disrupt larger sea mammals such as southern right whales and dolphins, while future dredging, plus propeller wash and contamination from commercial shipping vessels, will prohibit regrowth.
- As referenced on page 44 of the proponent's EIS, the company insists its industrial operations will only result in the deaths of between six to 12 of endangered echidnas. Surely, any deliberate mortality of the endangered echidna should be considered unacceptable.
- To "offset" its dead echidnas, Kangaroo Island Plantation Timbers says it will assist with a feral cat eradication program which it claims is "the main factor threatening the echidna population".
- The Kangaroo Island echidna was recently listed as endangered under the EPBC, and therefore any added mortality risk to this endangered species should not be overlooked – regardless of the claimed "offset".
- Outside this EIS, in December 2018, AusOcean - a not-for-profit Australian Ocean Lab - conducted the first detailed underwater marine survey of Smith Bay.
- Kangaroo Island Plantation Timbers barely scratches the surface in its own survey to support its proposal, some of which was conducted without appropriate permits and should therefore be invalid in its documentation
- While the proponent not surprisingly found little to wonder at in Smith Bay, AusOcean made startling discoveries that should provide the template for your Government to re-assess the value in these waters.
- AusOcean's revelations included the discovery of an ancient two-metre-tall coral head and more than 10 new species of fish.
- I also draw your attention to the National Geographic website, which identifies what is at stake if this Seaport goes ahead at Smith Bay

I implore you in your role as Minister for Planning, Transport and Infrastructure, to reject this proposal.

Thank you for taking the time to consider my objection to this proposal.

I trust your Government will act in the best interests of Kangaroo Island, its environment and its people.

Yours faithfully

Michael Peter Raymount.

Michael Raymount

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Robert Kleeman,
Unit Manager Policy and Strategic Assessment
Planning and Development, Development Division
Dept of Planning, Transport and Infrastructure
GPO Box 1815
Adelaide SA 5000

via email to: majordevadmin@sa.gov.au

27th May 2019

Re: Proposed timber port at Smith Bay, Kangaroo Island

Dear Mr Kleeman,

We write to you as long-term residents of Kangaroo Island, small business owners, parents, community volunteers and KIPT shareholders.

Kangaroo Island is our family's home and we share it with the rest of the world – and although tourism is extremely important to KI it is not the be all and end all.

KI needs business and industries that support our communities year-round. I am a strong supporter of the Deep-Water Port Facility at Smith Bay on Kangaroo Island for a number of reasons.

Forestry has been a part of KI life for the past 40 years, but it has had a troubled past; for the first time a private company has had the foresight to tackle the issue which has held the industry back on KI and that is the ability to move the timber from KI to world markets in an economical way, essentially providing a route to market.

The Smith Bay port proposal is well thought out, considered and the right location on KI. The real truth of Smith Bay is that it already houses a sizeable commercial industry in Yumbah – acres of shade cloth, with security fencing, significant local road traffic from employees, freight into and out of the business. It makes sense to keep the commercialised areas together – we do not need or want further commercialisation of our coast areas – it is important to keep these industrial-looking areas together.

For some opponents of the Smith Bay proposal any port location around KI would be problematic. They would be unable to agree on any location, as all locations are pristine and loved and have either tourism operations, townships or businesses that would be impacted – Ballast Head, Cape Dutton, Kingscote and Vivonne Bay have all been spruiked about – but they have all been considered and discounted by the proponents and rightly so.

- **Ballast Head** – Steep land down to sea level, Glossy Black habitat including Shea Oak vegetation; in-sea Oyster leases within a couple of kilometres and expansion of the oyster operation underway; close proximity to Pelican Lagoon Sanctuary Zone (protected since 1914); full view of Kangaroo Islands 'millionaires playground' at Island beach – whose opposition would be huge.

- **Cape Dutton** – narrow rocky bay (deep gully) with steep headlands, Glossy Black habitat & vegetation with nearby Lathamai Conservation Park. Cape Dutton is in a declared marine park – which has been protected for good reason allowing only recreational activities

- **Kingscote Wharf** – is a commercial area, but shallow and well protected by the 'Spit', this would require massive changes to the mode of transport as well as significant dredging, facility upgrades. Heavy freight traffic back into the residential areas of Kingscote (which haven't experienced this noise and disruption for more than 30 years when the Troubridge and Island Seaway used to dock here). 24/7 trucks into town would be unwelcome now-a-days, especially past the school and hospital. Also, the need to stockpile large quantities of woodchips – there isn't the space at this facility. Bay of Shoals is a protected marine sanctuary zone. Nepean Bay is of substantial significance; Natural Resources KI in conjunction with community groups have been for a number of years conducting seagrass revegetation – which is proving successful and research shows seagrass meadows provide important habitat for King George Whiting, Snapper, Gummy Sharks and a number of protected species of (seahorses, sea dragons and pipefish). https://www.naturalresources.sa.gov.au/kangarooisland/coast-and-marine/coast-marine-program/monitoring-seagrass-fish-communities

- **Vivonne Bay** – Harsh South Coast seas – highest number of shipwrecks/treacherous and unprotected waters, the bay itself is beautiful and pristine with a handful of cray fishermen using it as a mooring. It is also very shallow and with limited road access to the bay itself. It would require significant land acquisition and road infrastructure as well as dredging of this pristine bay. Vivonne Bay has on a number of occasions been named Australia's 'Best Beach' there are very few people who would support the port being at Vivonne Bay. There is the very large Southern Kangaroo Island Marine Park and the Restricted Access Zone of Seal Bay immediately to the East of Vivonne Bay, these protected areas must be protected at all costs and bring many millions of dollars into the KI community and the State budget. Vivonne Bay is also a township of several hundred people with many holiday homes.

The Kangaroo Island Council has recently voted against supporting the Smith Bay proposal. I resigned from my position as councillor recently, due in part to their short-sighted views and inability to declare conflicts of interest. The Mayor lives within 2kms of Smith Bay and has a demonstrated bias and a perceived conflict of interest. The Mayor unashamedly uses his position to influence people (including council) to back his beliefs, and prejudice those who do not agree with his position. Mayor Pengilly has always stated that he doesn't support the proposed location – even before all the facts were presented in the EIS came. He has used his position of power to influence an extremely important decision of council and for this reason the council's position is flawed.

There is no one on Kangaroo Island who wants Yumbah's business to be affected and given the facts and scientific information presented in the EIS I don't believe that Yumbah will be affected. I have had the privilege of touring the Yumbah facility on a couple of occasions with David Connell (General Manager) and am aware of their concerns and their passion. They are a very good company, well run and respected, but like all KI businesses they struggle with the cost of doing business on KI – high freight and transport costs and high energy costs. The abalone industry is fraught with high costs and also vulnerability to diseases – but that is not a reason to prevent the forestry industry from becoming a far greater economic contributor than Yumbah alone and an extremely significant individual contributor to Kangaroo Island's Gross Regional Product.

Biosecurity is a huge concern for all of Kangaroo Island and commercially there are procedures and protections in place with international shipping and biosecurity laws. There is greater regulation of the commercial shipping industry than recreational vessels, the latter posing significant biosecurity risks. Natural Resources KI notes in surveys undertaken in 2008 discoveries of marine pests have been 'directly linked to vessel traffic from infected mainland ports. In particular, vessels such as yachts and motor cruisers have been identified as the main method of dispersal of these pests, as they are carried as hull fouling from one port to another'. Highlighting recreational vessels as a high-risk mode of introducing diseases to all of KI's waters and potentially affecting aquaculture industries.

https://www.naturalresources.sa.gov.au/kangarooisland/coast-and-marine/marine-pests

KIPT has committed to a monitoring and anti-biofouling regime, on top of the legislation it will enforce on its shipping providers.

There are a great number of positives for the forestry industry on Kangaroo Island and there are a significant number of supporters for the industry – many of whom are worried about speaking out for fear their businesses could suffer significant losses due to discrimination for speaking out in favour of the proposed port.

Forestry on Kangaroo Island has the ability to:

- Improve the lives of individuals and families through providing full time work opportunities. Islanders suffer from underemployment (rather than unemployment) – full time work will mean that families will find it easier to get home loans and access to finance which is particularly problematic on KI. The knock-on effect of more secure, full time work is more money into our community, strengthening other businesses, for example increased construction industry work and increased retail trade for hardware stores.

- Improve the economic viability of small businesses; the 174 direct additional employees that are required for the forestry industry will come not only from current residents but mostly from new island residents. They will live on KI full time – contributing to the island economy; spending money at our retail shops and service providers (mechanics, doctors, builders, etc), sending their children to schools – providing the flow-on effects of increasing teacher numbers and the viability of subject choices for senior school students (currently limited due to lack of student numbers and therefore limited specialist teacher positions), forcing a large number of senior year students off island to boarding school – which would be far less of a necessity if students had greater choices available on island.

- Increase the need for housing – there are over 1300 vacant blocks of land on KI; the cost of land is relatively cheap (the cost of building is up to 30% more expensive than on the mainland) with full time work, employees can hope to save and have access to home loans enabling them to build new homes – which in turn supports the construction industry across the island. With much of the employment being needed at the western end of the Island we would expect to see increased building activity in Parndana. The Parndana Community Club has pre-empted this and is subdividing land within the township to enable the town to grow as demand requires. They are very much looking forward to the expansion of their community that the forestry industry will bring.

- Significantly increased construction industry requirements during the initial port development stage as well as long into the future as the necessity for housing increases as employment predictions come to fruition. The construction industry on KI suffers with 'economies of scale' – there is just not quite enough to provide the confidence to builders and trades to expand and develop. The increased activity in the construction industry will help to drive down the costs of building as we increase the quantities of materials required (economies of scale) as well as improve competition between trades as the number of trades persons increases. The construction industry will likely form a significant number of the indirect FTE's predicted by KIPT and the Smith Bay wharf proposal.

- Private landowners with forests, which have been 'economically locked up' will finally be able to monetise their assets and have the choice to coppice the trees and resell them in another 10 years or to sell the logs and clear the land to revert back to traditional farming methods. The hope of course is that once timber has a route to market it will be a profitable and sustainable industry in its own right and these farmers may then have the confidence to continue to farm their forests as a profitable resource.

From a personal family perspective I don't necessarily see my children being directly employed in the forestry industry but this industry will expand KI's local economy in the region of 40 million dollars per annum, as well as create, in KI terms, unprecedented numbers of direct and indirect job opportunities– KI's age demographic is extremely skewed to 'baby boomers' and therefore retirees – we need to reverse the trend of our young people leaving to find work by creating diverse (including professional) job opportunities on Kangaroo island.

As a significant contributor to the construction industry on KI, Kauppila Builders sees the Smith Bay Wharf as a massive opportunity as well as an absolute necessity. Business confidence is currently low; with a council reducing its operational and infrastructure budget, limited government commercial construction work forecast for KI in the coming years and locked up economic potential of the forested lands – business owners like ourselves have considered and will consider if we can afford to remain on KI. This is a massive decision for us, but if we don't see a future here, we will need to look elsewhere for our family's future.

The major project process is meant to support developers through the process and provide businesses like us with confidence that all the boxes have been ticked and remove the uncertainty that fickle minded community consultation can cause to business confidence. We need to be certain about investing in our businesses and increasing our employee numbers including investing in young people and apprentices.

As a building company we have made a commitment to support our school leavers and take on local apprentices – we provide work experience opportunities and have supported 5 local apprentices over the past 8 years. The uncertainty around the port proposal means that we will not take on any new staff until there is a positive announcement of a major commercial project on the island that promotes business confidence and real jobs.

Some of the concerns being raised around the following issues – I think can all be turned into positives for the Island rather than negatives;

- Feral animals and over abundant species – once the forests have been monetised (meaning they have a route to market) and there is 'money' in forestry on KI, KIPT will, I have no doubt, be extremely responsible land managers and this includes the control of feral animals (particularly pigs) as well as the issue of over abundant species (i.e. koalas). KIPT will provide resources (time and money) to improve the management of these animals in conjunction with landholders as well as with the support of government bodies. This is a win-win for everyone.

- Fire risk – monetising the forests is the absolutely best way to ensure high level, considered fire management is implemented protecting their assets and those of their neighbours and the larger community.

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- Roads and transport networks – KIPT have always shown a commitment to road safety and the willingness to work with council to ensure road routes are the safest and most cost effective. There is significant state and federal funding opportunities available to the local council to help develop forestry roads. The council need to get their 'NO' hat off and show support for this industry if the Smith Bay proposal receives development approval. It is their (council's) responsibility to our community to ensure funding streams are actively sought for the benefit of this industry and the rate payer!

- I spoke to some long-term locals the other day who expressed concerns about the transport routes and potential costs to the rate payers.

    - They are concerned about accidents. Our international tourists are currently our biggest worries on the road and yet we don't say no to tourism!
    - A good council will work out an arrangement with KIPT to help fund the maintenance of the road network as well as reinstating roads to their former state as they finish harvesting on the smaller local roads. The larger arterial roads should be upgraded, and this doesn't have to fall back onto just the residents and ratepayers (of which KIPT is a significant rate payer). Federal and state funding should and could be actively sought to help fund roads to this new port and that help major industry development in regional areas.

I urge you to approve the export facility development by Kangaroo Island Plantation Timbers, which will enable the establishment of the forestry business - a new, sustainable and profitable industry for Kangaroo Island.

Yours sincerely,

DKauppila

LB & SK Kauppila

Kauppila Pty Ltd

RIGGS WINE COMPANY

28 May, 2019

Hon. Stephan Knoll
Minister for Planning
C/- Robert Kleeman
Unit Manager Policy and Strategic Assessment
Department of Planning, Transport and Infrastructure
GPO Box 1815
Adelaide, South Australia 5000

RE: Expression of Support – Major Development
Deep Water Port at Smith Bay, Kangaroo Island

SUBMITTED VIA EMAIL

Dearest Minister:

I am pleased to submit for your office's review and consideration this Expression of Support for that certain major development project outlined above and gazetted by the Parliament of South Australia on 23 February, 2017.

Having a working knowledge of the State Development Plan and having had numerous conversations with a wide range of interested stakeholders regarding the proposed project, it is my considered opinion that the project should go forward.

It is my view that the net benefit to the Kangaroo Island community, should the project be approved, outweighs the net risk. The flow-on effect of developing the plantation timber industry here will be a boon to the Island's economy and to the overall well-being of the people that call KI home.

That said, there are three areas of concern that I would like to table. They are:

- Protection of Yumbah Aquaculture's Operations: That there may be a potential negative operational impact on this existing business as a result of the proposed development – and what contingencies (financial, and otherwise) and remedies can be put in place should such an event occur - should be considered in the approval process.

- Funding of Road Works: That any improvements and modifications to the existing roads network be funded at the State and Federal level, to the extent possible. KI Council is currently financially unsustainable and simply does not have the means to fund said improvements.

- Jobs for Locals First: That KIPT be held to a transparent program that puts the training and development of Island residents first when it comes to staffing their operations – both those that are directly employed by the company as well as those employed by any contractors.

NEPEAN BAY, SOUTH AUSTRALIA ▪ +61 488 775 432 (M) ▪ RIGGSWINECO@GMAIL.COM

Should your office have any questions or require further information regarding my support for the proposed development at Smith Bay, please feel free to contact me on +61 488 775 432 at any reasonable hour. Alternatively, I can be reached via email at riggswineco@gmail.com.

Thank you for your time and attention in this matter and I will look forward its favourable consideration.

Very truly yours,

Kevin C. Riggs
Nepean Bay, Kangaroo Island

From: katie venable
To: DPTI:State Commission Assessment Panel
Subject: Objection Submission Smith Bay Development
Date: Tuesday, 28 May 2019 9:48:59 AM

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28 May, 2019
[redacted]
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The Hon Stephan Knoll
Minister for Planning
ATTENTION:
Robert Kleeman
Unit Manager, Policy & Development, Development Division
Department of Planning, Transport & Infrastructure
GPO Box 1815
Adelaide SA 5000
majordevadmin@sa.gov.au

Dear Minister,
I am writing this letter as a formal **objection** to the proposed Deep Seaport and Wood Chip Facility at Smith Bay on Kangaroo Island's North Coast.
The first part of this submission is how this proposed development has affected me personally.
In July of 2016, my husband and I purchased Lot 23 North Coast Road Smith Bay. Our Southern boundary is the North Coast road. Our Northern boundary joins Kangaroo Island Plantation Timber's(KIPT) coastal blocks(originally owned by someone from overseas at the time we purchased our block) and our Eastern boundary is the block (currently owned by Marshals but under contract to purchase by KIPT if port is approved) where KIPT are proposing to use for large vehicle parking and wood chip storage as well as possible redirection of the road into the port infrastructure.
We were completely unaware that this proposed development was on the horizon at the time of purchase. We had our house plans drawn up and were about to lodge these with Council for development approval when the proposed port was announced. Initially we thought we could live with a "jetty". My husband, trying to find a silver lining, said we could go fishing off the jetty! Our plans for a couple's retreat for bird watchers and my husband's dream of growing organic vegetables and developing an orchard for commercial sale seemed achievable on this block of land.
As time has passed, KIPT's proposed development has gone from a jetty to a multi-use and now a single use Deep Seaport. When I first met with Shauna Black at our block to try and understand the impact this might have on our plans, it seemed we might be able to live alongside this proposed port. I was told that although the trucks would be going past around every 15 minutes, it would be limited to working hours on week days. We started to look for another house site where we would be less exposed to noise from the trucks and decided we could run our retreats on the weekends when there would be no traffic noise. However, the dust from the trucks became a major concern as the most fertile, productive area for growing food was on the Southern flats close to the road where the truck traffic

would be most active. As KIPT's plans evolved into having wood chip storage on site at Smith Bay, it became clear that our plans for a quite and clean life on our beautiful North Coast block could not be achieved any longer. Although KIPT has offered to enter into a similar contract of option to purchase our land if the port is approved, it can never change the pain and anguish we feel daily about the loss of our dream and the destruction of this part of Kangaroo Island.

Other Concerns:

WOOD CHIP STORAGE

-How is KIPT planning to deal with the **smell** from wood chip storage?

-**Wood chip dust** from conveyor belt movements to vessels in the port?
-More detail is needed regarding the potential for **spontaneous combustion** and KIPT's fire-fighting plan, where will **water run off from fire-fighting efforts go? Where will water come from for fire-fighting?**
-The mitigation of leachate from the wood chip pile seems very simplistic. **Could you elaborate on KIPT's mitigation stratagy(s) for leachate?**

TRAFFIC & TRANSPORT

-How are our local roads, that are not designed to handle the type of vehicles and frequency of these vehicles, going to be maintained and **who is funding this maintenance?** I find it hard to understand why these questions were not required to be answered in the Environmental Impact Statement (EIS) *BEFORE* a decision is made on this proposal. **You have been quoted as saying "...there is no intention for the State Government to commit to a contribution towards the upgrade of local roads, should the development be approved..."**
-The frequency of trucks on our roads is unreasonable. Truck movements every 11 minutes 24 hours a day seven days a week past residential properties is completely inappropriate. There also seems to be multiple statistical differences(Exective Summary p.22, pages 462 & 472) on frequency of trucks throughout the EIS.
-Which one is correct?
How can the government legally approve a proposal with such discrepancies throughout this document?

-On all of the proposed trucking routes, there are many residential properties, sports clubs (Western Districts Football Club & Pony/Go Cart Clubrooms, Wisanger Football Club) tourist attractions, community halls, school bus routes and farms needing to move stock along these roads. Tourism is one of our biggest industries with many more self-drive tourists on our roads, many of whom are driving on a different side of the road than they are used to as well as road surfaces that can be challenging to many drivers. Wildlife is prolific throughout Kangaroo Island and often come into contact with vehicles.

What type of training are the truck drivers going to undertake before driving through our community? Who will implement and monitor these safety measures?

-Will KIPT develop a driving brochure to educate other drivers on how to drive on Kangaroo Island and share the roads with large logging trucks?

- Does KIPT have a *management plan for roadkill and wildlife road trauma victims*?

-How is KIPT planning to deal with *dust pollution* affecting neighbouring properties along trucking routes?

-How is KIPT planning to deal with *noise pollution* affecting neighbouring properties along trucking routes?

EMPLOYMENT:
-Once again there are many discrepancies on the number of jobs that will be created on Kangaroo Island. The only jobs listed in the EIS are as follows: Plantation Management 10; Harvest Operations; Haulage 20; Seaport operations; Stevedoring fly in specialists; and Corporate. Yet KIPT are claiming 234 full time equivalent jobs. I spoke to Peter Locket at one of the KIPT information sessions and he told me there would be 15 non-specialist jobs per construction phase equalling 45 jobs-more than likely the same 15 people would just renew short term contracts for each phase of construction so in reality only 15 people would be employed. These plus the 30 jobs listed above does not come near the number of jobs stated by KIPT used to gain initial major development status for this proposed development.

-What are these 234 jobs(list/identify) and how many will be permanent jobs for Kangaroo Island locals?

-Yumbah has 30 full time equivalent employees and has been operating almost 24 years. They have plans to expand which will offer more employment(possibly another 50+ jobs) opportunities within the local community. This business cannot operate alongside a port so close by. This means there will be 30 people who will loose their jobs and will probably move their families from Kangaroo Island.
How is this beneficial to Kangaroo Island?

LIGHT POLLUTION:
- Wildlife, homes and neighbouring businesses will be adversely affected by lighting needed for safety on and around the seaport infrastructure as well as the wood chip storage facility.

How is KIPT going to manage light pollution to all affected parties?

ENVIRONMENTAL IMPACTS:
-The corner of Rose Cottage Road and the North Coast Road has identified known Glossy Black Habitat in the form of food trees (sheoak) and potential future nesting sites in older sugar gums. This corner is on two of the preferred trucking routes.
How does KIPT plan to minimise the disturbance to this *endangered* species on these particular proposed trucking routes?
-Rosenberg's goanna is not listed on the EPBC, however, it is listed as vulnerable (National Parks and Wildlife Act 1972 version 212.2008)) and Kangaroo Island is it's last stronghold. "Due to their attraction to carrion, the rate of Rosenberg's

goanna deaths increase in line with the amount of traffic around the Island"(Natural Resources Kangaroo Island Website)

With increased carcasses on our roads from trucking activities, there will be increased activity from scavenger species, including the Rosenberg Goanna.

- How will KIPT manage this issue?

-" The number of echidnas likely to be killed by haulage trucks travelling from plantations to the KI Seaport and back is estimated at between six and 21 a year. The assessment concluded that there is potential for residual significant impact to the Kangaroo Island echidna (recently listed as endangered by the EPBC) and an offset under the EPBC Act is required."(pages 44-45 Executive Summary KIPT EIS) 'Mitigation' by funding the feral cat program on the Dudley Peninsula does not address road deaths of echidnas on the Western end of the Island. A study on echidnas on the western end of the Island is warranted to determine the real impact on echidnas where they are likely to be impacted, to develop a proper management plan.

Will KIPT do an appropriate study on echidnas on the Western end of Kangaroo Island before harvest begins and who will monitor the outcomes?

I understand that koalas are not addressed in KIPT's EIS, however I feel this is a major over site in the government's requirements for the EIS. I believe the existence of large koala populations living in the plantation timber sites could alter the forestry management plan for harvest. If harvest becomes financially prohibitive because of koala densities in the plantations, KIPT could potentially abandon harvest. Considering the Deep Seaport proposed is SINGLE-USE, with no product or minimal product to move off Kangaroo Island, we would have a port with no purpose.

"There is extreme risk for koalas resident in blue gum plantations to be injured or killed during harvest operations. It is therefore important that appropriate measures are taken to manage this risk.

There is also likelihood that koala welfare maybe adversely affected as a result of their habitat (blue gums) being harvested." (Australian Blue gum Plantation's Koala Protection and Management Plan)

The movement by koalas from Plantation Timber into native vegetation is inevitable once harvest begins. The Koala Census 2015-16 "estimated there were about 24,000 koalas in native vegetation and another 26,000 koalas in the Island's commercial blue gum plantations"(The Islander September 6, 2017 Martine Kinloch Natural Resources Kangaroo Island) "Koalas [population] are capable of doubling in size every three years" according to the Kangaroo Island koala population survey 2015. Considering these statistics, this would put the current koala population within KIPT's plantations at around 70,000+/- at present. If the Seaport at Smith Bay is approved in the next six months and construction takes around two years, this will put the koala population within the blue gum plantations around the 104,000+/- mark, all the while the koala population in the native vegetation is also increasing to around 96,000+/-.Considering the estimated populations in both the plantation timber as well as the native vegetation, this is an ecological disaster in the making. Not only is there potential for thousands of koalas to starve to death but there is a domino effect on other native species who depend on this habitat to live and reproduce.

- Is KIPT prepared for the cost of managing koalas in their Plantations and is there documentation to show this is a factor in their harvest plan budget?

Smith Bay is emerging as an important bio-diverse marine environment, currently ***FREE OF EXOTIC MARINE PESTS.*** It is a well documented place where **Southern Right Whales (endangered)** come to rest with their calves, a significant migratory path for **Bottlenose Dolphins** and feeding ground for **White-bellied Sea Eagles (endangered).**
I have read nothing in KIPT's EIS that adequetly addresses all the challenges these marine mammals and raptors will face if this development is approved.
- Can you please clarify how KIPT will manage noise and light disturbance with regard to marine mammals and sea eagles? What measures will be taken regarding toxicity and marine pests, turbidity during dredging and monitoring where ballast water is collected / dumped? Is this all self regulated or are there independent bodies responsible for all of the above?

-What are KIPT's strategies for managing roadside vegetation, especially in regards to the potential loss of rare or endangered plants?

In closing, I would like to say that I do not believe a port specific to this industry is warranted anywhere on Kangaroo Island. No matter where this proposed port is located, the same social and environmental issues will follow. I think it is agreed within the community that plantation timber should have never been planted on Kangaroo Island but how we use this resource has not been fully investigated.
The State Government touts Kangaroo Island as the Jewel in South Australia's Crown. How anyone could think such a small island could promote tourism alongside a logging industry is beyond me. Once again, it is a case of the government being fooled into allowing a large industry to infiltrate a small community with promise of prosperity. It has never worked anywhere in the long term and it never will. It's about get in get out economics.
I don't understand why other uses for the timber products are not being looked at. A great example of sustainable uses by a forward thinking company is Anergy(www.anergy.com). This company takes timber earmarked for wood chipping and converts it to a reusable asset. I am certain that doing something similar on Kangaroo Island is possible and would provide on Island employment with flow on effects to the local communities. Now is the time for governments to

recognise we can not sustain the same formula for perceived economic growth.
I am hopeful that this proposal will not go ahead and the Community of Kangaroo Island can come together and develop a more sustainable plan for economic and social growth for our Island home.
Thank you for your time and consideration on this matter.
Regards,
Kate Welz

From: John Symons
To: DPTI:State Commission Assessment Panel
Subject: Objection to Deep Sea Port at Smith Bay, KI
Date: Monday, 27 May 2019 8:57:52 PM
Attachments: EIS.docx

The South Australian Minister for Planning

Please find my attached submission.

I have outlined my areas of concern about the Smith Bay port development in the above attachment.

Thank you for the opportunity to make this objection.

Your Faithfully

John and Jo Symons
[redacted]

[redacted]

From: i_turner@bigpond.net.au
To: DPTI:State Commission Assessment Panel
Subject: Proposed KIPT Seaport at Smiths Bay
Date: Monday, 27 May 2019 2:34:48 PM

I wish to submit this objection to the KI Plantation Timbers' proposal for a port at Smiths Bay.

I use the plural, Smiths Bay, rather than Smith Bay as it was always known as Smiths Bay, including on all old official state maps. It was named after one Harry Smith, whose old cottage ruins are probably still there, very near where this proposed structure is to be built.

In 1882 my Great Grandfather and two Great Great Uncles settled at Smiths Bay. Having farmed near Cape Jervis and Second Valley since emigrating from England in 1854, they travelled the state before declaring, 'Smiths Bay is the best farming land available in South Australia'.

Whether that statement can be sustained agriculturally today is open to debate, but it certainly served our family well for 113 years before we sold the property in 1995 for a myriad of reasons. However, it is 'still home' in my heart, and one of the things that I am most proud of is the fact our family successfully farmed there while maintaining a strong ecological mindset. Over one third of our property was deliberately left as natural vegetation.

It is on part of what was our property that the KIPT 'deep seaport' and wood chipping facility is being proposed.

While some may argue that selling our property negates any comments we might have on this proposal of any relevance, I argue that we have as much, or more understanding of the region and this bay than most, and from the perspective of understanding the ecology and economic reality of the Island, I feel this objection to the KIPT proposal has strong credibility.

The huge EIS put out by KIPT is a document I will argue as deliberately large as to bury relevant points, or to present such a huge hurdle for people to digest in the hope they give up and don't bother. In this submission, I will not directly address single points within that EIS as there are far too many, but rather attempt to cover the bigger and more general key objection issues with this proposal.

1. Smiths Bay is a delicate ecological ocean area, as recent research is only just starting to verify. There is a shelf that runs right across this bay which is very important for ocean flora and fish life. Smiths Bay, as most who have ever had any meaningful contact with it would realise is not a deep bay. For it to even remotely cater for the vessels suggested in this proposal, it would need a huge amount of dredging which would have a devastating effect on the Bay's delicate and fragile ecology. Our family, and others in the immediate district would export their produce from Smiths Bay in the early days via the SS Karatta from an area known as 'The Landing'. Wool and grain (bagged) would be stacked at that area (well to the east) and when the ship arrived, it would anchor in the Bay; the produce loaded on drays pulled by horses that would then wade out into the Bay as far as they could go past the rocky shoreline, while bigger barge boats would be rowed in from the Karatta; the produce loaded onto them from the drays, then they would row back out to the Karatta and loaded on board – very inefficient multiple handling, but the best available at the time. The relevance being that if the Karatta, a small ship compared with the vessels proposed by KIPT could not get any closer, whereas it could dock at the Kingscote & Penneshaw jetties, it highlights the shallowness of Smiths Bay and the lunacy of such a proposal.
2. Our family collected water flow levels and salinity sample levels from Smith Creek at Freestone Bridge and upstream for many years. This was part of a program to test and measure to decide on the location of a reservoir/dam to supply water to mainly Kingscote. It was only raised salinity/mineral levels coming from the eastern tributary of the Creek that put Middle River into the frame as 'preferred site' for what we now know as the Middle River Dam. I have found nothing in the EIS that addresses water flow from Smith Creek. It may only have the name of a Creek, but a lot of water flows down that waterway, especially in a wet winter. In my 45 years there, there were two huge flood events (in the 1950s and 1990s) where the water coming over that Freestone Bridge was well up freestone Hill. In such scenarios, which will happen again, and if we believe climatologists is likely to happen more often, what safeguards are going to be in place to protect the Bay from flood washed woodchips causing a major pollution of the Bay? The site of their proposal is virtually at the mouth of that waterway, and such events (including lesser ones are also usually accompanied by deep low-pressure systems and king tides

3. Pages and pages of the EIS are devoted to soil tests at the site, presumably to ascertain any levels of pollution on the site from previous practices. This is confusing on several levels and helps lead to my assumption it is part of a plan to discourage scrutiny of things that matter. As the previous owners of the land up to the 1990s, in order to find, or to verify past use and possible contamination issues, one would have thought contact with us might have been a relevant course of action. What these tests concluded, we could have told them in 5 minutes – it was only used for grazing and cropping from 1882 to then. However, the relevance of this testing questionable – why is possible past pollution of importance to this industrial proposal that has far greater potential to pollute the land and the Bay?
4. Kangaroo Island was the birthplace of South Australia, and despite transport problems and some water supply issues, it has more than carried its weight as an important economic contributor to the state's economy. Initially it was through Agriculture, which is hugely important. In the 1980s KI had the highest sheep density in SA, with over 1,2 million sheep being successfully run by KI farmers. Again, my ancestors, and more recent generations as well, have been at the forefront of the agricultural development and improvement on the Island. In 1911 (I believe) barley from our property won a gold medal at an international grain show in Paris. The KI Agricultural show was instigated through my family's efforts, along with the Ag Bureau, with many firsts on credit. KIPT dismisses Agriculture as minor and relatively unimportant in comparison with its own projections of importance, economically and from an employment viewpoint. With respect, rather than the contempt they have shown for others, their employment figures are unsubstantiated, and even if they employ anywhere near the numbers they project, by their own admission very few will be filled by Islanders. It is history now, but agriculture's importance in KI economic figures was lessened through the 90s and beyond by the number of hectares of prime farming land taken out of production through acquisition for these ill thought out schemes that were built around an incentive which virtually became a tax dodge scheme for people using other people's money. If these properties were under agricultural use today, or in the future, employment numbers would be just as high, or higher that being proposed here, plus those jobs would be occupied by Island residents.
5. KI has been recognised and labelled as 'the jewel in SA's Tourism crown'. This is because of its relatively unspoilt environment and wilderness areas, the iconic coastal features of the Island, and the flora and fauna opportunities it presents. If this government is at all interested in seeing further development of such tourism opportunities for KI and the state, then this proposal is so wrong on so many levels. I have just spent 3 weeks in Tasmania and witnessed first-hand the workings of a woodchip port at Burnie, along with the amazing tourism opportunities elsewhere in that state – and the contrasts couldn't be more obvious. Compared with Tasmania, KI is much smaller and 'hiding' the activity around such a port proposal would be virtually impossible. That may be behind some of KIPT's thoughts in choosing such a location, but it is going to create as many, or more problems than it 'solves'. The unique experiences tourists can get on the Island are greatly at threat by this proposal. I have seen tourism go from a small minor industry to what is now a hugely important one, becoming more professional and diverse in the experiences being offered every year. Tourism on KI is extremely vital and important for the long-term employment and economic sustainability. The careful 'marriage' with agriculture and fishing (also a vital and sustainable industries) has seen KI become the 'jewel in SA's Tourism's crown'. While the south coast iconic sites such as Seal Bay, Remarkable Rocks, Flinders Chase etc are the features on which tourism was initially built around, maturity in the market-place has seen numerous other attractions being developed. The north coast is now being recognised for what Islanders have always known, a beautiful scenic drive, with Western River Cove, Middle River & Snellings Beach, Stokes Bay, Smith Bay and Emu Bay all prominent with what they offer. The dolphins that have lived at Dashwood/Smiths Bay have been there all my life and were a big and pleasurable part of my life there. KI Marine Adventures has brought the joy I know to many more, with the potential growth in this enterprise being huge. Further, with the decline in whaling through international pressure, the whales are returning to Smiths Bay in increased numbers. I witnessed them back in my childhood in the 1950s and 60s spasmodically, but the increase in their numbers is a huge bonus, both from an ecological point in assisting their comeback, but also from a tourism perspective. Down the east coast of Tasmania where I have just been, whale and dolphin spotting are high on people's viewing agenda. The tourism activity at Victor Harbor and Fowlers Bay are just two examples of what the potential is here. The KIPT proposal at Smiths Bay would kill off this potential overnight, plus from an ecology viewpoint, also greatly impinge on the whale migration through this area. Further, Molly's Run is an accommodation business in Smiths Bay that would most seriously be affected by

this proposal, through the visual eyesore and transport noise and danger, why would anyone want to stay or visit there? Again, the potential accommodation tourism ventures all along the north coast, would be killed off overnight.
Although an introduced species and arguably in plague proportions, Koalas have become a tourism delight. Good luck promoting tourism in one breath, and justifying the numbers of koalas that will die through the removal of their 'home' in the blue gums; or the enormous roadkill that will occur of all our fauna species from the constant transport.

6. Besides the obvious unsuitability of the Bay for a 'deep sea' port, the roads selected as preferred transit routes are even more unsuitable. Huge spending into the many millions would be needed before you could even contemplate regular heavy truck movement along these roads in conjunction with car or other transport options. They have neither the width, foundation; or the surface to accommodate such a proposal. There seems to be a heavy-handed expectation on KIPT's approach that 'as KI's biggest landholder and ratepayer' that whatever route they choose, the toads will have to be 'made ready' by council or government. As a taxpayer who has always addressed expenses needed to run my own businesses, I strongly object to my taxes going to help the coffers of a publicly listed company, especially one that offers very little benefit for KI, or I suspect the SA Government. I also suspect most KI residents would feel the same way if they were to find out their taxes and rates were to also go to such a venture.
7. The first block of land we sold was section 338 in the Hundred of Menzies, which through various owners and partners saw the establishment of the KI Abalone Farm, based around suppling an insatiable demand for this seafood from Asia, while also protecting natural stocks in our oceans. We assisted and encouraged John Hall & Justin Scanlon in their initial stages of development. Through trial and tribulation, Yumbah now runs this facility that has grown to a much larger scale, employing 25 people. In their own words, "an enviable location, a pristine stretch of clean, unpolluted water at Smith Bay – ensuring we can produce a world-class abalone right here on Kangaroo Island for distribution to both foreign and domestic markets". The placement of the KIPT proposal right alongside would simply be disastrous for this company, its customers and the growth potential, and would undo and destroy a quarter of a century of 'blood, sweat and tears' in favour of a questionable enterprise at best. These two enterprises simply can not live alongside each other, and I'd suggest Yumbah would find it extremely difficult to survive as it is alongside such a proposal.

In summary, KIPT seems to be apply the schoolyard bully attitude to this development proposal. It has ruled out far more suitable alternative port sites through a tunnel vision focus on Smiths Bay, without any consideration of the people already in business there; serious ecological concerns for endangered land & ocean creatures, or other Islander or visitor transport needs.

I trust this Government to have a wider focus than on unsubstantiated job figures, which were enough to sway the previous government into granting it 'major development' status, thus allowing KIPT to take on the 'holier than thou' attitude it presents.

Besides unsubstantiated employment figures, the questions need to be asked on costs to benefits. Lost tourism returns and employment, plus potential huge ecological damage needs to be weighed up against the suggested and unsubstantiated promises and benefits.

Whether the harvesting of these pines and blue gums for woodchips is permitted by this government or not, this port proposal is certainly not the location.

Ian Turner, 15 Ray Orr Drive, Mt Barker, SA 5251 (& former long term resident of Smith Bay)

From:	Andrew.Thornton@jlta.com.au
To:	DPTI:State Commission Assessment Panel
Subject:	Proposed timber port at Smith Bay, Kangaroo Island
Date:	Monday, 27 May 2019 8:16:51 AM

May 27 2019

Robert Kleeman,
Unit Manager Policy and Strategic Assessment
Planning and Development, Development Division
Dept of Planning, Transport and Infrastructure
GPO Box 1815
Adelaide SA 5000

Dear Mr Kleeman,

I am emailing you in support of the proposed timber port at Smith Bay, Kangaroo Island.

We are an insurance broker with expertise in the timber industry. We arrange plantation insurance on Kangaroo Island and throughout the green triangle region. In addition to that we have many clients that harvest and haul timber throughout South Australia and Victoria. This project would be a huge boost for many of our clients in the industry who would extend their operations to Kangaroo Island which would create further jobs and opportunities on the Island.

In my current role I have seen the direct and positive impact of the timber industry in large regional centres such as Mount Gambier, Portland, Hamilton and Colac to name a few. This would be replicated on Kangaroo Island when it comes to things like employment, retail, housing, services to the industry and numerous other benefits.

I have no doubt that the proposed timber port will be a huge boost to the economy of South Australia and as Kangaroo Island is one of the best places in the Country to grow timber, the export potential is huge.

With any such development there will always be objections but the positives of such a facility on Kangaroo Island far outweigh any negatives and the benefits can start to flow and will exist for a very long period of time. This vital piece of infrastructure is relevant to the timber industry but can also open up so many other opportunities in a broader sense.

I urge you to give this port your greatest consideration so that the benefits can start to flow.

Yours sincerely,

Andrew Thornton

Minister for Planning
C/- Robert Kleeman
Unit Manager Policy and Strategic Assessment
Department of Planning, Transport and Infrastructure
GPO Box 1815, ADELAIDE SA 5000

majordevadmin@sa.gov.au

Dear Minister,

Deep Water Port Facility, Smith Bay, Kangaroo Island

I grew up on Kangaroo Island and now live here with my own family. I have been involved with various businesses and I understand how hard it can be to make a business work on Kangaroo Island, with the cost of freight and fuel and so on.

I support the development of the Smith Bay Wharf proposal because it creates a new freight option for Kangaroo Island. I know the timber company is building it for its own exports but I believe in time it will have other uses. In any case, even if it only ever used for timber, this is still a good reason to build it.

As a local, I want to see our Island grow and I want it to be a place where businesses can invest confidently. Also, a place where young people can look forward to employment. Since the closure of Safcol and the abattoirs many years ago, the only industry that has really grown is tourism.

I am not against tourism but it cannot be the answer to everything. We need an industry that brings people to live here, not just to visit.

As a fisherman, I see no reason to fear the impact of the proposed wharf on the sea around Smith Bay. Fish and dolphins are attracted to these structures because they are like artificial reefs.

I have had some dealings with Kangaroo Island Planation Timbers over managing feral pig populations in the plantation forests and I have found the company to be receptive and transparent in their dealings. They have shown they want to be good corporate citizens.

I ask you to approve this wharf so that the forest industry can start providing jobs for locals, including in the transport and trucking sector.

Yours sincerely

Clayton Morrison

Kingscote

KANGAROO ISLAND ROAD SAFETY COMMITTEE

PO Box 164, Parndana SA 5220

Chairperson: Bob Pain
Ph: 0428 410 311 or 8553 3172
Email: kiroadsafety@gmail.com

Secretary: Sue Florance
Ph: 0428 828 400 or 8559 6104
Email: kiroadsafety@gmail.com

The Hon Stephan Knoll, MP
Minister for Planning

27 May 2019

Attention: Robert Kleeman
Unit Manager, Policy & Development, Development Division
Department of Planning, Transport and Infrastructure
GPO Box 1815
ADELAIDE SA 5000

majordevadmin@sa.gov.au

Dear Minister,

Re: Smith Bay Seaport proposal – Draft Environmental Impact Statement

We write to you with regard to the scope of the Draft EIS, which is to assess the potential impacts associated with the construction and operation of offshore and onshore infrastructure at Smith Bay, including site access from the North Coast Road to and from plantation operations to the West of Kangaroo Island.

We have focused only on the implications that the proposal will have on Road Safety as it pertains to the Transport and Traffic areas of the EIS, as these areas are of most interest to the Kangaroo Island Road Safety Committee (KIRSC).

Clarification of some perceived inconsistencies:

1. There is some seemingly inconsistent data relating to road kilometres travelled by the heavy-haulage fleet while transporting resource from plantation to wharf. In the executive summary (page 62) it states that the total number of road kilometres travelled in a given year will be approximately 6.6 million, with an extrapolation that this will result in roughly 6.5 extra 'non-serious' accidents over background numbers in that year. This 6.6 million

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kilometre figure contrasts with a figure of 3.4 million kilometres travelled per annum quoted in several sections of the main report, such as at page 475. On this page it is determined that 3.2 'non-serious' accidents, over and above otherwise expected accident levels, are likely to occur. Both the numbers and the extrapolative process used to determine outcomes, in terms of accidents, seem to vary between these two sections. ***We ask that this seeming inconsistency be explained or resolved.***

2. In the section on page 470 of the main report it examines the averages of road-use-kilometre by vehicle type and the types and frequencies of the accidents they are involved in while travelling these kilometres. It appears from this statistical analysis, that heavy vehicles are involved in fatal accidents in a disproportionate manner when compared to the other road users, compared with the kilometres they travel. In fact they are twice as likely to be involved in fatal accidents when compared to other road users and are, to some degree, commensurately less likely to be involved in minor traffic accidents.
   In this context it is interesting to examine the EIS statements which only envisions 'non-serious' traffic accidents resulting from the KIPT operations on Kangaroo Island, stating these should increase slightly following a quite significant increase of heavy-haulage road users on the island.

Queries and Concerns:

1. Can we be assured that the atypical nature of other road users on Kangaroo Island has been adequately examined during the formulation of the EIS? Bearing the following in mind... It would be true to state that Kangaroo Island has, in general, a far higher proportion of road users from third countries, when compared to average rural road use demographics from around Australia.

   Many of these users are very inexperienced in travelling on rural road systems particularly on densely vegetated roadside verges found on KI. They may come from home countries where driving on the right hand side of the road is the norm and may have English as a second or third language, assuming they speak and/or read it at all. This is causing issues throughout roads on the island already and is a primary focus of KIRSC.

2. It could be suggested that a significant increase in the proportion of heavy vehicles using the already stretched road system on Kangaroo Island might possibly lead to an increase in both crashes and the severity of crashes which may not have been adequately dealt with in the documents at hand.

   Another major change in the nature of the project is outlined on page 88 and again on page 460 of the main report. In these sections it is stated that the operation of harvest and haulage, when undertaken, will be a 24-hour a day, seven day a week operation. We had previously understood that harvest and haulage would be continuous at times when resource is available, and when either storage or shipping is also open to accepting product.

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We were also of the understanding the operation was to be conducted during daylight hours only. This premise was clearly spelled out in the engineering report by Anna Osmond in 2017. It has been a core consideration during consultations that have been conducted examining the proposal.

3. We note the statements made on page 474 of the main report dealing with road surface impacts. In this section, the assertion is made that the increased usage of Kangaroo Island roads by KIPT vehicles represents only a 6% increase in usage of the road system. It further states that this will therefore have a 'negligible' effect on the road system. We point out that current usage patterns have considerable impacts on road surfaces and, in fact, the previous State Government committed significant extra funding to Kangaroo Island, via the Council, to address the serious impacts experienced on our already over taxed and often inadequate roads. While a further 6% of traffic does not seem a massive burden to be placed on the system overall, we would point out that this analysis may be inadequate, as the impacts will be centred on a small-subset of roads and not spread evenly over the entire network.

   Within the EIS it appears to provide the statistic that nearly a third of vehicles using a significant section of the Playford Highway may be reasonably expected to be heavy B-double or A-double vehicles in the next 15 years should the KIPT operations commence. It is hard to see how these usage figures can be achieved without having commensurate negative effects on road surface quality on high-usage roads that have been defined as part of the transport corridor within the documents under consideration.

4. We also would like to query a series of points made on the topic of multiple-interest road usage on page 480. In the first of the dot-points it appears that firstly, KIPT is claiming that it may be possible for greater road funding for joint tourist/haulage routes to be obtained, but then in the next dot point it states it should be possible to dissuade tourists from utilising these routes and that locals will learn to avoid these roads, presumably because of the inherent risks that exist when light vehicles and heavy haulage vehicles share a relatively constricted transport corridor. ***It appears, to some degree, that these points are contradictory. We seek clarification.***

5. It is mentioned that the transport route will be both for the fully laden and the unladen vehicles therefore ***can it be assured that the upgrading of the roads will take that into account when assessing an adequate width for road modifications?***

Financial Considerations and its ramifications for the Island wide road maintenance:

1. We note that the whole of this document is predicated in terms of the public funding that would need to be accessed for this project. This would require, in the first instance, the upgrade of existing ***"not fit-for-heavy-transport-purpose roads"*** and, in the second place, maintain the whole of the feeder road and transport corridor road network in adequate condition. It is clear that this funding is to be sought and accessed by KI Council, DPTI and

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'assisted by KIPT' as noted at the start of the Executive Summary, as well as on page 58; 4.2.6 and elsewhere.

This seems to indicate that at least some, and possibly all, funds may be sought through the mechanism of Capital Works Grants, with the flow on implications through the levied depreciation being transferred to KI Council therefore to Kangaroo Islands. ***Your response to this is sought?***

NOTE: When these types of issues were raised with KIPT around 24 months ago, they appeared to indicate that it was their intention to fully self-fund all road upgrades and to pay for all maintenance of roads impacted by their operations. In fact, we believed that it was KIPT's intention to restore all public roads damaged as part of their harvest cycle to the 'original condition', by the company and from its own resources. ***This undertaking now appears to no longer exist and we would request an explanation of why this apparent reversal of previous commitments made during public consultations has occurred?***

In closing KIRSC would like to commend the proponent and the consultant in producing a series of high quality EIS documents and would like to thank you for your attention in examining our comments and look forward to your response to the issues we have raised.

Our main concern is the impact that transport operations will have on our road network both sealed and unsealed, and focusing on the proposed routes selected by KIPT as their preferred road network routes.

Our collective view is that if the port at Smith's Bay is approved and the industry moves forward with their plans, we see that this will create both benefits and disadvantages whichever way you look at it and we would hope that the State Government, Kangaroo Island Council and KIPT could work together in a positive and collaborative way to ensure the best outcomes for the Kangaroo Island Community.

Yours faithfully

For Bob Pain
Chair
Kangaroo Island Road Safety Group

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