Appendix GG   Marine Mammals Assessment

CAWTHRON

Assessment of environmental effects on marine mammals: Taharoa Ironsands Limited Central and Southern Blocks Fast-track application

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Assessment of environmental effects on marine mammals: Taharoa Ironsands Limited Central and Southern Blocks Fast-track application

Deanna Clement

This report has been prepared for Taharoa Ironsands Limited in respect of its application for all approvals under the Fast-track Approvals Act 2024 for the Central and Southern Blocks of the Taharoa Ironsand Mine. The Panel appointed to consider the application for the Central and Southern Blocks Mining Project may rely on this report for the purpose of making its decision under the Fast-track Approvals Act 2024.

This report has been prepared in accordance with the Environment Court's Code of Conduct for expert witnesses, contained in the Environment Court's Practice Note 2023. The authors of this report agree to comply with the Code of Conduct, and confirm that unless otherwise stated, the issues addressed in this report are within the area of expertise of the authors. No material facts have been omitted that might alter or detracted from the opinions expressed in this report.

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Contents

Executive summary

Taharoa Ironsands Limited (TIL) operates an ironsand mine at Taharoa on the west coast of the North Island. The mine is approximately 8 km south of Kāwhia Harbour and includes Port Taharoa, which is immediately adjacent to the mine. TIL is currently seeking all necessary approvals under the Fast-track Approvals Act 2024 to continue the existing ironsand mining operation, including collection, concentration and processing facilities and the export of ironsand from Port Taharoa.

This report describes the marine mammals that use Port Taharoa and the surrounding waters. The report considers all aspects of the activities undertaken in the marine environment but does not address any land-based mining activities. Information on the various species was reviewed for any life-history dynamics that could make them more vulnerable to proposed activities or where the mine's sites may overlap with any ecologically significant feeding, resting or breeding habitats. This, in turn, enabled the potential effects on marine mammals to be assessed in the context of the consent application.

The Port Taharoa area is part of ecologically significant habitat for the nationally critically endangered Māui dolphin and represents important year-round habitat. For other species of marine mammal, these waters represent only a small fraction of similar habitats available throughout nearby coastal regions. However, it is important to note that several of these species are nationally and / or internationally recognised as threatened species, and thus need to be considered in regard to Policy 11(a) of the New Zealand Coastal Policy Statement (NZCPS).

Following assessment of the potential direct and indirect effects highlighted in this report, the overall risk of any significant adverse effects for marine mammals (including Māui dolphin) arising from the proposed offshore consent is assessed as *nil* to *less than minor*. Given the low level of risk posed by the operation, no mitigation actions are proposed for any of the activities, but best management practices for working in environments with marine mammals are suggested.

1. Introduction

Taharoa Ironsands Limited (TIL) operates an ironsand mine at Taharoa, on the west coast of the North Island, approximately 8 km south of Kāwhia Harbour. The operation also includes Port Taharoa (also known as Taharoa Offshore Terminal), which is immediately adjacent to the land-based mine. The Port primarily consists of a mooring buoy approximately 3.5 km offshore with export pipelines stretching along the seabed from the mine to the buoy (Figure 1). The mine has been in operation since 1972 (owned by New Zealand Steel Limited until 2017) and covers an area of 1,300 hectares.

The mine currently operates under a suite of resource consents held by TIL and granted in 2006 by Waikato Regional Council. These consents expired on 31 December 2020. TIL is continuing to rely on these resource consents to operate under section 124 of the Resource Management Act 1991 (RMA). TIL is now seeking the necessary environmental approvals for the Central and Southern Block Mining Project under the Fast-track Approvals Act 2024 (FTAA). TIL aims to continue mining the Central and Southern Block while undertaking ship-loading facilities and other services supporting the balance of the mine for a period of 35 years.

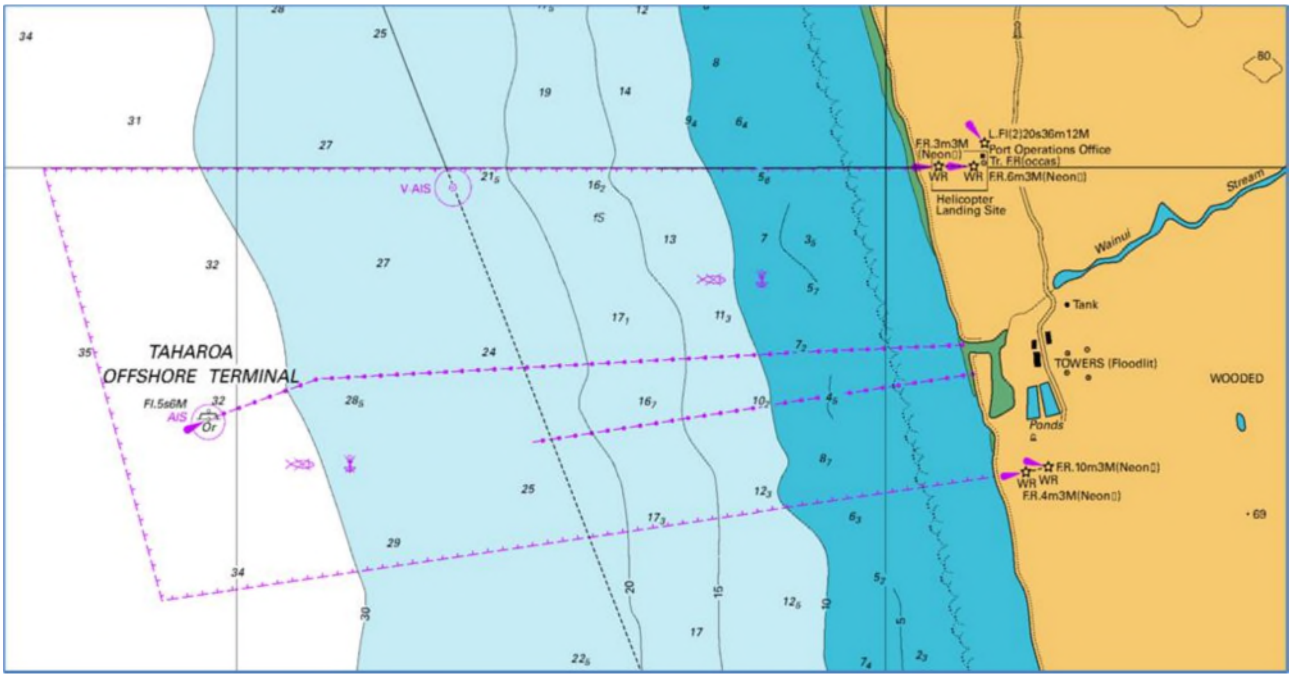

Figure 1. The location of the Taharoa Ironsands Limited mining offshore mooring buoy and seabed pipeline as well as the approximate boundaries of Port Taharoa operational area (purple hatched lines). Reproduced with permission from Tonkin & Taylor (2025).

1.1 Scope of assessment

TIL has contracted the Cawthron Institute (Cawthron) to provide an assessment of environmental effects (AEE) on marine mammals for the continuation of the ironsands mining operations in respect of the activities relating to Port Taharoa (Port). This report includes descriptions of the proposed ironsand extracting activity and the existing environment from a marine mammal perspective. It focuses on four key assessment components:

1. a desktop review of resident and transient marine mammal populations using the harbour surrounding Taharoa and wider area, with a particular focus on Māui dolphins
2. a review of comparable national and international literature to describe any potential marine mammal effects associated with similar sand extraction activities
3. the identification and categorisation of any potential effects, their spatial scales and durations, likelihood and potential consequences
4. recommendations for avoidance, remediation and mitigation options based on the final risk assessment of effects.

The following material was considered and reviewed during the development of this AEE:

Roberts JO, Webber DN, Roe WD, Edwards CTT, Doonan IJ. 2019. Spatial risk assessment of threats to Hector's and Māui dolphins (*Cephalorhychus hectori*). Wellington: Ministry for Primary Industries. New Zealand Aquatic Environment and Biodiversity Report No. 214. Report prepared for Fisheries New Zealand.

MetOcean. 2025. Discharge dispersion modelling. Updated report for Iron Sand Mining Operations. Prepared for Taharoa Ironsands Limited.

SLR. 2025. Marine ecological impact assessment. TIL Central and Southern Fast Track Application. Prepared for Taharoa Ironsands Limited.

Tonkin & Taylor. 2025. Effects on coastal processes. Prepared for Taharoa Ironsands Limited.

Various scientific publications and reports listed in the appendices and references.

2. Activity characterisation

The Tonkin & Taylor AEE (2025) provides a detailed description of the mining process. A summary of the key activities is included below.

2.1 Mining process

TIL uses a variety of mining techniques to extract the ironsand on the land-based site. Traditional excavators, bulldozers and other earthwork machinery are used above the groundwater table. Dredging equipment is used to mine ironsand deposits that lie below groundwater. Mining occurs at a rate of approximately 35,000 tonnes per day and continues 24 hours per day, 7 days a week. Current overall production rates are approximately 3 million tonnes per annum, with an intention to increase this to 4–5 million tonnes per year within the next 5 years.

Once extracted, dry sand is mixed with water (dredge extracted sand is already mixed with water) on site to separate out titanomagnetite, the mineral of interest. Following this separation process, the concentrated titanomagnetite is once again mixed with water and pumped as a slurry to a system where it is cyclone separated and stockpiled awaiting export. Water used in the separation process is recovered and fed back into the mining process (i.e. water is recycled on site). No hazardous substances are used in the ironsand concentration process.

2.2 Exporting of ironsand

The site has no natural or human-made harbour and is therefore fully exposed to oceanic wave conditions. This requires the export vessel to be moored offshore at a stationary single berth mooring buoy, located some 3.5 km offshore. This 12 m diameter mooring buoy is anchored to the seabed by six sets of chains and anchors, each weighing 124 tonnes. The buoy is designed to allow a moored vessel to rotate freely around its circumference (weathervane) in various wind and tide conditions. The buoy, and the surrounding waters, are legally defined as Port Taharoa (see approximate limits of the Port in Figure 1).

Prior to the ship-loading process, the ironsand concentrate is mixed with water to form a slurry in a constant density feed tank. The slurry is then pumped via two parallel 318 mm diameter submerged steel pipelines and two 305 mm internal diameter hoses connected to marine floating hoses. These pipelines run from the shore facility along the seabed to the mooring buoy, which convey the concentrate to the export ship at the Port. The delivery system to the buoy is capable of pumping 2,500 dry tonnes per hour through these two parallel pipelines.

The export fleet currently consists of the *Taharoa Destiny*, *Taharoa Eos* and *Taharoa Providence,* which have all been purpose-built for export of ironsand to China and Japan. Each export ship is 290 m long and 45 m wide. Each full ship-loading activity takes approximately 90 hours of pumping time; however, weather conditions have an influence on loading time frames. Ship-loading operations at the offshore port are currently undertaken approximately 20 times per year and could increase up to a maximum of 35 times per year.

2.3 Ship-loading discharge

The export ship is prepared to receive the slurry by pumping fresh water into the hold in order to provide protection from the ironsand slurry hitting and damaging the hold floor. The export ships are fitted with dewatering equipment and the resulting fresh water, containing residual fine suspended material (inert, inorganic geological material) that is removed from the ironsand slurry, is discharged from the ship to the coastal marine area (CMA). While most clay material is removed during the concentration process, some remains and is separated from the ironsand slurry when it is pumped to the export ship. Consequently, when the slurry is dewatered offshore, the resulting water is turbid (containing residual fine suspended material and dissolved metals) when it is discharged to the CMA. The discharge forms a buoyant plume that floats on the seawater surface before dispersal and dilution. It is likely the plume would be visible for several hours after the discharge ceases and before dispersal (MetOcean 2025).

Onshore process water and stormwater from around the pump house and concentrate stockpiles at the mine are occasionally discharged to the CMA through the ship-loading pipeline. Discharges to the CMA will occur on occasions when it is not possible to effectively discharge to land (the primary method of disposal), for example, during flood events.

3. Environment characterisation

3.1 General approach

When considering the potential implications of marine activities on marine mammals, the appropriate scale of consideration is not just the level of the proposed activities but also the spatial scales relevant to the species involved. For most marine mammals, normal home ranges can vary between hundreds to thousands of kilometres. Hence, the importance of these coastal waters needs to be considered in the context of the relevant species' regional and Aotearoa New Zealand-wide distributions.

There has been little dedicated marine mammal research on the west coast of the North Island around the Port, with the notable exception of long-term research and survey work on Māui dolphins (Slooten et al. 2006; Hamner et al. 2012, 2014; Baker et al. 2016; Cooke et al. 2019; Roberts et al. 2019). The best data available for other species comes from mostly opportunistic sightings reported to the Department of Conservation (DOC; including the public, tourism vessels, seismic surveys, etc.) and strandings (previously collated through Te Papa National Museum and now DOC). However, these data sources should be considered as indicative rather than fully representative of marine mammals within the region as they do not reflect dedicated marine mammal survey effort.

In the absence of survey data targeted at population information (e.g. growth trends, total abundance), any potential risks to marine mammal species associated with the proposed activities must be assessed on a general understanding of the species' life-history dynamics (e.g. species-specific sensitivities, conservation listing, lifespan, main prey sources) summarised from Aotearoa New Zealand and international data sources. Collectively, this information is used to determine what is currently known about any relevant species' occurrence, behaviour and distribution within the area of interest and to evaluate those species most likely to be affected by the proposed project.

3.2 Existing environment – marine mammals

Out of the more than 50 species of cetaceans (whales, dolphins and porpoises) and pinnipeds (seals and sea lions) known to live or migrate through Aotearoa New Zealand waters, at least 27 cetacean and one pinniped species have been sighted or stranded along the northwestern coastline of the North Island. Appendix 1 highlights the various marine mammal species recorded between the Manukau Harbour and New Plymouth over several decades. It is important to note again that most of these sightings are collected opportunistically rather than systematically. Consequently, the number of sightings does not necessarily represent unique animals (i.e. the same animal may be reported by multiple members of public or on separate days / in separate years) or their regular distribution patterns (see Appendix 1: Tables A1.1, A1.2, Figures A1.1, A2.1). As survey effort (i.e. time / distance spent looking) is not considered with opportunistic data, favourite fishing spots and tour boat tracks are likely to be over-represented, especially during periods of more favourable conditions (e.g. summer, daylight periods over evening).

3.3 Species of interest

The most reported species occurring along the Port coastline are Māui dolphins, with over 1,000 sightings in more than 20 years of dedicated survey effort for this species. Despite this large number of sightings, the current population estimate for this Nationally Critical species is fewer than 100 individuals. Additional details of Māui dolphins are provided in Appendix 2.

Other than Māui dolphins, the next most common species recorded (and most likely to be potentially affected by the proposed project) include common dolphin / aihe and orca / maki. There are also records of sperm whales / parāroa, blue whales, pilot whales and some beaked whales. However, most of the locations recorded for these species are well offshore and they are much less likely to be found in and around the Port area, given their preference for deeper waters. Other species of interest include those that may be less frequent visitors but are more vulnerable to anthropogenic (human-made) impacts due to their current conservation status (e.g. southern right whales / tohorā). Appendix 1 summarises the marine mammal species considered further in terms of any effects associated with this proposal.

Based on the available species data, and in reference to section 6(c) of the RMA,[1] and Policy 11 of the New Zealand Coastal Policy Statement (NZCPS), there is no evidence indicating that most of these species have home ranges restricted solely to the region around the Port and nearby waters. While several whale species have migration routes through this region, these inshore waters are not considered an important migration corridor, as most migrating whales generally pass by the area further offshore (see Figure A1.1). Hence, based on current knowledge, the Port itself is not considered ecologically more significant in terms of feeding, resting or breeding habitats for any marine mammal species relative to nearby coastal regions or those further along the northwestern coastline.

The sole exception is the Māui dolphin, which is Nationally Critical. The total population is mainly restricted to the area between the Maunganui Bluff (to the north) and New Plymouth (to the south), with the majority of individual dolphins found between Manukau and Kāwhia Harbours. The Port is at the southern limit of the main population centre for Māui dolphins and is well within the normal range for this species. Therefore, the Port sits within the important resting and feeding habitat for a population of less than 100 mature dolphins (Baker et al. 2019). This species is therefore highly relevant to an assessment of the actual and potential effects of the proposed activity on the environment, in particular under Policy 11(a) of the NZCPS, which refers to avoiding adverse effects on nationally and / or internationally recognised threatened species. Other endangered species, such as bottlenose dolphins, orca and southern right whales are found in these waters as highlighted in Appendix 1. While these species are rarely reported near the immediate Port area, their current status makes them relevant to an assessment of effects (including under Policy 11(a) of the NZCPS).

[1] Section 6(c) – the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.

4. Assessment of effects

The most consequential interactions between marine mammals and coastal development usually result from a direct overlap between the spatial location of the activity and important habitats of the species (i.e. feeding or nursing grounds). Recent studies into the effects of underwater noise associated with such activities have demonstrated that this overlap can be significantly larger and the effects wider ranging than previously thought. On this basis, there are a range of potential impacts on marine mammals from the proposed mining activities. These include:

1. underwater noise from vessels and pipelines
2. vessel strike
3. vessel lighting
4. entanglement
5. ecological effects including contaminants and prey impacts.

As discussed in the previous section, there is little information about the marine mammals likely to be in the Port area or the extent of any potential impacts of the mining activities on these species. While a lack of data will increase the uncertainty of assessment, useful parallels and lessons can be taken from similar operations elsewhere. Based on this background, the likelihood of the potential effects on local or visiting marine mammals is discussed below and summarised in Table 2. The recommended management options based on these risks are then discussed in Section 5 and summarised in Table 3.

4.1 Underwater noise

Anthropogenic underwater noise is now recognised as a concern by several industries and regulatory agencies around the world (e.g. OSPAR Commission 2009; DPTI 2012; ACCOBAMS 2013; WODA 2013; NMFS 2018). The main sources of underwater noise from the mining operations are likely to come from two areas: vessel noise (including noise from engines, generators, dewatering equipment, pumps, propeller, etc.) and pipeline noise (primarily noise from the slurry being pumped through the pipe to the vessel). These activities are located within the marine environment (e.g. vessel movements, slurry transfer pumps) and as they are created by mechanical sources, they generate underwater noise.

Materially increasing underwater noise has the potential to adversely affect both cetacean and pinniped species, as they rely heavily on underwater sounds for communication, orientation, predator avoidance and foraging. Nowacek et al. (2007) noted that underwater noises can elicit three types of responses in marine mammals: behavioural (e.g. changes in surfacing or diving patterns), acoustic (e.g. changes in type or timing of vocalisations) and physiological (e.g. auditory threshold shifts and stress). In this assessment, the following terms are used to categorise potential effects or responses of marine mammals to underwater noise:

1. Permanent threshold shift (PTS): alteration of hearing function caused by physical damage and leading to irreversible hearing loss. The damage can be due to acute or chronic impacts.

2. Temporary threshold shift (TTS): non-permanent alteration of hearing function causing temporary hearing loss, in which the longer the exposure time, the longer this temporary effect lasts.
3. Behavioural responses: animals can either be displaced or attracted to the noise source, including changes in swimming direction, surfacing or diving patterns, click rates, etc.; responses can range from low level to more moderate.
4. Acoustic responses: animals change their acoustic rates or call frequency to prevent or avoid acoustic interference (also known as masking) from the anthropogenic source.

In humans, the onset of TTS is often described as the muffled effect your hearing might have after a loud concert; the longer the exposure time, the longer this temporary effect lasts. PTS results in alterations of hearing function, leading to actual physical damage and irreversible hearing loss. PTS can occur suddenly through trauma (i.e. intense impulses) or develop gradually over time. Overseas behavioural disturbance studies from underwater noise show that marine mammal responses tend to be highly variable between species and among individual animals, as well as being context specific (e.g. they display different reactions when feeding versus travelling), making them less predictable. The duration of exposure may also be an important factor (Southall et al. 2007, 2019, 2021). Acoustic disturbance can involve the 'masking' of certain communication or echolocation signals. For instance, members of the same species may find it more difficult to communicate with one another across particular frequencies or at certain sound levels while near an anthropogenic noise source.

Marine mammals have different hearing sensitivities depending on their mode of communication, navigation and behaviour. These differences have been generalised into five groups based on the sensitivity of their hearing across the different frequencies (Table 1). It is expected that Māui dolphin will be the main species present near the Port. However, the five categories listed below represent all of the possible marine mammal functional hearing groups. Therefore, noise impacts that may affect any species that are not listed or directly addressed in this report are still considered under these standards.

Table 1. Summary of the generalised functional hearing ranges defining the different marine mammal hearing sensitivity groups used by the USA National Oceanic and Atmospheric Administration agency.
Source: NMFS (2024).

Hearing group	Generalised hearing range
Very high-frequency cetaceans (VHF) **e.g. Hector's and Māui dolphin**	200 Hz to 165 kHz
High-frequency cetaceans (HF) **e.g. toothed dolphins / whales, beaked whales**	150 Hz to 160 kHz
Low-frequency cetaceans (LF) **e.g. baleen whales (e.g. humpback / southern right whale)**	7 Hz to 36 kHz
Phocid carnivores in water (PCW) **e.g. true seals and leopard seals**	40 Hz to 90 kHz
Otariid and other marine carnivores in water (OCW) **e.g. sea lions and fur seals**	60 Hz to 68 kHz

Vessel noise

There are no data available on the underwater noise levels produced by the 290 m long bulk carriers that collect and dewater the slurry, and transport the ironsand. There is a range of noise-generating sources from the vessels, including engines, generators, dewatering equipment, pumps and propellers. Vessels of a similar size and configuration to the export vessels can be very noisy when underway (e.g. > 190 dB re 1 mPa @ 1 m; Pine et al. 2016; Findlay et al. 2023) and may disturb marine mammals at distances of several kilometres away (Nowacek et al. 2007). For container ships, while the total length and gross tonnage can influence noise trends, vessel speed is the best predictor of source levels (Murchy et al. 2022). The export vessels will be moving slowly[2] and / or will be moored and stationary when at the Port. While these vessels will still generate underwater noise when on anchor (e.g. Murchy et al. 2022), the noise levels will be significantly reduced relative to transiting at full speed and / or other nearby ships are travelling past (e.g. Findlay et al. 2023).

With respect to the potential noises generated from pumping operations, the large pumps required to pump the slurry from shore to the vessel are housed on land and therefore will not introduce any noise into the water. While there are pumps aboard the export vessels, these onboard pumps are only used to pump out the water left over from the dewatering process. As these pumps are standard for a vessel of this size, the noise level generated from their operation should be no different from other similar-sized vessels.

Without actual measurements of the underwater noise from the export vessels, it is not possible to confirm the exact nature and extent of any noise disturbance at the Port. Moored vessels will be audible to most marine mammals over several kilometres (Murchy et al. 2022). However, based on the overseas noise evidence from vessel studies, it is assumed that an export vessel (similar to TIL's vessels) slowly approaching the pumping station or moored is unlikely to produce any noises at physiological levels that could damage marine mammal hearing, i.e. TTS or PTS (e.g. Findlay et al. 2023). Instead, the most likely impacts will be limited to behavioural and / or masking responses within an area around the moored vessel and only when the export vessel is present (up to 35 trips a year).

Pipeline noise

There is little information or data available about the noises generated from pipelines transporting mining slurry. However, data are available on underwater noise produced from dredging activities, which include the use of riser pipes and pipelines to transfer dredged seabed material. For example, the underwater noises produced from dredging activities are continuous, broad-band sounds at frequencies mostly below 1 kHz (Todd et al. 2015). Underwater noise reviews by CEDA (2011) and WODA (2013) found that suction dredges (which pump and / or suck material from the seabed to the surface) produce mostly low frequency, omni-directional sounds between 100–500 Hz. Their bandwidths can fluctuate as low as 20 Hz and as high as 20 kHz, as sound levels will be dependent on the specific vessel, the sediment extraction process and the types of sediment being extracted, with coarser gravel causing greater sound levels (WODA 2013, references therein). This latter point is important, as the Taharoa

[2] Advice from Len Woods (Marine Operations Manager in 2020, TIL) on vessel speeds: (i) within 3 nautical miles from the coast (pilotage limit), 5 knots; (ii) within 1 nautical mile from the buoy, speed has reduced to 2 knots; and (iii) 500 metres from the buoy, speed has reduced to 0.5 knots.

slurry generally contains very small particles ranging from 0.1 to 100 µm, which corresponds to clay, fine silt and very fine sand (see MetOcean Solutions 2025, table 2.2). This means that it is likely that the noise levels produced from the pipelines will be lower than if they were transporting larger, coarser particles or materials.

Any potential impacts from pipeline noise will likely occur along the entire length of the 3.5 km pipeline, including each of the 318 mm diameter submerged steel pipelines, which house the two 305 mm internal diameter hoses and the marine floating hoses. If there is any disturbance from pipeline noise, it could, in principle, create a temporary 3.5 km zone of disturbance stretching from the shore to the export vessel, which could disrupt marine mammal communication, displace individuals from the immediate area or even stop individuals from moving across this zone. However, the transfer of noise into the water will be mitigated by how much of the pipe is in direct contact with the water. For example, the submerged steel pipelines are completely buried in the sandy seabed in the foreshore and wave zone, which will reduce the amount of noise transferred in these areas. In addition, the high energy surf zone likely contributes to greater ambient noise levels relative to other coastal zones. Given these factors, it is highly unlikely that the pipeline will generate noise levels great enough to be within any physiological hearing ranges (e.g. TTS) and not applicable for hearing injury (e.g. PTS).

Summary of noise effects

Any effects from underwater noise will be limited to those periods when a vessel is on station and the pipeline is being used to actively transport ironsand. Based on noise characteristics from similar overseas activities, it is likely that any effects will be limited to the temporary masking of some marine mammal acoustic communication within the vicinity of the operation and / or possible behavioural responses (avoidance or attraction) in the vicinity of the vessel and / or pipeline (see Table 2). The likelihood of any hearing injury effects occurring is considered not applicable in the case of PTS and expected to be highly unlikely for any localised TTS. The most relevant factors contributing to this assessment are summarised below:

Spatial and temporal factors

- While there have been few marine mammal surveys undertaken within the Port area, the site is located within the restricted range of Māui dolphin, and a range of other marine mammals have been reported in the wider area.
- Most odontocete and pinniped species known to frequent the Port and surrounding area are likely to be regularly exposed to underwater noise from commercial and recreational vessels transiting throughout their distributional range.
- Port Taharoa and the surrounding area are not considered unique or particularly important feeding, resting or nursery habitats for any residential or visiting species, with the notable exception of Māui dolphins.

Acoustic factors

- There are no measurements of underwater noise from any of the proposed operations, but there are overseas data on similar vessel operations.

The likely frequency spectra of underwater noise from the export vessel and pipeline will be primarily within the low- and medium-frequency range (Māui dolphins are high-frequency cetaceans).

Any effects from underwater noise will only be temporary, i.e. up to 36% of the year, and during the remainder of the year, no noise will be generated.

At present, there are no known studies that have collected information on underwater noise levels (natural or anthropogenic) along this section of the North Island coastline. An *in situ* study would be useful in benchmarking and understanding the current underwater noise levels to which local marine mammals and other wildlife are subjected. Such measurements could confirm the expected noise levels of the export vessels and their pump activities discussed in this report. In particular, noise measurements should be collected when (i) export vessels are arriving and departing from Port Taharoa, (ii) vessels are attached to the buoy, and (iii) vessels are collecting and dewatering the slurry. This information would also provide a useful benchmark for future comparisons and assessments if vessels or equipment were to change.

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Table 2. Summary of potential effects on marine mammal species from mining activities at Port Taharoa.

Potential environmental effects	Spatial scale of effect on marine mammals	Persistence / duration of effect for marine mammals	Consequences for marine mammals	Likelihood	Avoidance factors / mitigation options	Significance level of residual effect
Behavioural and / or physical responses to underwater sound NB. No measurements of underwater noise levels available. Estimates only	**Small to Large** Behavioural / masking responses possible at varying distances from pipeline during operations	**Short to Persistent** • Operations only undertaken for 90 hours, up to 35 trips a year, with no impact when the operation is not operating • Operations consent is for 35 years	**Individual Level**: • Individuals may avoid or approach noise sources • Individuals potentially subject to potential behavioural responses and acoustic masking	**Not Applicable** – PTS **Low** – TTS, behavioural and / or masking	• Short duration of activity of 90 hours approximately 35 times a year • Very low probability of marine mammal presence near proposal area with possible exception of Māui dolphins • Regular maintenance and proper upkeep of pumping equipment, pipeline and the export vessels • *In situ* verification of noise levels associated with activities recommended	**Nil –** PTS **Nil to Negligible** – TTS **Less than Minor –** behavioural and / or masking
Marine mammal / vessel collision risk	**Large** Vessel movements over several km within Port Taharoa	**Short to Persistent** Risk only during vessel movements but any injury could have long-term consequences	**Individual Level:** Death or injury of non-threatened species **Regional to Population Level:** Death or injury of endangered or threatened species	**Low**	• Very low probability of marine mammal presence near proposal area with possible exception of Māui dolphins • Slow speeds of export vessels help reduce consequences of a collision to injury rather than mortality and significantly reduce risk of vessel strike	**Negligible**
Attraction to artificial lighting on vessel(s)	**Small** Dependent on types of lights	**Short and Persistent** Risk only when vessel present 90 hours, 35 trips a year	**Individual Level** Local attraction of pinnipeds and some dolphins	**Not Applicable to Low**	• Minimum amounts of lighting and proper positioning to reduce the attraction of wildlife	**Nil to Negligible**
Entanglement in mooring and / or debris	**Small to Medium** Limited to immediate waters around mooring buoy	**Short to Persistent** Risk only when vessel present 90 hours, 35 trips a year	**Regional to Population Level:** Death or injury of endangered or threatened species **Individual Level:** Death or injury of pinniped or dolphin	**Not Applicable to Low**	• Large mooring equipment should preclude entanglement for all species including Māui dolphins • Avoid use of loose rope and other lines • Compliance with NZ Maritime Protection Rules Part 180	**Nil to Negligible**
Habitat and / or prey disturbance from smothering, contamination or increased turbidity	**Small to Large** Limited to immediate waters covered by dewatering discharge plume	**Short to Persistent** Periodic plumes expected to settle out quickly after vessel leaves Dependent on type and level of any contamination in sediments	**Individual Level** Limited, short-term disturbance or exposure for any individual	**Not Applicable to Low**	• Localised sediment plume restricted to immediate area around export vessels • No evidence of significant levels of contaminates in discharged sediments • Marine mammals commonly feed in turbid waters naturally • No unique feeding habitats in the proposed areas • Areas represent only a small portion of similar available habitat for Māui dolphins	**Nil to Negligible**

Ranking of terms used in table:

- Spatial scale of effect: Small (tens of metres), Medium (hundreds of metres), Large (> 1 km)
- Duration of effect: Short (days to weeks), Moderate (weeks to months), Persistent (years or more)
- Consequence: Individual, Regional, Population
- Likelihood of effect: Not Applicable (NA), Low (< 25%), Moderate (25–75%), High (> 75%)
- Significance of effect: Nil (no effects at all), Negligible (effect too small to be discernible or of concern), Less than Minor (discernible effect but too small to affect others), Minor (noticeable but will not cause any significant adverse effects), More than Minor (noticeable that may cause adverse impact but could be mitigated), Significant (noticeable and will have serious adverse impact but could be potentially mitigated).

4.2 Vessel strike

Vessel strikes are a well-known source of injury and mortality for several species of marine mammals around the world, particularly baleen whales (Laist et al. 2001). In Aotearoa New Zealand and overseas waters, vessel strikes are often associated with large fast vessels, such as container or carrier ships (e.g. Jensen and Silber 2004; Vanderlaan and Taggart 2007; Gende et al. 2011; Constantine et al. 2015). Between 1996 and 2014, 17 Bryde's whale deaths in the Hauraki Gulf have been attributed to vessel strike and the speeds at which commercial ships pass through the area (Constantine et al. 2015).

The likelihood of vessel strike depends on a number of operational factors including vessel type, speed, and location (van Waerebeek et al. 2007). The greatest increase in both the risk of a collision and the likelihood that it will result in severe injury or death occurs at speeds over 11 knots (Vanderlaan and Taggart 2007; Gende et al. 2011). Export vessels will be moving at slow speeds (e.g. less than 5 knots) when approaching and departing from the mooring buoy at the Port. There is no chance of vessel strike when the vessel is attached to the mooring. Therefore, the only time when vessel strike can occur is during the approximately 35 approaches and 35 departures of the export vessels from the mooring buoy per year. It is unlikely that vessel strike will be an issue for these slow-moving vessels. Dredge vessels, which generally move at slow speeds (and which are similar to slow-moving export vessels), had only a single report out of the 134 worldwide reported collisions that occurred between 1975 and 2002 (Jensen and Silber 2004).

The likelihood of a vessel collision (injury or mortality) within the proposal area is assessed as very low for migrating baleen whales and odontocete species within the Port area (see Table 2). The most relevant factors contributing to this assessment are summarised below:

Spatial and temporal factors

- While the marine mammal survey data from the Port area are limited, the site is located within the normal range of Māui dolphins. Several other marine mammal species have also been reported in the wider area.
- With the notable exception of Māui dolphins, the Port and surrounding areas are not considered unique or particularly important feeding, resting or nursery habitats for any residential or visiting species.

Known collision factors

- Low probability of the export vessel striking an individual animal given the vessel will be stationary when moored or slow moving while approaching and leaving the mooring buoy.
- Most dolphin species have a general attraction to boats and safely approach and / or bow-ride. New Zealand fur seals / kekeno often respond neutrally to boats when in the water (although they may bow-ride occasionally).

4.3 Vessel lighting

To date, the effects of vessel lighting on marine mammals are relatively unknown with little to no research in this area nationally or internationally. As operations continue 24 hours a day during loading, export vessels will have standard navigation and safety deck lighting in operation. However, any lighting footprint will most likely be confined to within a few hundred metres of the vessel and within surface to subsurface depths. Night lighting on stationary vessels has the potential to attract small food species including plankton, larvae and bait fish. This attraction in turn might similarly attract any small cetaceans, such as common, bottlenose or Māui dolphins already in the area around the vessel. However, marine mammals will more likely be attracted to increases in noise or changes in vessel activity rather than the lights themselves.

Given that any effects will be limited to less than 36% of the year, potential impacts on Māui dolphins and other marine mammals from lighting are likely to be not applicable to low (see Table 2).

4.4 Marine debris and entanglement

The nature of the mining and vessel activities means the likelihood of marine wildlife entanglement in marine debris is low (Table 2). Marine debris collectively includes such items as lost ropes, support buoys, bags and plastics (e.g. Laist et al. 1999). Whales, dolphins and pinnipeds are often attracted to floating debris, with a potential risk of becoming entangled in floating lines and netting (e.g. Suisted and Neale 2004; Groom and Coughran 2012). Loose, thin lines pose the greatest entanglement risk (e.g. lines used to tie up boats, floats and other equipment) and especially lost ropes or lines. The mooring buoy to which the export vessels attach is 12 m in diameter and is anchored to the seabed by six sets of chains and anchors, each weighing 124 tonnes. Given the size of the chain, anchor and buoy, there is a negligible risk of entanglement to any marine mammals as the gear is too large and heavy to entangle even a whale.

Marine debris generation is generally non-existent in well-maintained coastal projects with proper waste management programmes in place (e.g. secure onboard storage of lines, ropes, and waste) that comply with the New Zealand Maritime Protection Rules Part 180.[3] Because of this, any subsequent effects on marine mammals are expected to be *nil to negligible* (see Table 2).

4.5 Indirect effects through the ecosystem

Any potential impacts to the ecosystem from the resulting plume associated with the dewatering of the slurry aboard the export vessel will be dependent on many variables, including the composition, nature, scale and duration of the plume. High turbidity levels and movements of any sediment plumes created by anthropogenic activities can be a concern to fauna within or next to work sites (e.g. Todd et al. 2015). There is potential for such plumes to be additive to existing turbidity levels or become entrained in local

[3] https://www.maritimenz.govt.nz/rules/all-rules/marine-protection-rules-part-180/

gyres and eddies. In addition, at-sea disposal of sediments in the dewatering discharge has the potential for any associated contaminants to become adsorbed to the sediments, making them biologically available to potential marine mammal prey species.

Marine mammals are known to inhabit fairly turbid environments worldwide and especially within Aotearoa New Zealand's nearshore environments. While they have very good vision, it does not appear to be the sense they rely upon most for foraging. Instead, odontocetes mainly depend on their sonar systems for underwater navigation and searching for food. Even baleen whales, which do not have the ability to echolocate, regularly forage in dark, benthic environments, stirring up sediments to find prey. Thus, turbidity plumes are more likely to affect marine mammals indirectly via their prey resources rather than directly by influencing feeding behaviour (Todd et al. 2015).

Relative to other regions along the northwestern coastline, the Port area is not currently considered unique or important feeding habitat for local or visiting marine mammals. In fact, most local species, including Māui dolphins, common dolphins and New Zealand fur seals, are generalist feeders that will opportunistically forage throughout the entire Port area, as well as along most northwestern coastal regions and more offshore waters. Orca are considered more specialist feeders; they regularly forage for rays among estuarine mud and sand flats areas (Visser 1999). Some migrating species (i.e. humpback whales) may not even feed while passing through Aotearoa New Zealand waters during parts of their migration (Dawbin 1956).

While ecosystems may be altered by the introduction of sediment plumes, there is currently little research into how such changes may indirectly affect marine mammals. SLR (2025) and MetOcean (2025) provided summaries of the likely impact from the dewatering plume on the seabed, benthic communities and water column. The following conclusions were presented:

1. Plume modelling indicates the turbid plume is constrained to the immediate vicinity of the vessel and quickly dissipates as it is transported away from the release point.
2. Based on the west coast environment, models predict that a relatively small proportion of the marine environment is affected by the vessel dewatering discharges (and associated process water and stormwater discharges). Any subsequent ecological effects on the benthic ecology due to suspended sediments and any associated contaminants are considered low based on field sampling results.
3. Any deposition of fine sediment from the discharge has a negligible effect on coastal processes and landforms in both the open coast and nearby harbours, and is likely undiscernible when compared to the natural baseline and alongshore transport.
4. The subtidal benthic communities are considered to have a moderate ecological value given that (i) the benthic invertebrate community typically has high species richness, diversity and abundance and is expected to be tolerant of the periodic disturbances, (ii) no threatened or at-risk species are present, and (iii) habitat modification is limited to Port of Taharoa and the surrounding area.
5. The predicted concentration of suspended sediment and associated contaminants is very low and not at levels that would be expected to have adverse effects on shellfish or fish (acute or chronic). Furthermore, such low sediment accumulation or metal concentrations would be very difficult, if not impossible, to measure over and above natural variability.

6. As anchoring and fishing is prohibited within the Taharoa Offshore Terminal area (e.g. area approximately 2 km by 4 km), this zone provides some degree of protection to local marine fauna and habitat by acting as a marine protected area.

Overall, effects on ecosystem ecology are considered to be low. Accordingly, the likelihood for bioaccumulation and biomagnification effects on local marine mammal species from the resuspension and dispersal of any contaminants during extraction activities is not applicable to low. As a result, the discharge plumes generated from dewatering activities are not expected to have any detrimental or long-term flow-on effects to local marine mammals in the region, and therefore will be *nil* to *negligible* (Table 2).

5. Management of effects

Overall, the residual effects of any impacts from mining activities on local and visiting marine mammals are considered to be *nil* to *less than minor* (Table 2). This assessment is based on the consideration of the types of effects, their spatial scales and durations, and relevant species information. It also takes into account existing operational aspects, as well as natural avoidance factors, that currently help mitigate adverse effects on marine mammals.

Given the low risks identified, no mitigation or management is required. However, the extended timeline (35 years) necessitates consideration of several recommended best management practice (BMP) measures in relation to marine mammals (see Table 3). These BMPs can help further minimise any residual risks on local marine mammals and ensure the risks remain minimised throughout the life of the consent.

Table 3. Proposed mitigation goals and practices to mitigate or minimise the risk of any adverse effects of ironsand mining activities on marine mammals at Port Taharoa.

Management goal	Best management practice	Recommended reporting
1. Minimise the potential of injury to marine wildlife caused by marine-based mining activities	1a. Use best practical option to minimise underwater noise effects	• Measure underwater noise levels from existing operation and any new equipment or activities, following commencement of works
	1b. Regular maintenance and proper upkeep of all equipment and vessels (e.g. lubrication and repair of pumps, generators)	• Nothing required; self-checking as part of regular maintenance procedures. Consideration given to noise outputs from all aspects of the operation
	1c. Record any marine mammal interactions, noting the operational cycle (e.g. dewatering, moored), conditions and animal's behaviour. This is especially important for any Māui dolphin sightings	• Record and report in a standardised format the type and frequency of marine mammal interaction with vessels or pipeline within Port Taharoa. Annual records provided to DOC and made publicly available (e.g. web) • Encourage the collection of additional information on species' behavioural responses during normal operations
	1d. Ensure only minimum amount of vessel lighting is used, minimise light 'spill' overboard to reduce attraction of prey fish	• Nothing required; self-checking as part of normal deck duties
2. Minimise the risk of vessel collisions with any marine mammal and aim for zero injury / mortality	2a. Formal adoption of best boating guidelines for marine mammals, including speed limits, to reduce any chances of mortality from vessel strikes	• Record all vessel strike incidents or near incidents regardless of outcome (e.g. injury or mortality) in a standardised format
	2b. Formally establish and maintain a watch for marine mammals while transiting towards and within Port Taharoa	• In case of a fatal marine mammal incident, carcass(es) recovered (if possible) and given to DOC, and further steps taken in consultation with DOC to reduce the risk of future incidences. This is not required as an RMA condition because this is a legal obligation under other legislation
	2c. Record marine mammal sightings to build a baseline occurrence in waters near Port Taharoa	• Record and report the type and frequency of marine mammal sightings within and around Port Taharoa in a standardised format. Annual records provided to DOC
3. Aim to minimise entanglement with a goal of zero mortality	3a. Avoid loose rope and / or rubbish around or off vessels. All deck lines should be tied up when not in use or be under some degree of tension	• Nothing required; self-checking as part of normal deck duties
	3b. Minimise potential for loss of rubbish and debris from vessels and recover lost material	• Nothing required; self-checking as part of normal deck duties
	3c. Record all entanglement incidents regardless of outcome (e.g. injury or mortality)	• Records available to DOC. In case of a fatal incident, carcass(es) recovered and given to DOC, and steps taken in consultation with DOC to reduce the risk of future incidences

6. Summary

This report describes the marine mammals that use the Port and surrounding waters. Information on the various species was reviewed for any life-history dynamics that could make them more vulnerable to the proposed activities or where the mine's sites may overlap with any ecologically significant feeding, resting or breeding habitats. This, in turn, enabled the potential effects on marine mammals to be assessed in the context of the application.

The marine mammals most likely affected by the proposal include the few species that frequent the wider region around the Port year-round or on a semi-regular basis. The species reported most frequently in the area between Manukau Heads and New Plymouth is the Māui dolphin. Other threatened species reported in the area include common dolphins, southern right whales and orca. In addition, there are also a range of offshore species (e.g. blue whales, sperm whales, beaked whales) which, while being recorded in the wider area, are unlikely to be found in the immediate Port area.

Other than the Māui dolphin, the Port and surrounding waters are not considered ecologically significant habitats for any of these species. For the Māui dolphin, these waters represent only a small fraction of similar habitats available to these marine mammals throughout nearby coastal regions. However, the Port area is part of ecologically significant habitat for this Nationally Critical species and represents important year-round habitat. It should also be noted that several of the above listed species are nationally and / or internationally recognised as threatened species, and thus they need to be considered in regard to Policy 11(a) of the NZCPS.

In light of the potential direct and indirect effects highlighted in this report, the overall risk of any significant adverse effects for marine mammals (including Māui dolphin) arising from the proposed consent is assessed as *nil* to *less than minor*. The proposed level of vessel activity at Port Taharoa is approximately 21% to 36% of the year, and for the remainder of the year, there are no impacts from this activity. Given the low level of risk posed by the operation, no mitigation actions are proposed for any of the activities, but several industry standard BMPs for working around marine mammals are suggested.

7. Appendices

Appendix 1. Marine mammals reported from Port Taharoa and surrounding waters

The majority of opportunistic marine mammal sightings were recorded from inshore waters during dedicated survey work for Māui dolphins, but other sources include aerial surveys, offshore seismic surveys, fisheries observers and strandings (Table A1.1). For this assessment, less importance was placed on the exact location of sightings with more emphasis on the presence and timing of an identified species in the vicinity of Port Taharoa and surrounding waters. The extent of area considered for the purposes of this assessment included marine mammals reported between Manukau Harbour in the north and New Plymouth in the south.

The more prevalent species are listed in Table A1.2 and divided into three general categories that describe the current knowledge about their distribution patterns within Port Taharoa and nearby waters. Species information is likely to change as more systematic research becomes available, particularly for less common species.

Resident – a species that lives (remains and feeds and / or breeds) in the vicinity of Port Taharoa and / or nearby waters either permanently (year-round) or for regular time periods.

Migrant – a species that periodically travels through part(s) of Port Taharoa and / or nearby waters but remains only for temporary time periods that may be predictable seasonally.

Visitor – a species that visits the vicinity of Port Taharoa or nearby waters intermittently. Depending on the proximity of Port Taharoa to the species' normal distribution ranges, visits may occur seasonally, infrequently or rarely.

Table A1.1. Marine mammal species reported from the Department of Conservation’s Opportunistic Marine Mammal Sighting and Stranding database along the west coast of the North Island between New Plymouth and Manukau Harbour.

Common name	Scientific name	Stranding or incident	Sighting
Andrew’s beaked whale	*Mesoplodon bowdoini*	Y	
Blainville’s beaked whale	*Mesoplodon densirostris*	Y	
Blue whale	*Balaenoptera musculus*	Y	Y
Bottlenose dolphin	*Tursiops truncatus*		Y
Bryde’s whale	*Balaenoptera edeni*	Y	Y
Common dolphin	*Delphinus delphis*	Y	Y
Cuvier’s beaked whale	*Ziphius cavirostris*	Y	
Dusky dolphin	*Lagenorhynchus obscurus*		Y
False killer whale	*Pseudorca crassidens*	Y	Y
Fin whale	*Balaenoptera physalus*		Y
Ginkgo toothed whale	*Mesoplodon ginkgodens*	Y	
Gray’s beaked whale	*Mesoplodon grayi*	Y	
Hector's dolphin	*Cephalorhychus hectori*	Y	Y
Humpback whale	*Megaptera novaeangliae*	Y	Y
Orca / killer whale	*Orcinus orca*	Y	Y
Māui dolphin	*Cephalorhychus hectori Māui*	Y	
Minke whale	*Balaenoptera acutorostrata*	Y	Y
New Zealand fur seal	*Arctocephalus forsterii*		Y
Pilot whale	*Globicephala melas*	Y	Y
Pygmy right whale	*Caperea marginata*	Y	
Pygmy sperm whale	*Kogia breviceps*	Y	
Risso's dolphin	*Grampus griseus*		Y
Sei whale	*Balaenoptera borealis*		Y
Shepherd's beaked whale	*Tasmacetus shepherdi*	Y	Y
Southern right whale	*Eubalaena australis*		Y
Sperm whale	*Physeter macrocephalus*	Y	Y
Strap toothed whale	*Mesoplodon layardii*	Y	
Striped dolphin	*Stenella coeruleoalba*	Y	

Table A1.2. The residency patterns of marine mammal species known to frequent Port Taharoa and nearby waters. Species' conservation threat status is listed for the New Zealand Threat Classification System (NZTCS; Baker et al. 2019; Lundquist et al. 2025) and International Union for Conservation of Nature (IUCN) Red List (ver 3.1).

Common name	Species name	NZ Threat Classification System	IUCN Red List	Residency category in area	Patterns of Seasonality (relative to proposal area)
Māui dolphin	*Cephalorhychus hectori Māui*	Nationally Critical	Critically endangered	Year-round resident	Less than 100 individuals in the total population. Range between Maunganui Bluffs and New Plymouth, with the majority between Manukau and Kāwhia Harbours. Present year-round and generally coastal (e.g. within 7 nautical miles of the coast). At risk from fishing, disease and coastal developments. Estimated spatial density show in Figure A2.1
Common dolphin	*Delphinus delphis/capensis*	Not Threatened	Least Concern	Seasonal to year-round resident	Common throughout northwestern waters year-round. Feed on schooling or more pelagic fish species. Generally observed in coastal waters but also some offshore sightings
New Zealand fur seal	*Arctocephalus forsteri*	Not Threatened	Least Concern	Seasonal to year-round resident	Present year-round with multiple haul-out sites and breeding colonies along the northwestern coast of the North Island (e.g. Sugar Loaf Islands, Gannet Island, Muriwai). More susceptible to human effects at breeding colonies. Feed mainly over shelf waters but also inshore regions
Killer whale	*Orcinus orca*	Nationally Critical	Data Deficient	Seasonal to semi-resident	Occasionally seen in northwestern waters. Known to forage in harbours, estuaries and sandy beaches on rays, fish and other marine mammal species
Pilot whale (spp.)	*Globicephala melas / macrohynchus*	Not Threatened to Data Deficient	Least Concern	Offshore semi-resident	While a more offshore species, inshore sightings occur mainly over summer months. Forages off shelf waters. Known for frequent and mass strandings around New Zealand
Southern right whale	*Eubalaena australis*	Nationally Increasing	Least Concern	Seasonal migrant	Occasionally seen. Generally use more inshore, shallow regions during seasonal migration periods, particularly with newborn calves
Humpback whale	*Megaptera novaeangliae*	Migrant	Endangered	Seasonal migrant	Likely to pass through the area during north and south migrations but more prevalent and closer to shore on southern return migration when with calves (mainly Oct to late Dec)
Sperm whale	*Physeter macrocephalus*	At Risk – Declining	Vulnerable	Offshore visitor	Generally an offshore species and rarely seen inshore. Taonga species

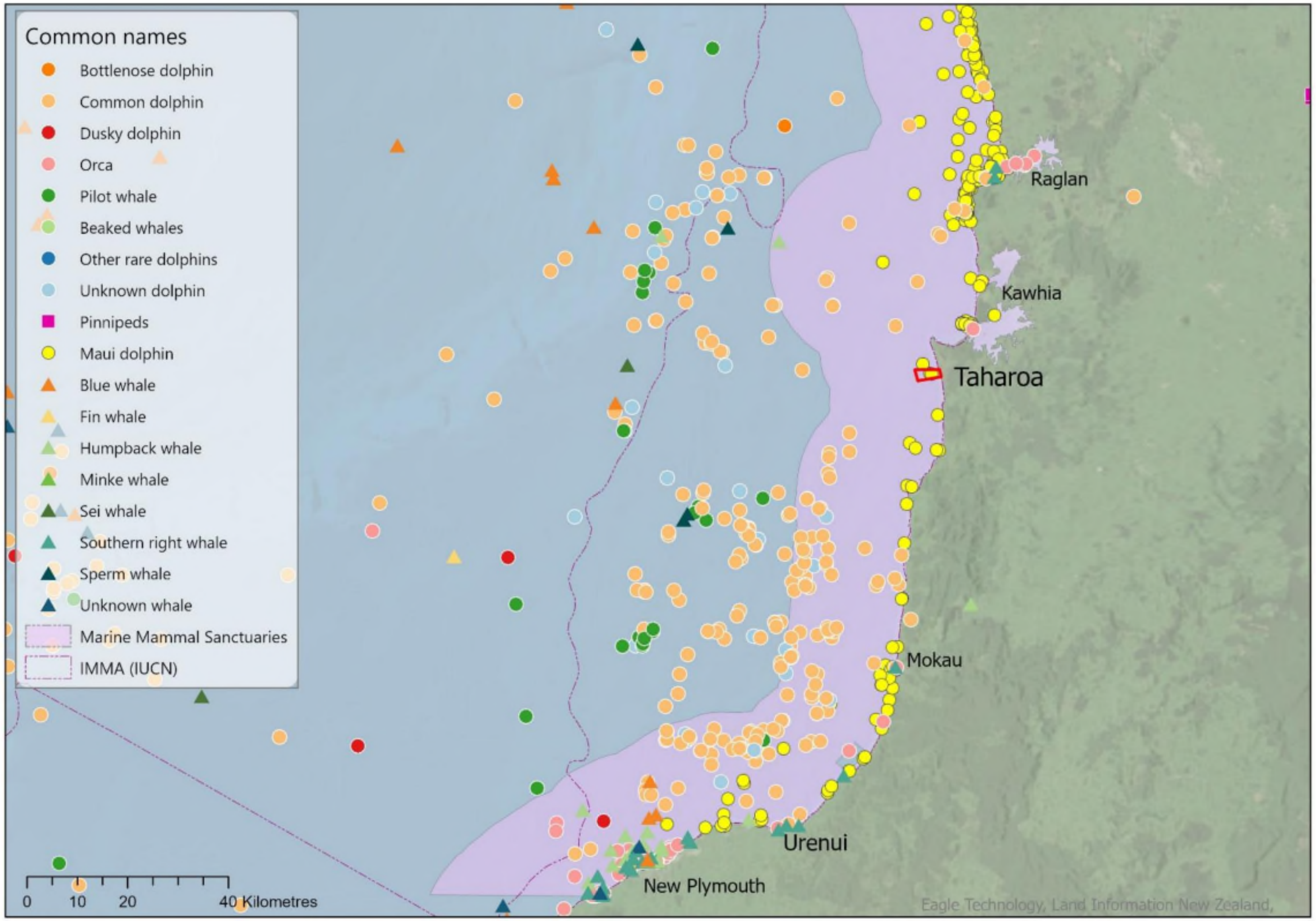

Figure A1.1. Marine mammal species reported from the Department of Conservation's Opportunistic Marine Mammal Sightings database along the west coast of the North Island between New Plymouth and Manukau Harbour.

Appendix 2. Summary of Māui dolphin biology and ecology

The following section is a summary of chapter 6 'Hector's dolphin (*Cephalorhynchus hectori hectori*) and Māui dolphin (*C H. Maui*)' in 'Aquatic environment and biodiversity annual review 2018' published by Ministry for Primary Industries.

Introduction

Hector's and Māui dolphin (*Cephalorhynchus hectori*), comprising the South Island subspecies referred to as Hector's dolphin (*C. h. hectori*) and the North Island subspecies known as Māui dolphin (*C. h. Māui*), is endemic to the coastal waters of New Zealand. The following sections provide details about Māui dolphins and relevant details about Hector's dolphins where data are not available for Māui dolphins.

Taxonomy

Hector's and Māui dolphin are one of four species in the genus *Cephalorhynchus*, which are all restricted to cool, temperate, coastal waters in the southern hemisphere. On the basis of morphological differences, and genetic information indicative of reproductive isolation, Hector's and Māui dolphin was divided into two subspecies; Hector's dolphin around the South Island (41˚S to 47˚S) and Māui dolphin, on the west coast of the North Island (WCNI, 36°S to 40°S; Baker et al. 2002). The reproductive isolation of the Māui subspecies is supported by a more recent genetic analysis with a larger sample size (Hamner et al. 2012a) despite genetic analyses having located four Hector's dolphins off the WCNI (Hamner et al. 2014).

Conservation status

Hector's and Māui dolphin was gazetted as a 'threatened species' by the Minister of Conservation in 1999 and is defined as a 'protected species' according to part 1, s2(1) of the Fisheries Act 1996 and s2(1) of the Marine Mammals Protection Act (MMPA) 1978. Management of fisheries impacts on Hector's and Māui dolphins is legislated under both these acts.

Threat classification is an established approach for identifying species at risk of extinction (IUCN 2013). The risk of extinction for Hector's and Māui dolphin has been assessed under two threat classification systems: the New Zealand Threat Classification System (Townsend et al. 2008) and the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (IUCN 2013).

The IUCN classifies Māui dolphin as Critically Endangered under criteria A4c,d and C2a(ii)5 due to an ongoing and projected decline of greater than 80% over three generations, and there being fewer than 250 mature individuals remaining (Reeves et al. 2013a). Critically Endangered is the most threatened status before 'Extinct in the Wild'. Under the New Zealand Threat Classification System (Baker et al. 2019), Māui dolphin is classified as Nationally Critical, the most threatened status, under criterion A(1), with the qualifier Conservation Dependent (CD)7.

The Port of Taharoa sits within the boundary of the West Coast North Island Marine Mammal Sanctuary, which was set up in 2008 as a part of the Hector's and Māui Dolphin Threat Management Plan (DOC 2008). The boundaries of the sanctuary extend out to 12 nautical miles and alongshore from Maunganui Bluff in Northland to Oakura Beach, Taranaki, in the south. Within the sanctuary boundaries restrictions are placed on seabed mining activities and acoustic seismic survey work.

Distribution

Māui dolphins are most frequently sighted between Maunganui Bluff and New Plymouth (Slooten et al. 2005; Du Fresne 2010; Hamner et al. 2012a, 2012b). Research surveys since 2003 have sighted Māui dolphins between Kaipara Harbour and Kawhia (Slooten et al. 2005; Du Fresne 2010; Hamner et al. 2012a, 2012b). Historical samples from strandings and museum specimens have allowed genetic identification of Māui dolphins on the west coast of the North Island (WCNI) from Dargaville to Wellington (DOC 2017a, 2017b; Hamner, pers. comm.); however, there are doubts as to the provenance of a record of a Māui dolphin attributed to the Bay of Islands (Hamner, pers. comm.).

There are reported public sightings of Hector's and Māui dolphins from all around the North Island coast, including the Bay of Islands, Hauraki Gulf, Coromandel Peninsula, Hawkes Bay, Wairarapa and Kapiti Coast (Baker 1978; Cawthorn 1988; Russell 1999; DOC 2017a). Pichler and Baker (2000) reported genetic analysis of samples of Hector's and Māui dolphins dating back to 1870 and suggest that abundance has declined, and geographic range has contracted over the past 140 years. It has also been suggested that the Māui dolphin's range has contracted off the WCNI in recent history coincident with a decline in abundance (MPI & DOC 2012).

Small-scale movements by Māui dolphins over up to 80 km of coastline have been revealed by repeated genetic sampling of the same individuals (mean distance between the two most extreme locations for the six individuals sampled at least three times = 35.5 km; SE = 4.03 km; Oremus et al. 2012).

The highest density of Māui dolphins occurs inshore (within 4 nm of the coast) between Manukau Harbour and Port Waikato (Slooten et al. 2005; MPI & DOC 2012; Oremus et al. 2012). Sightings are occasionally made beyond 4 nm from the coast, extending at least to 7 nm offshore (Du Fresne 2010; Thompson & Richard 2012). Sightings of Māui dolphins have been made in three North Island harbours (Kaipara, Manukau and Raglan; see review in Slooten et al. 2005). Passive acoustic monitoring of these three harbours, in addition to Kawhia Harbour, revealed a low-level of episodic use of Kaipara and Manukau harbours (Rayment et al. 2011b).

Roberts et al. (2019) provided an updated spatial distribution model for Māui dolphins based on the most recent available data (Figure A2.1) which provides the best available science describing the present distribution of Māui dolphins.

Foraging ecology

Miller et al. (2013) investigated the diet of Hector's and Māui dolphins through the examination of diagnostic prey remains in the stomachs of 63 incidentally captured and beach-cast animals. They concluded that Hector's dolphins take a wide variety of prey throughout the water column (in total 29 taxa were recorded), but that the diet is dominated by a few mid-water and demersal species, particularly red cod (*Pseudophycis bachus*), ahuru (*Auchenoceros punctatus*), arrow squid (*Notodarus* sp.), sprat (*Sprattus* sp.), sole (*Peltorhamphus* sp.) and stargazer (*Crapatulus* sp.). Prey items ranged from an estimated 0.5–60.8 cm in length, but the majority were less than 10 cm in length, indicating that the juveniles of some species were targeted (Miller et al. 2013). The diets of Hector's dolphins from the South Island west and east coasts were significantly different, due largely to the importance of javelinfish (*Lepidorhynchus denticulatus*) on the west coast, and a greater consumption of demersal prey species on the east coast (Miller et al. 2013). Only two samples were derived from Hector's/Māui dolphins off the WCNI, containing only red cod, ahuru, sole and flounder (*Rhomboselea* sp.; Miller et al. 2013). The stomachs of the six smallest dolphins in the sample (standard length under 90 cm) contained only milk, while the next largest (99 cm standard length) contained milk and remains of arrow squid (Miller et al. 2013). Milk was not found in the stomachs of any dolphins longer than 107 cm (Miller et al. 2013).

Reproductive biology

Incidentally captured and stranded Hector's dolphins have provided information on the life history and reproductive parameters of the species. Males reach sexual maturity between six and nine years of age, and females have their first calf between seven and nine years old (Slooten 1991). Examination of the ultrastructure of the teeth from these necropsied animals revealed that females live to at least 19 years (n = 33) and males (n = 27) to at least 20 (Slooten 1991). Photo-ID studies have provided additional data and revealed that the calving interval is two to four years (Slooten 1990) and that longevity is at least 22 years (Rayment et al. 2009b; Webster et al. 2009). Gormley (2009) extended these analyses, estimating mean female fecundity of Hector's dolphins off Banks Peninsula at 0.205 female offspring per capita per annum (s.d.: 0.050) and mean age at first reproduction at 7.5 years (s.d.: 0.42).

Calves are typically born during spring and early summer, with neonatal length estimated to be 60–75 cm (Slooten & Dawson 1994). Calves stay with their mothers for at least one year, more usually two, and the mother does not appear to conceive again until the calf is independent (Slooten & Dawson 1994). Application of the growth models produced by Webster et al. (2010) to the diet data obtained by Miller et al. (2013) suggests that weaning occurs between one and two years of age. Growth is rapid and asymptotic length is reached in 5–6 years (Webster et al. 2010). Sexually mature adults usually fall within the range of 119–145 cm total length and at maturity females are approximately 10 cm longer than males (Slooten & Dawson 1994; Webster et al. 2010). In a sample of 66 female and 100 male known-age Hector's dolphins, the maximum total length measurements were 145 cm and 132 cm respectively (Webster et al. 2010). Māui dolphins are significantly longer than Hector's dolphins, with a maximum recorded total length of 162 cm (Russell 1999).

Population biology

The first abundance estimate for Māui dolphins was 111 (CV = 44%; Slooten et al. 2006) from aerial survey data.

Genetic mark-recapture data yielded estimates of average annual population change for Māui dolphin of -0.13 (i.e., a 13% decrease p.a.; 95% c.i.: -0.40–+0.14) for the period 2001–07 (Baker et al. 2013), and -

0.03 (95% c.i.: -0.11–+0.06) for the period 2001–11 (Hamner et al. 2012b). Baker et al. (2016b) estimated an abundance of N = 63 with 95% log-normal CL = 57, 75 for the population of Māui dolphins one year old and older. This estimate is comparable to, but slightly larger than the previous estimate of N = 55 (95% CL = 48, 69) based on the genotype surveys in 2010–11 (Hamner et al. 2012b).

Population trends have also been inferred for Māui dolphins via other methods, including linear regression of the natural logarithm of abundance estimates obtained using a variety of survey methods over the period 1985 to 2011 (-0.032; 90% c.i.: -0.057 to -0.006 for aerial and boat surveys; -0.037; 90% c.i.: -0.042 to -0.032 for boat surveys alone; Wade et al. 2012). Analysis of the Māui dolphin risk assessment expert panel's mortality scores yielded an estimated rate of population decline of 7.6% per annum (95% c.i.: = 13.8% decline to 0.1% increase; Currey et al. 2012). Across methods, estimates of Māui dolphin population trends indicate a high probability that the population is declining, with mean or median estimates suggesting a rate of decline at or above 3% per annum (Currey et al. 2012; Hamner et al. 2012b; Wade et al. 2012; Baker et al. 2013). Based on the more recent genetic mark-recapture data (Baker et al. 2016b), the best-fitting Pradel Survival and Lambda model estimated the annual rate of change to be 0.983 (95% c.i.: 0.940–1.028). Therefore, the Māui dolphin estimates suggest that the population declined by approximately 1.5–2% per year between 2001 and 2016; however, the decline was not confirmed with 95% confidence, as the upper confidence limits span a range up to a population increase of 3% per year (Baker et al. 2016b).

Annual survival of the Māui dolphin has been estimated from the genotype mark-recapture data (Hamner et al. 2012b; Baker et al. 2013, 2016b). The best-fitting Pradel Survival and Lambda model for the data series, 2001–16, estimated the annual survival for age 1+ dolphins to be 0.888 (95% c.i.: 0.842–0.922; Baker et al. 2016b).

Known and potential threats

Roberts et al. (2019) provided a spatial explicit risk assess of all threats for Hector's and Māui dolphins which provides the best source of data for these species.

Fishing-related mortality is known to be a potentially serious threat to Hector's and Māui dolphins (DOC & MFish 2007; MPI & DOC 2012). Roberts et al. (2019) estimated that the median risk ratio for Māui dolphins was below 0.28 indicating that present fishing levels will prevent population recovery to 90% of the unimpacted level.

Non-fishery threats have also been observed but are difficult to quantify. There has been one confirmed death due to boat strike since 1921, a Hector's dolphin calf in Akaroa Harbour in 1999 (Stone & Yoshinaga 2000; DOC 2017a). Other known sources of mortality include predation by sharks (e.g. Cawthorn 1988), disease (e.g. Roe et al. 2013) and separation of calves from their mothers (DOC 2017a), possibly exacerbated by extreme weather conditions (DOC & MFish 2007; MPI & DOC 2012).

The presence of tourist vessels has been demonstrated to cause behavioural changes (Bejder et al. 1999; Martinez et al. 2012), as has underwater noise. There are potential negative effects due to bioaccumulation of organochlorines and heavy metals (reviewed by Slooten & Dawson 1994). Stockin et al. (2010) reported elevated levels of PCBs and organochlorine pesticides in the tissues of Hector's and

Māui dolphins but noted that no PCB concentrations were over the threshold considered to have immunological and reproductive effects. Additionally, both subspecies face pressures placed on coastal habitat through activities such as aquaculture, seabed mining, dredging and tidal energy installations (DOC & MFish 2007; Currey et al. 2012; MPI & DOC 2012).

A comprehensive list of the threats posed to Māui dolphins was produced as part of the spatially explicit, semi-quantitative risk assessment (Currey et al. 2012). The expert panel was asked to identify, analyse and evaluate all potential threats to Māui dolphins. Working from a previously established list of 47 potential threats to Hector's dolphins from the Hector's and Māui dolphin TMP (DOC & MFish 2007), the expert panel assessed 23 threats potentially relevant to Māui dolphins (i.e., present within their established distribution) in terms of whether these were likely to affect population trends within the next five years. For each of these threats, the expert panel provided estimates of the number of Māui dolphin mortalities per year.

The panel process resulted in estimated numbers of Māui dolphin mortalities from commercial set net fisheries of 2.33 (95% c.i.: 0.02–4.26) per annum, with spatial disaggregation of the estimates indicating that Māui dolphins are exposed to the greatest level of risk from set net fisheries in the area of the northern Taranaki coastline out to 7 nm offshore, and at the entrance to the Manukau Harbour. Subsequent interim measures banned set-net fishing within 2 nm of the Taranaki coast (between Pariokariwa Point and Hawera) and required full observer coverage of commercial set net fishing out to 7 nm. No Māui dolphins have been captured or sighted by observers in the Taranaki set-net fishery since observer coverage began in July 2012.

The expert panel's assessment of mortalities can be treated as testable hypotheses reflecting the limitations of available knowledge at that time and should be updated using new information. In particular, Roe et al.'s (2013) finding that 2 of 3 Māui dolphins tested in the period 2007 to 2011 had died as a result of *Toxoplasma gondii* infection, possibly as a result of run-off from terrestrial sources, indicates that the panel results may have underestimated mortality from this source. Roe et al. (2013) note that toxoplasmosis may have other effects beyond direct mortality and could be an important cause of neonatal loss. New work to investigate the risk of toxoplasmosis to Hector's and Māui dolphins is ongoing (W. Roe, pers. comm.) and will inform the update of the TMP.

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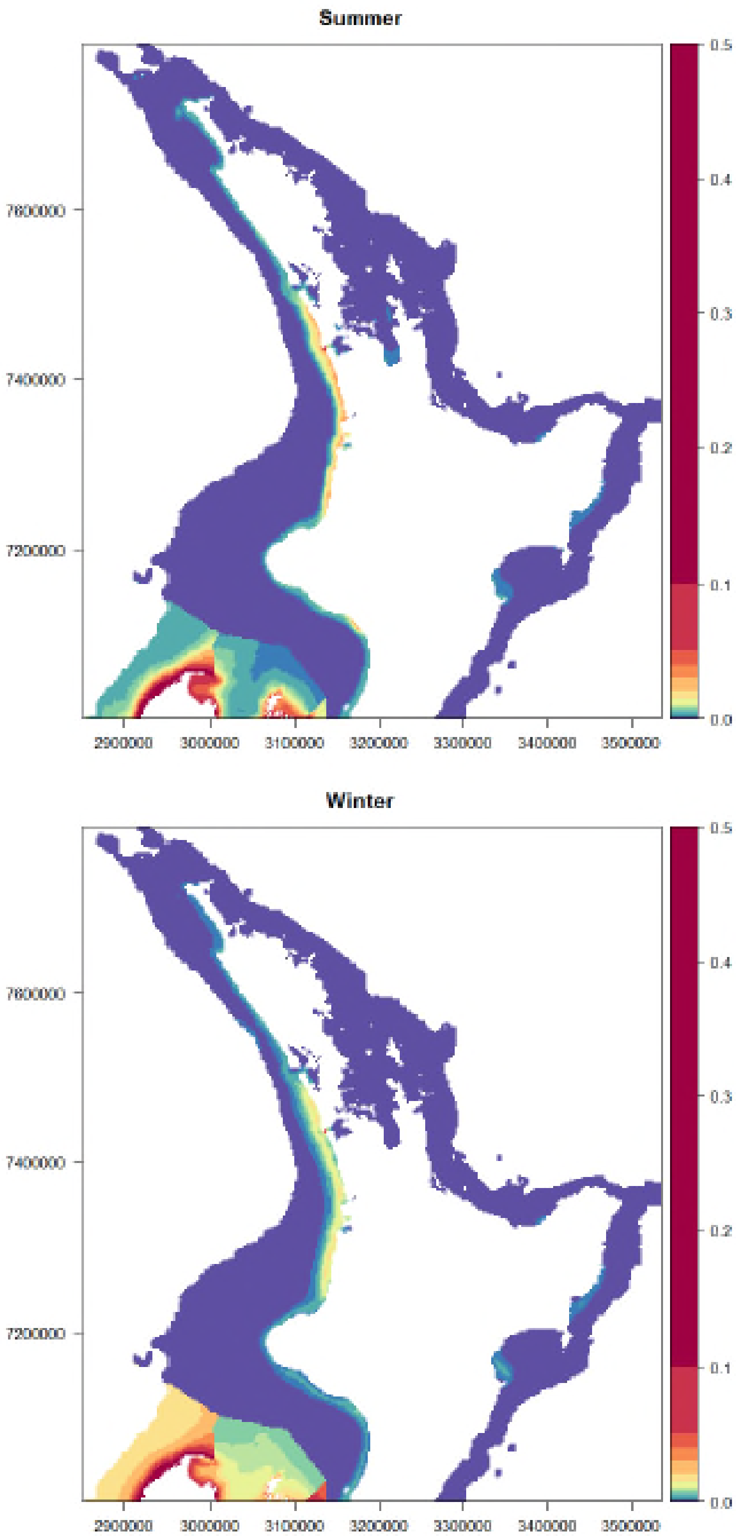

Figure A2.1. Final seasonal estimated density of Hector's and Māui dolphins in winter used for spatial risk assessment – North Island. Source: Roberts et al. (2019), figure 18.

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