

Conservation Services Programme

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Marine Mammal Medium-Term Research Plan

December 2021

Conservation Services Programme

Department of Conservation

1. Purpose

The Conservation Services Programme (CSP) undertakes research to understand and address the effects of commercial fishing on protected species in New Zealand fisheries waters (for further details see the [CSP Strategic Statement](#)). All marine mammal species in New Zealand waters are protected under the Marine Mammals Protection Act 1978; those encountered in New Zealand waters and subject to this plan are detailed in Table 1.

This CSP marine mammal medium term research plan (CSP marine mammal plan) will be updated annually and used as a tool to develop projects for the CSP Annual Plan over the next five years to deliver on the marine mammal population, mitigation, and interaction research components of CSP. It has been developed as part of the work of the CSP Research Advisory Group ([CSP RAG](#)), and will be used in the development of [CSP Annual Plans](#) and any other relevant delivery mechanisms.

Marine mammal research that falls outside the scope and mandate of CSP, for example work prioritised and conducted through existing Threat Management Plans (i.e. the New Zealand sea lion and the Hector's and Māui dolphin TMPs) that relates to threats other than the direct and indirect effects of commercial fishing, is not included in this plan.

2. Guiding objectives and risk framework

The CSP marine mammal medium term research plan is guided by several key documents and processes, these include the CSP Strategic Statement, Te Mana O Te Taiao Aotearoa New Zealand Biodiversity Strategy 2020, relevant action and management plans, the New Zealand Threat classification system, and relevant risk assessments. These are detailed further on in this document.

The relevant CSP objectives that have guided the development of this plan are as follows (for further details see the [CSP Strategic Statement](#)):

- **Objective A:** Proven mitigation strategies are in place to avoid or minimise the adverse effects of commercial fishing on protected species across the range of fisheries with known interactions.
- **Objective B:** The nature of direct adverse effects of commercial fishing on protected species is described.
- **Objective C:** The extent of known direct adverse effects of commercial fishing on protected species is adequately understood.
- **Objective D:** The nature and extent of indirect adverse effects of commercial fishing are identified and described for protected species that are at particular risk to such effects.
- **Objective E:** Adequate information on population level and susceptibility to fisheries effects exists for protected species populations identified as at medium or higher risk from fisheries.

The risk referred to in the guiding objectives is the risk of direct and indirect fisheries-related impacts, both of which could result in population level effects, to the 57 marine mammal taxa found in New Zealand waters (Table 1). In the marine mammal risk assessment by Abraham et

al., 2017, risk is estimated as the ratio of the annual potential fatalities (APF) in trawl, longline, setnet, and purse-seine fisheries within New Zealand's EEZ to the population sustainability threshold (PST, similar to Potential Biological Removal, PST = maximum number of human-caused mortalities that will allow population recovery to a defined management target). This level 2 (semi-qualitative) risk assessment comes with 2 caveats:

- 1) it only considers direct commercial fishing interactions with the New Zealand EEZ and therefore is not considered to be a test of adverse effect, and
- 2) it is limited to an assessment of the populations of 35 marine mammal (sub)species that inhabit New Zealand waters.

For the purpose of this plan, risk estimation (used to prioritise between species and fisheries) will be primarily based on the findings of Abraham et al. (2017) and any future updates of that approach.

Currently, comprehensive Risk Assessments (evaluating risk wider than just direct commercial fishing interactions) exist for several marine mammal species; Hector's and Māui dolphins (Roberts et al., 2019), and New Zealand sea lions (Roberts and Doonan, 2016).

Unlike seabirds and protected fish species, marine mammals do not currently have a National Plan of Action to help guide research on these taxa. The last iteration of a Marine Mammal Action Plan by the Department covered the period from 2005 to 2010 ([MMAP](#)). In lieu of an updated plan, the two primary aims of the MMAP and their related objectives remain relevant:

- **Species protection:** To actively protect marine mammal species and populations, and allow the recovery of those that are threatened with extinction or that have been depleted or otherwise adversely affected by human activities or unusual natural events.
 - To build understanding of the main biological parameters for all marine mammals, and especially species threatened or affected by past or present human activities;
 - To protect key sites in New Zealand waters that are of significance to marine mammals;
 - To maintain and restore the distribution, abundance, and diversity of marine mammals in NZ waters and beyond;
 - To achieve self-sustaining populations of all marine mammals throughout their natural range, and avoid extinctions of all marine mammal populations.
- **Management of human interactions and use:** To manage human interactions with marine mammals in order to minimise adverse effects on their survival, welfare and recovery, and to ensure the appropriate management of both living and dead marine mammals.
 - To identify and assess all significant threats to marine mammals (in general and as species, populations and individuals);
 - To address and mitigate human-related threats to the welfare of marine mammals and the viability of their populations and habitats, and to progressively work towards eliminating human-related mortalities of marine mammals;

- To manage dead and distressed marine mammals, and the holding and taking of marine mammals (including body parts);
- To address risks and uncertainty when making decisions and to ensure a precautionary approach is taken.

The Department of Conservation reviewed the New Zealand Threat Classification (NZTCS) for marine mammals in 2019 (Baker et al., 2019). This new listing replaces all previous NZTCS lists for marine mammals and informs prioritisation and changes in threat status now reflected in this document.

The Department of Conservation have updated the New Zealand Biodiversity Strategy 2000-2020 and published **Te Mana O Te Taiao Aotearoa New Zealand Biodiversity Strategy 2020¹**, (TMOTT). The Strategy outlines thirteen objectives to safeguard New Zealand's biodiversity, each of which has specific goals set to achieve five-, ten- and thirty-year targets. The most pertinent 5-year/2025 goals in the Strategy that relate to CSP and to marine mammals include ambitious fisheries bycatch reduction goals, goals for the sustainable use of marine resources, and goals to protect marine biodiversity and ecosystems:

10.1.1 Prioritised research is improving baseline information and knowledge of species and ecosystems

10.7.1 There have been no known human-driven extinctions of indigenous species

12.2.1 The number of fishing-related deaths of protected marine species is decreasing towards zero for all species

By 2030 and 2050, respectively, TMOTT includes bycatch reduction goals aiming that:

12.2.2 The direct effects of fishing do not threaten protected marine species populations or their recovery

12.2.3 The mortality of non-target species from marine fisheries has been reduced to zero

The TMOTT goals serve to provide context for the broader application of CSP research into The Department's wider research planning and strategic directions for the next 5 years plus.

3. Data Requirements

In general, there is a gross lack of data relating to the population structure of marine mammals in New Zealand. There are 57 taxa (species/sub-species) of marine mammal found in New Zealand waters. Of these, 30 are classified as data deficient (i.e. not enough information exists to properly determine their threat status). Of the remaining 27 taxa, the breakdown is as follows:

| | |
|------------------------------------|---|
| Threatened – Nationally Critical | 4 |
| Threatened – Nationally Endangered | 1 |
| Threatened – Nationally Vulnerable | 2 |
| At Risk – Recovering | 1 |

¹ <https://www.doc.govt.nz/globalassets/documents/conservation/biodiversity/anzbs-2020.pdf>

| | |
|------------------------------|----|
| At Risk – Naturally Uncommon | 2 |
| Not threatened | 5 |
| Migrant | 1 |
| Vagrant | 11 |

This plan describes a research approach to fill knowledge gaps to better understand marine mammal species' susceptibility to impacts from commercial fisheries and therefore inform and prioritise management actions to avoid, remedy, or mitigate these impacts:

- **Estimated capture rates:** The estimation of capture rates and numbers in different fisheries is a core prerequisite for setting research priorities for marine mammals as this is of great importance in accurately estimating risk. This information is generally best obtained through vessel observation programmes but may increasingly be supplemented by data collected via cameras on vessels. Preliminary information has been included in this plan that can be used in setting observation and mitigation priorities.
- **Species distributions:** To accurately assess risk of fishing as a function of overlap with and impacts from commercial fisheries, developing accurate species distributions are required. For migratory species these distributions should contain seasonal distributions. For the more commonly caught marine mammals (dolphins and pinnipeds), it is possible that some information can be obtained through incidental capture and fisheries observer data.
- **Population demographics:** Most marine mammals exhibit slow growth rates, late sexual maturation, and low fecundity. These factors place them at increased risk of impacts from commercial fishing mortalities. Having a better understanding of the size and genetic structuring of marine mammal populations would allow better determination of the resilience of these populations to fishing impacts and key areas of susceptibility.
- **Post-release survival:** The degree of post-release survival in commercial fisheries is not well understood for marine mammal species. Some fishery/species interactions may have a higher incidence of live release than others, for example marine mammals bycaught on longline vs caught in trawl and/or setnets. While these bycaught animals are assessed as being alive at time of release, the level of injury or subsequent interaction induced mortality is poorly understood.
- **Mitigation efficacy:** Female New Zealand sea lions have been observed interacting with squid trawl nets around the Auckland Islands. The squid trawl fishery developed SLEDs (sea lion exclusion devices) to reduce the number of sea lions caught and drowned in trawl nets. SLED efficacy has been questioned as animals that exit from a net via a SLED may suffer impacts with the device, potentially leading to mild brain injury (e.g. mild concussion) leading to risk of drowning. Work was undertaken through the Aquatic Environment Working Group to improve our estimation of the number of sea lions likely to escape through the SLED and survive. This pulled together the best

available information and expert opinion to estimate and model the likelihood of each potential outcome for a sea lion interacting with a trawl net. This work allowed for a multiplier to be used in the development of the current SQU 6T Operational Plan that took cryptic mortality into account. There will be uncertainty around the estimations, however, until technology allows for more accurate assessments of the fate of sea lions interacting with trawl nets, the desktop study by Meyer (2019) provides the best available information to guide this work in the meantime.

- **Indirect effects:** The indirect effects of fishing (i.e. the alteration of food sources through habitat modification and/or prey competition, which can cause nutritional stress) has been identified as a potential driver of population decline for New Zealand sea lions, and could similarly be so for other marine mammal populations. Further information on the effect of the alteration of food sources and/or nutritional stress on marine mammal populations would be of importance for accurately estimating risk.
- Other sources of information, particularly regarding the nature of marine mammal interactions with fishing gear (i.e. trawl gear, longline gear, setnets, and trap and/or pot lines), is also of great importance in accurately estimating risk.

4. Current risk and uncertainty

Not all marine mammals have been reported interacting with commercial fisheries in New Zealand; most beaked whales and large whales (with the exception of the Humpback whale) have a relatively low incidence (≤ 0.3 mean annual potential fatalities) of being bycaught in commercial fisheries in New Zealand (Table 3). Therefore, these species would be lower priority candidates for research (Abraham et al., 2017). Table 4 lists the risk ratios for 35 of the species and sub-species of marine mammals in New Zealand covered by the Marine Mammal Risk Assessment, relative risk scores have yet to be assigned.

The uncertainty in risk arises from uncertainty in a range of parameters; capture estimation, estimates of New Zealand distribution, maximum population growth rate, and population size were estimated through an expert led Delphi² survey to which there were few responses. Reliable scientific information was available for a limited number of species; where available, this information replaces the Delphi survey.

There are some limitations to the work by Abraham et al. 2017 that also give rise to some uncertainty. The risk assessment only examines the direct effects of commercial fishing and does not account for the indirect effects of fishing (i.e. habitat removal, prey availability, etc.) or any wider anthropogenic or environmental change effects. The population research component of this plan is focused on obtaining better estimates of those parameters, which contribute most uncertainty in risk estimates.

While this plan is largely focused on the outputs of Abraham et al. (2017), more detailed quantitative modelling to assess fisheries risk has been completed for some taxa. These

² An internet-based survey approach often used in data poor situations, which provides an approach for soliciting expert judgement in a systematic and transparent way (Abraham et al., 2017).

assessments are listed in Table 2. This plan does not attempt to summarise the findings and recommendations from these assessments, but the gaps identified in those documents are captured here. The findings should be taken into consideration by the CSP RAG when prioritizing research proposals for these taxa.

5. Research priorities

As there is a relative paucity of data for marine mammals in New Zealand, particularly relating to their population structure and the nature of their interactions with commercial fishing, this plan is not intended to prescribe a fixed five-year stream of research, but rather provides a list of research priorities that should be undertaken in the next few years to narrow the data gaps and allow for further research.

The CSP marine mammal research priorities fall roughly into six categories:

- 1) Characterisation of marine mammal bycatch
- 2) Mitigation studies
- 3) Population monitoring
- 4) Population size and structure determination
- 5) Tracking/distribution studies
- 6) Post release survival

These priorities have been developed to meet the following outputs which are specifically related to the risk from fishing:

- Routine population monitoring for marine mammal species at risk from commercial fishing impacts (i.e. aerial monitoring, vessel surveys, pup counts (pinnipeds), drone monitoring, public and tourism sightings and observer/fishermen reports). Methods to integrate different monitoring techniques.
- Tracking studies of highly mobile marine mammal species to inform estimates of both species' distribution and spatial overlap between commercial fisheries and marine mammal species. These studies should be designed to be informative on seasonal movements, foraging, and diving behaviour.
- Population size and structure should be determined (through genetic analysis) for marine mammal species to identify both population structuring within the New Zealand Exclusive Economic Zone (NZ EEZ) and differentiation from worldwide populations, thus enabling adequate population level management.
- Quantification of the nature of migratory species' migration patterns (i.e. identification of migratory routes, seasons, and overlap with commercial fishing activity), and how they might change under future climate change scenarios. Engaging in coordination with international agreements for marine mammals.
- Where marine mammal species are known to be released alive following capture, assess post-release survival to better estimate bycatch mortality.

- Development of further live release methods and protocols to maximise post-release survival probability of marine mammal species for fisheries where live captures are relatively frequent.
- Method and species-specific bycatch mitigation options developed for each protected marine mammal species known to interact with commercial fisheries.
- Quantification of the indirect effects of fishing and whether these effects can act as potential drivers of population decline in marine mammals.
- Description of the diet of marine mammals, and identification of potential interactions with commercial species; examination of the potential overlap between marine mammal feeding grounds and commercial fishing species distribution and how this might change under future climate change scenarios
- Description of potential high-risk areas following fishing effort data, historic bycatch records, fleet characterisation, and marine mammals' known distribution.

Table 6 details the research and development priorities for the 10 marine mammal taxa that have been suggested as priority species. These 10 species have been selected based on their threat status, the incidence of being bycaught in commercial fisheries, or a combination of these two. Please note that Māui dolphin is not included in this list at present as a separate process is being developed to guide research priorities for Māui dolphin. Additionally, Hector's dolphin and New Zealand sea lion are also subject to other research prioritisation processes.

Priority level (Low, Medium, and High) has been assigned qualitatively based on the importance of the work (i.e. whether the research addresses significant data gaps), the NZ threat classification of the species, the species' risk of fisheries related mortality, and the species' estimated annual potential fatalities.

To develop research priorities to deliver the CSP research response detailed in Table 6, some further operational principles were developed and used as appropriate:

- Studies on highest risk species prioritised for earlier years, as informed by the Level 2 marine mammal risk assessment and species-specific risk assessments;
- Mitigation, live release, and post release survival studies should focus on fisheries with most frequent interactions;
- Annual grouping of CSP projects by location across protected species taxa, to maximise synergies with other research projects, for example vessel-based research in the Auckland Island squid fishery can assist both basking shark and New Zealand sea lion research;
- Planning live release, survival estimation, and tracking studies in a complementary manner;

- Aim to leverage from existing studies, of both the Department and other government and non-government organisations;
- Prioritise review projects thereby ensuring adequate data collection is advanced in early years, as these projects are relatively low cost and may result in finding current risk estimates are under-estimated, and;
- Prioritise studies which make better use of existing research platforms such as biological sampling by government observers.

6. References

- Abraham, E.R.; Neubauer, P.; Berkenbush, K.; Richard, Y. 2017. Assessment of the risk to New Zealand marine mammals from commercial fisheries. New Zealand Aquatic Environment and Biodiversity Report 189. Prepared for the Ministry of Primary Industries. 127 p.
- Baker, C.S.; Boren, L.; Childerhouse, S.; Constantine, R.; van Helden, A.; Lundquist, D.; Rayment, W.; and Rolfe, J.R. 2019. Conservation Status of New Zealand marine mammals, 2019. New Zealand Threat Classification Series 29. 18p
- Currey, R.J.C.; Boren, L.J.; Sharp, B.R.; Peterson, D. 2012. A risk assessment of threats to Maui's dolphins. Ministry for Primary Industries and Department of Conservation, Wellington. 51 p.
- Meyer, S. 2019. Desktop estimation of pinniped cryptic mortality in trawls using SLEDs. New Zealand Aquatic Environment and Biodiversity Report 222. Prepared for the Ministry of Primary Industries. 29 p.

Roberts, J.; Doonan, I. 2016. Quantitative Risk Assessment of Threats to New Zealand Sea Lions. New Zealand Aquatic Environment and Biodiversity Report No. 166. 111 p.

Slooten, E.; Davies, N. 2012. Hector's dolphin risk assessments: old and new analyses show consistent results. *Journal of the Royal Society of New Zealand* 45(1): 49-60.

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Tables

Table 1. List of 57 species of marine mammals encountered in New Zealand waters and their NZ and IUCN Threat statuses, adapted from Abraham et al., 2017. (to be updated)

| Species Group | Common name | Scientific name | New Zealand threat status | IUCN threat status | |
|---------------------------|------------------------------|---|--------------------------------|-----------------------|----------------|
| Whales | Bryde's whale | <i>Balaenoptera edeni brydei</i> | Nationally critical | Least concern | |
| | Southern right whale | <i>Eubalaena australis</i> | At risk - recovering | Least concern | |
| | Sperm whale | <i>Physeter macrocephalus</i> | Data deficient | Vulnerable | |
| | Antarctic minke whale | <i>Balaenoptera bonaerensis</i> | Data deficient | Near threatened | |
| | Dwarf minke whale | <i>Balaenoptera acutorostrata</i> "dwarf" | Data deficient | Least concern | |
| | Antarctic blue whale | <i>Balaenoptera musculus</i> <i>intermedia</i> | Data deficient | Critically endangered | |
| | Fin whale | <i>Balaenoptera physalus</i> | Data deficient | Vulnerable | |
| | Pygmy blue whale | <i>Balaenoptera musculus</i> <i>brevicauda</i> | Data deficient | Data deficient | |
| | Sei whale | <i>Balaenoptera borealis</i> | Data deficient | Endangered | |
| | Humpback whale | <i>Megaptera novaeangliae</i> | Migrant | Least concern | |
| | Pygmy right whale | <i>Caperea marginata</i> | Data deficient | Least concern | |
| | Pygmy sperm whale | <i>Kogia breviceps</i> | Data deficient | Least concern | |
| | Dwarf sperm whale | <i>Kogia sima</i> | Data deficient | Least concern | |
| | Large Dolphins | Killer whale | <i>Orcinus orca</i> | Nationally critical | Data deficient |
| Killer whale | | <i>Orcinus orca</i> "Type B, C, D" | Vagrant | Data deficient | |
| Long-finned pilot whale | | <i>Globicephala melas</i> | Not threatened | Least concern | |
| False killer whale | | <i>Pseudorca crassidens</i> | At risk - naturally uncommon | Near threatened | |
| | Short-finned pilot whale | <i>Globicephala macrorhynchus</i> | Data deficient | Least concern | |
| Small Dolphins | Māui dolphin | <i>Cephalorhynchus hectori</i> <i>maui</i> | Nationally critical | Critically endangered | |
| | Hector's dolphin | <i>Cephalorhynchus hectori</i> <i>hectori</i> | Nationally vulnerable | Endangered | |
| | Bottlenose dolphin | <i>Tursiops truncatus</i> | Nationally endangered | Least concern | |
| | Southern right whale dolphin | <i>Lissodelphis peronii</i> | Data deficient | Least concern | |
| | Common dolphin | <i>Delphinus delphis</i> | Not threatened | Least concern | |
| | Dusky dolphin | <i>Lagenorhynchus obscurus</i> | Not threatened | Least concern | |
| | Hourglass dolphin | <i>Lagenorhynchus cruciger</i> | Data deficient | Least concern | |
| | Pygmy killer whale | <i>Feresa attenuata</i> | Vagrant | Least concern | |
| | Melon-headed whale | <i>Peponocephala electra</i> | Vagrant | Least concern | |
| | Risso's dolphin | <i>Grampus griseus</i> | Data deficient | Least concern | |
| | Fraser's dolphin | <i>Lagenodelphis hosei</i> | Data deficient | Least concern | |
| | Pantropical spotted dolphin | <i>Stenella attenuata</i> | Vagrant | Least concern | |
| | Striped dolphin | <i>Stenella coeruleoalba</i> | Data deficient | Least concern | |
| | Spectacled porpoise | <i>Phocoena dioptrica</i> | Data deficient | Least concern | |
| | Rough-toothed dolphin | <i>Steno bredanensis</i> | Data deficient | Least concern | |
| | Beaked whales | Andrews' beaked whale | <i>Mesoplodon bowdoini</i> | Data deficient | Data deficient |
| | | Goose-beaked whale | <i>Ziphius cavirostris</i> | Data deficient | Least concern |
| | | Dense-beaked whale | <i>Mesoplodon densirostris</i> | Data deficient | Data deficient |
| | | Gray's beaked whale | <i>Mesoplodon grayi</i> | Not threatened | Data deficient |
| Hector's beaked whale | | <i>Mesoplodon hectori</i> | Data deficient | Data deficient | |
| Shepherd's beaked whale | | <i>Tasmacetus shepherdi</i> | Data deficient | Data deficient | |
| True's beaked whale | | <i>Mesoplodon mirus</i> | Data deficient | Data deficient | |
| Southern bottlenose whale | | <i>Hyperoodon planifrons</i> | Data deficient | Least concern | |
| Spade-toothed whale | | <i>Mesoplodon traversii</i> | Data deficient | Data deficient | |
| Strap-toothed whale | | <i>Mesoplodon layardii</i> | Data deficient | Data deficient | |
| Arnoux's beaked whale | | <i>Berardius arnuxii</i> | Data deficient | Data deficient | |
| Ginkgo-toothed whale | | <i>Mesoplodon ginkgodens</i> | Data deficient | Data deficient | |
| Pygmy beaked whale | | <i>Mesoplodon peruvianus</i> | Data deficient | Data deficient | |
| Pinnipeds | | New Zealand sea lion | <i>Phocarctos hookeri</i> | Nationally vulnerable | Endangered |
| | | Southern elephant seal | <i>Mirounga leonina</i> | Nationally critical | Least concern |
| | New Zealand fur seal | <i>Arctophoca australis</i> <i>forsteri</i> | Not threatened | Least concern | |
| | Antarctic fur seal | <i>Arctocephalus gazella</i> | Vagrant | Least concern | |
| | Subantarctic fur seal | <i>Arctocephalus tropicalis</i> | Vagrant | Least concern | |
| | Leopard seal | <i>Hydrurga leptonyx</i> | At risk - naturally uncommon | Least concern | |
| | Weddell seal | <i>Leptonychotes weddellii</i> | Vagrant | Least concern | |
| | Crabeater seal | <i>Lobodon carcinophaga</i> | Vagrant | Least concern | |
| | Ross seal | <i>Ommatophoca rossi</i> | Vagrant | Least concern | |

Table 2. List of marine mammal risk assessments

| Species | Citation and Link |
|---------------------------------------|--|
| Hector's and Māui dolphin | Roberts, J.O.; Webber, D.N.; Roe, W.D.; Edwards, C.T.T.; Doonan, I.J. 2019. Spatial risk assessment of threats to Hector's and Māui dolphins (<i>Cephalorhynchus hectori</i>). New Zealand Aquatic Environment and Biodiversity Report No. 214. Prepared by Fisheries New Zealand. 174 p |
| New Zealand sea lions | Roberts, J.; Doonan, I. 2016. Quantitative Risk Assessment of Threats to New Zealand Sea Lions. New Zealand Aquatic Environment and Biodiversity Report No. 166. 111 p. |
| Level 2 Marine Mammal Risk Assessment | Abraham, E.R.; Neubauer, P.; Berkenbush, K.; Richard, Y. 2017. Assessment of the risk to New Zealand marine mammals from commercial fisheries. New Zealand Aquatic Environment and Biodiversity Report 189. Prepared for the Ministry of Primary Industries. 127 p. |

Table 3. Estimated number of annual potential fatalities of marine mammal species within New Zealand’s Exclusive Economic Zone in commercial trawl, set-net, surface-longline (SLL), bottom-longline (BLL), and purse-seine fisheries, by fishing method, between the fishing years 2012–13 and 2014–15 (inclusive). Cases where the mean and 95% credible interval (c.i.) limits were zero after rounding to one decimal place were left blank. From Abraham et al., 2017. Note that estimates for

| Species group | Species | Trawl | | Set net | | SLL | | BLL | | Purse seine | | Total | |
|----------------|------------------------------|-------|-------------|---------|------------|-------|------------|------|----------|-------------|----------|-------|---------------|
| | | Mean | 95% c.i. | Mean | 95% c.i. | Mean | 95% c.i. | Mean | 95% c.i. | Mean | 95% c.i. | Mean | 95% c.i. |
| Pinnipeds | New Zealand fur seal | 569.9 | 345.0–917.0 | 236.5 | 97.0–517.6 | 138.6 | 19.0–314.0 | 2.5 | 0.4–7.3 | 1.5 | 0.0–5.5 | 948.9 | 610.9–1 401.6 |
| | New Zealand sea lion | 24.5 | 13.0–41.0 | 1.2 | 0.0–6.0 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.3 | – | – | 25.8 | 13.5–43.0 |
| | Southern elephant seal | 0.9 | 0.1–3.5 | 0.4 | 0.0–3.3 | 0.0 | 0.0–0.3 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 1.4 | 0.1–5.7 |
| Small dolphins | Bottlenose dolphin | 5.1 | 0.2–23.8 | 3.5 | 0.0–21.4 | 0.6 | 0.0–2.4 | 0.0 | 0.0–0.2 | 0.0 | 0.0–0.1 | 9.3 | 1.1–36.0 |
| | Common dolphin | 157.3 | 72.0–299.0 | 71.3 | 14.4–207.5 | 1.7 | 0.1–5.1 | 0.1 | 0.0–1.4 | 0.1 | 0.0–0.9 | 230.4 | 115.8–421.7 |
| | Dusky dolphin | 9.8 | 2.5–28.1 | 18.4 | 5.7–43.2 | 0.3 | 0.0–1.6 | 0.0 | 0.0–0.2 | 0.0 | 0.0–0.1 | 28.6 | 11.7–58.4 |
| | Hector’s dolphin | 9.0 | 1.1–26.6 | 32.3 | 13.8–65.8 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | – | – | 41.3 | 19.1–77.7 |
| | Hourglass dolphin | 0.8 | 0.0–6.3 | 0.9 | 0.0–6.1 | 0.0 | 0.0–0.3 | 0.0 | 0.0–0.1 | – | – | 1.7 | 0.0–11.2 |
| | Māui dolphin | 0.0 | 0.0–0.1 | 0.2 | 0.0–0.5 | – | – | – | – | – | – | 0.2 | 0.0–0.5 |
| | Southern right whale dolphin | 0.5 | 0.0–3.8 | 0.3 | 0.0–3.1 | 0.0 | 0.0–0.1 | – | – | – | – | 0.9 | 0.0–6.6 |
| Large dolphins | False killer whale | 0.2 | 0.0–1.2 | 1.1 | 0.0–9.1 | 0.1 | 0.0–0.8 | 0.5 | 0.0–3.4 | 0.0 | 0.0–0.3 | 1.9 | 0.0–10.8 |
| | Killer whale | 0.2 | 0.0–1.4 | 1.0 | 0.0–7.9 | 0.1 | 0.0–0.4 | 0.4 | 0.0–2.6 | 0.0 | 0.0–0.2 | 1.6 | 0.0–9.5 |
| | Long-finned pilot whale | 3.3 | 0.2–8.7 | 3.4 | 0.0–13.9 | 0.5 | 0.0–2.3 | 1.5 | 0.1–7.1 | 0.0 | 0.0–0.3 | 8.7 | 2.1–25.2 |
| | Short-finned pilot whale | 0.9 | 0.0–4.9 | 3.1 | 0.0–20.9 | 0.3 | 0.0–1.6 | 2.8 | 0.0–11.9 | 0.1 | 0.0–0.6 | 7.0 | 0.0–30.5 |
| Beaked whales | Andrews’ beaked whale | 0.1 | 0.0–0.6 | 0.0 | 0.0–0.4 | 0.1 | 0.0–0.5 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.2 | 0.0–1.2 |
| | Cuvier’s beaked whale | 0.2 | 0.0–1.3 | 0.1 | 0.0–0.9 | 0.1 | 0.0–0.8 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.2 | 0.4 | 0.0–2.4 |
| | Dense-beaked whale | 0.1 | 0.0–0.6 | 0.0 | 0.0–0.3 | 0.1 | 0.0–0.5 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.2 | 0.0–1.3 |
| | Gray’s beaked whale | 0.3 | 0.0–2.4 | 0.1 | 0.0–1.0 | 0.2 | 0.0–1.1 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.6 | 0.0–3.8 |
| | Hector’s beaked whale | 0.1 | 0.0–0.6 | 0.0 | 0.0–0.4 | 0.1 | 0.0–0.5 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.2 | 0.0–1.4 |
| | Shepherd’s beaked whale | 0.1 | 0.0–0.6 | 0.0 | 0.0–0.3 | 0.1 | 0.0–0.5 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.2 | 0.0–1.2 |
| | Southern bottlenose whale | 0.1 | 0.0–0.6 | 0.0 | 0.0–0.3 | 0.1 | 0.0–0.5 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.2 | 0.0–1.2 |
| | Spade-toothed whale | 0.1 | 0.0–0.6 | 0.0 | 0.0–0.3 | 0.1 | 0.0–0.5 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.2 | 0.0–1.2 |
| | Strap-toothed whale | 0.1 | 0.0–0.8 | 0.1 | 0.0–0.6 | 0.1 | 0.0–0.6 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.3 | 0.0–1.6 |
| Whales | Antarctic blue whale | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | – | – | 0.0 | 0.0–0.3 |
| | Antarctic minke whale | 0.1 | 0.0–0.5 | 0.0 | 0.0–0.2 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.1 | 0.0–1.0 |
| | Bryde’s whale | 0.0 | 0.0–0.3 | 0.1 | 0.0–0.9 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.3 | 0.0 | 0.0–0.1 | 0.2 | 0.0–1.6 |
| | Dwarf minke whale | 0.0 | 0.0–0.2 | 0.1 | 0.0–0.3 | 0.0 | 0.0–0.2 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.1 | 0.0–0.8 |
| | Fin whale | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.2 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.1 | 0.0–0.5 |
| | Humpback whale | 0.4 | 0.0–3.8 | 0.3 | 0.0–3.3 | 0.4 | 0.0–2.1 | 0.1 | 0.0–0.8 | 0.1 | 0.0–0.7 | 1.4 | 0.0–6.6 |
| | Pygmy blue whale | 0.0 | 0.0–0.3 | 0.0 | 0.0–0.3 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.1 | 0.0–0.8 |
| | Pygmy right whale | 0.0 | 0.0–0.1 | – | – | 0.0 | 0.0–0.1 | – | – | – | – | 0.0 | 0.0–0.1 |
| | Pygmy sperm whale | 0.0 | 0.0–0.2 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.3 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.1 | 0.0–0.8 |
| | Sei whale | 0.1 | 0.0–0.5 | 0.0 | 0.0–0.3 | 0.0 | 0.0–0.2 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | 0.1 | 0.0–0.9 |
| | Southern right whale | 0.2 | 0.0–1.3 | 0.1 | 0.0–0.8 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.2 | 0.0 | 0.0–0.2 | 0.3 | 0.0–2.2 |
| | Sperm whale | 0.1 | 0.0–0.5 | 0.0 | 0.0–0.3 | 0.0 | 0.0–0.1 | 0.0 | 0.0–0.1 | – | – | 0.1 | 0.0–0.9 |

Table 4. Risk ratio for New Zealand marine mammals, calculated as the ratio of the annual potential fatalities (APF) to the Population Sustainability Threshold (PST). Values are displayed on a logarithmic scale, and the distribution of the risk ratios within their 95% credible interval indicated by the coloured shapes, including the median risk ratio (vertical line). Species are listed in decreasing order of the median risk ratio. From Abraham et al., 2017.

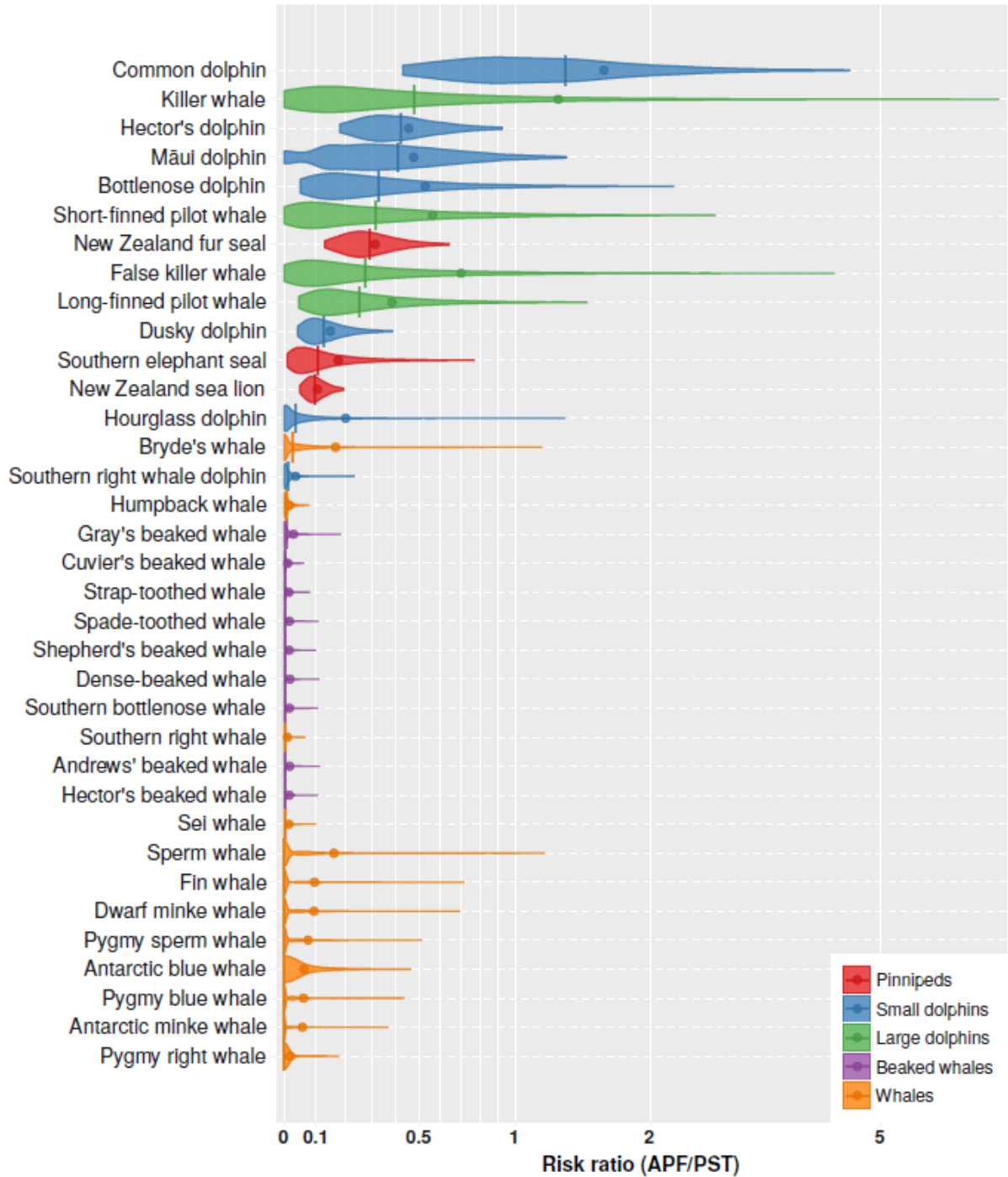


Table 6. CSP research and development priorities for select New Zealand marine mammal taxa for 2022-2027

High and Medium/High priorities have been highlighted

| | Hector's dolphin | New Zealand sea lion | Killer whale | Bottlenose dolphin | New Zealand fur seal | Common dolphin | Pilot whale | Dusky dolphin | Humpback whale | Southern elephant seal |
|--|---|---|--|--|-----------------------------------|--|---|--------------------------------------|--------------------|---|
| Mitigation studies | Medium/ High (capture mitigation – setnet & trawl) | | Medium (pot/trap lines) | | Medium/ High (capture mitigation) | Medium/ High (capture mitigation – setnet & trawl) | Medium (capture mitigation – trawl) | Medium (capture mitigation - setnet) | Medium (pot lines) | Medium (capture mitigation – trawl) |
| Population monitoring | High | High (annually) | Medium/High | Medium (different coastal populations) | Medium/ High | | Low/Medium (genetic overview of population) | | | Medium |
| Population size and structure determination | High (top of the South Island) | Medium | High (population size for coastal ecotype) | Medium (Marlborough Sounds) | Medium/ High | Medium | Low/Medium (genetic overview of population) | Medium | | |
| Tracking/distribution studies | Medium/ High (species distribution/ habitat use – Marlborough Sounds) | Low/Medium (quantify fisheries overlap) | | | | | | | | Low/Medium (quantify fisheries overlap) |
| Indirect effects of fishing | Low/ Medium | Medium | Low/ Medium | Low/ Medium | Low/ Medium | Low/ Medium | Low/ Medium | Low/ Medium | Low/ Medium | Low/ Medium |
| Post release survival | Low/ Medium | | Low/ Medium | Low/ Medium | Low/ Medium | Low/ Medium | Low/ Medium | Low/Medium | Low/Medium | Low/Medium |