

Conservation Services Programme

Marine Mammal medium term research plan

December 2018

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 2018](#)). All marine mammal species in New Zealand waters are protected under the Marine Mammals Protection Act 1978; those commonly 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 Maui 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 relevant action and management plans, and the New Zealand Threat classification system and relevant risk assessments. These are detailed below.

The relevant CSP objectives that have guided the development of this plan are as follows (for further details see the [CSP Strategic Statement 2018](#)):

- **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 (i.e. mortality) and indirect (sub-lethal) fisheries-related impacts, both of which could result in population level effects, to the 52 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 only considers direct commercial fishing interactions with the New Zealand EEZ and therefore is not considered to be a test of adverse effect. It has been underway for several years, the latest draft results of which were presented in November 2016 (Abraham et al., 2017). 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 (Slooten and Davies, 2012) and Māui dolphins (Currey et al., 2012), and New Zealand sea lions (Roberts and Doonan, 2016). The Hector's and Maui dolphin Risk Assessment is due for review in 2018-19.

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 is in the process of reviewing the New Zealand Threat Classification for marine mammals. Prior to the review being finalised, this plan will reflect the current threat status for marine mammals (Baker et al., 2016). An initial meeting took place in March 2018 to discuss threat status in detail, a final report has yet to be produced. The outputs of this will further inform prioritization and any changes in threat status will be reflected in this document.

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 52 species of marine mammal found in New Zealand waters, 16 of these are classified as Vagrant. Of the 36 species of marine mammals determined to inhabit New Zealand waters (and included in the marine mammal risk assessment), seven are classified under the New Zealand Threat Classification System as Migrant, nine as Not Threatened, three as Nationally Endangered, and five as Nationally Critical (see Table 1). The remaining 12 species are classified as data deficient which means that not enough information exists to properly determine their threat status.

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:

- 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. Preliminary information has been included in this plan that can be used in setting observation and mitigation priorities.
- 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.
- 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.
- The degree of post-release mortality 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.

- 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. The potential for loss of sea lions from nets (incomplete retention) has also been raised by some, suggesting that fishermen and fisheries observers are unable to enumerate the number of sea lions that have drowned in the net when the gear is retrieved on deck. As such, further examination of sea lion exclusion device (SLED) efficacy is important to better inform estimates of sea lion interaction levels and cryptic mortality in fisheries that deploy SLEDs.
- 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 Delphi¹ 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

¹ 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).

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 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. Table 5 details the CSP marine mammal research priorities. 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, and individual, 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). 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.
- Description of potential high-risk areas following fishing effort data, historic bycatch records, fleet characterisation, and marine mammals' known distribution.

To develop research priorities to deliver the CSP research response detailed in Table 5, some further operational principles were developed and used as appropriate:

- Studies on highest risk species prioritised for earlier years, as informed by the draft 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 for potential new taxa; 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.; Chilvers, B.L.; Childerhouse, S.; Constantine, R.; Currey, R.; Mattlin, R.; Van Helden, A.; Hitchmough, R.; Rolfe, J. 2016. Conservation status of New Zealand marine mammals, 2013. New Zealand Threat Classification Series 14. 18 p.

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.

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.

Tables

Table 1. List of 52 species of marine mammals encountered in New Zealand waters and their NZ and IUCN Threat statuses, adapted from Abraham et al., 2017.

Species group	Common name	Scientific name	New Zealand threat status	IUCN threat status	
Whales	Bryde's whale	<i>Balaenoptera brydei</i>	Nationally critical	Data deficient	
	Southern right whale	<i>Eubalaena australis</i>	Nationally endangered	Least concern	
	Sperm whale	<i>Physeter macrocephalus</i>	Not threatened	Vulnerable	
	Antarctic minke whale	<i>Balaenoptera bonaerensis</i>	Not threatened	Data deficient	
	Dwarf minke whale	<i>Balaenoptera acutorostrata</i>	Not threatened	Least concern	
	Antarctic blue whale	<i>Balaenoptera musculus intermedia</i>	Migrant	Critically endangered	
	Fin whale	<i>Balaenoptera physalus</i>	Migrant	Endangered	
	Pygmy blue whale	<i>Balaenoptera musculus breviceauda</i>	Migrant	Data deficient	
	Sei whale	<i>Balaenoptera borealis</i>	Migrant	Endangered	
	Humpback whale	<i>Megaptera novaeangliae</i>	Migrant	Least concern	
	Pygmy right whale	<i>Caperea marginata</i>	Data deficient	Data deficient	
	Pygmy sperm whale	<i>Kogia breviceps</i>	Data deficient	Data deficient	
	Dwarf sperm whale	<i>Kogia sima</i>	Vagrant	Data deficient	
	Large Dolphins	Killer whale	<i>Orcinus orca</i>	Nationally critical	Data deficient
		Long-finned pilot whale	<i>Globicephala melas</i>	Not threatened	Data deficient
False killer whale		<i>Pseudorca crassidens</i>	Not threatened	Data deficient	
Short-finned pilot whale		<i>Globicephala macrorhynchus</i>	Migrant	Data deficient	
Small Dolphins	Māui dolphin	<i>Cephalorhynchus hectori maui</i>	Nationally critical	Critically endangered	
	Hector's dolphin	<i>Cephalorhynchus hectori hectori</i>	Nationally endangered	Endangered	
	Bottlenose dolphin	<i>Tursiops truncatus</i>	Nationally endangered	Least concern	
	Southern right whale dolphin	<i>Lissodelphis peronii</i>	Not threatened	Data deficient	
	Common dolphin	<i>Delphinus delphis</i>	Not threatened	Least concern	
	Dusky dolphin	<i>Lagenorhynchus obscurus</i>	Not threatened	Data deficient	
	Hourglass dolphin	<i>Lagenorhynchus cruciger</i>	Data deficient	Least concern	
	Pygmy killer whale	<i>Feresa attenuata</i>	Vagrant	Data deficient	
	Melon-headed whale	<i>Peponocephala electra</i>	Vagrant	Least concern	
	Risso's dolphin	<i>Grampus griseus</i>	Vagrant	Least concern	
	Fraser's dolphin	<i>Lagenodelphis hosei</i>	Vagrant	Least concern	
	Offshore pantropical spotted dolphin	<i>Stenella attenuata attenuata</i>	Vagrant	Least concern	
	Striped dolphin	<i>Stenella coeruleoalba</i>	Vagrant	Least concern	
Rough-toothed dolphin	<i>Steno bredanensis</i>	Vagrant	Least concern		
Beaked whales	Andrews' beaked whale	<i>Mesoplodon bowdoini</i>	Data deficient	Data deficient	
	Cuvier's beaked whale	<i>Ziphius cavirostris</i>	Data deficient	Data deficient	
	Dense-beaked whale	<i>Mesoplodon densirostris</i>	Data deficient	Data deficient	
	Gray's beaked whale	<i>Mesoplodon grayi</i>	Data deficient	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	
	Southern bottlenose whale	<i>Hyperoodon planifrons</i>	Data deficient	Data deficient	
	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>	Migrant	Data deficient	
	Ginkgo-toothed whale	<i>Mesoplodon ginkgodens</i>	Vagrant	Data deficient	
	Lesser/pygmy beaked whale	<i>Mesoplodon peruvianus</i>	Vagrant	Data deficient	
	Pinnipeds	New Zealand sealion	<i>Phocarctos hookeri</i>	Nationally critical	Endangered
		Southern elephant seal	<i>Mirounga leonina</i>	Nationally critical	Least concern
New Zealand fur seal		<i>Arctophoca australis 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>	Vagrant	Least concern	
Weddel seal		<i>Leptonychotes weddellii</i>	Vagrant	Least concern	
Crabeater seal		<i>Lobodon carcinophagus</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 dolphin	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.
Māui dolphin	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.
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.

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.

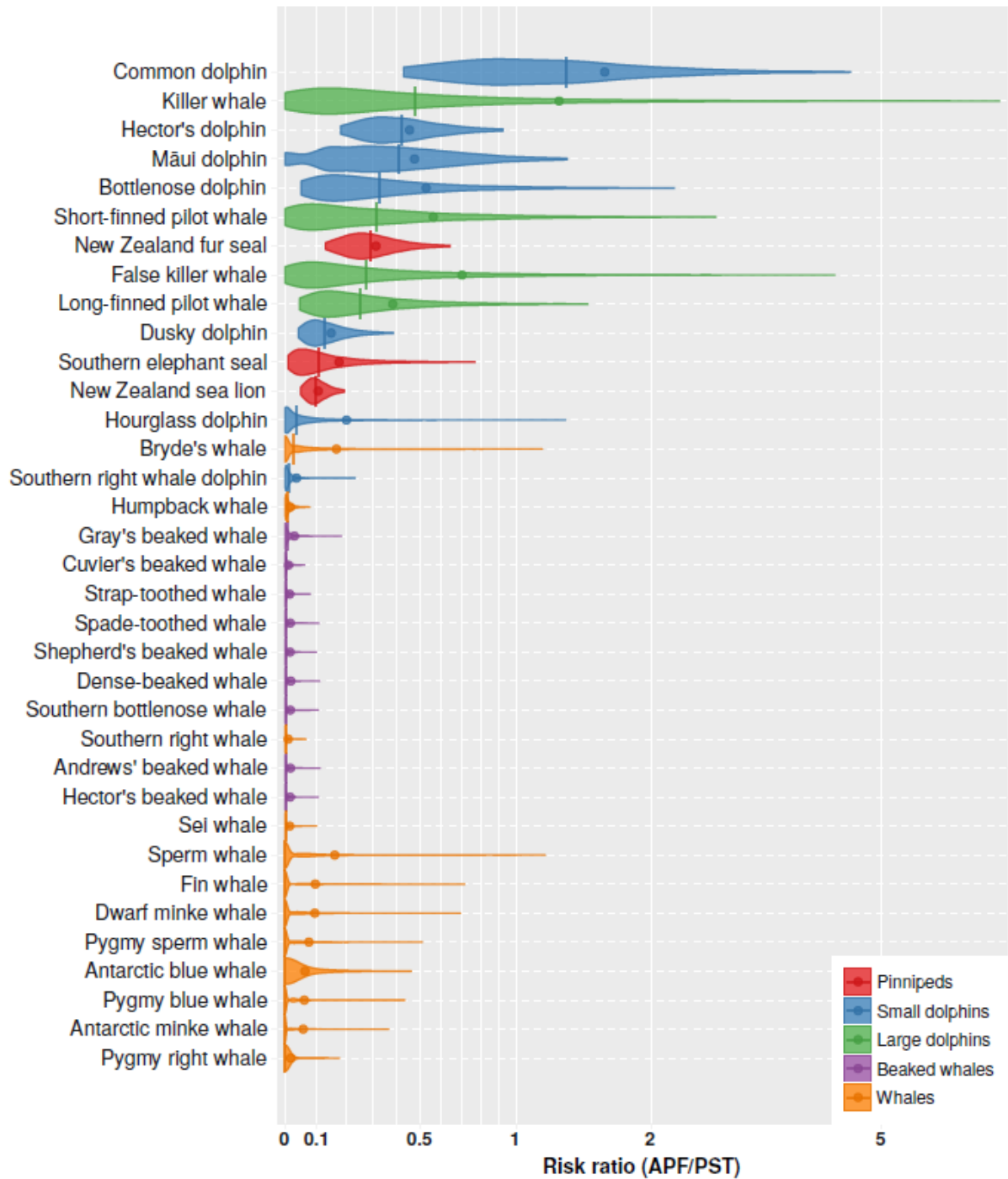


Table 5. CSP Research Priorities for New Zealand marine mammals 2019-2024

Research Priority	Priority level*	Species involved
Characterisation of marine mammal bycatch (i.e. interaction/catch rates in all fisheries)	High	All species (prioritising those at greatest risk from fishing)
Mitigation studies Project ideas include:	High	All species (prioritising those at greatest risk from fishing)
<ul style="list-style-type: none"> Mitigation of captures 	Medium-High	New Zealand fur seal
<ul style="list-style-type: none"> Mitigation of captures 	Medium-High	Common dolphins
<ul style="list-style-type: none"> Mitigation of dolphin captures in the set net fishery 	Medium-High	Common dolphins, Hector's dolphin, dusky dolphins
<ul style="list-style-type: none"> SLED efficacy (being undertaken by MPI) 	Medium-High	New Zealand sea lion***
Population monitoring Project ideas include:	Medium-High	All species (prioritising those at greatest risk from fishing)
<ul style="list-style-type: none"> Abundance estimate (every five years) 	High	Hector's & Māui dolphins**
<ul style="list-style-type: none"> Pup count (Auckland Is/Mainland annually, Campbell Island TBD) 	High	New Zealand sea lion***
Population size and structure Project ideas include:	Medium-High	All species (prioritising those at greatest risk from fishing)
<ul style="list-style-type: none"> Determination of population size and structure (including age demographics) 	Medium	Hector's & Māui dolphins**
<ul style="list-style-type: none"> Bounty Islands population assessment 	Medium	New Zealand fur seal
<ul style="list-style-type: none"> Cook Strait population assessment 	Medium	New Zealand fur seal
Tracking/distribution studies Project ideas include:	Medium	All species (prioritising those at greatest risk from fishing)
<ul style="list-style-type: none"> Quantifying species distribution 	Low-Medium	All species (prioritising those at greatest risk from fishing)
<ul style="list-style-type: none"> Quantifying species distribution (i.e. extent of Maui dolphins in harbours, and research on foraging and diving behaviour) 	Medium-High	Hector's & Māui dolphins**
<ul style="list-style-type: none"> Analysis of existing tracking data to quantify fisheries overlap 	Low-Medium	New Zealand sea lion***
Post release survival of marine mammals in fisheries (prioritising fisheries that pose highest risk)	Low-Medium	All species (prioritising those at greatest risk from fishing)

*Note: Priority level has been assigned qualitatively by DOC 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.

** Action from the Hector's & Māui dolphin Threat Management Plan; to be reviewed in 2018-19 as part of the review of the Hector's & Māui dolphin Threat Management Plan

*** Action from the New Zealand sea lion Threat Management Plan