

CSP Initial research proposals 2019/20

CSP RAG 8 March 2019

Purpose

These initial project proposals have been developed to deliver outputs to address research gaps identified by the Conservation Services Programme (CSP) Research Advisory Group (RAG). These gaps have been identified through the development of medium-term research plans, or at previous meetings of the RAG. It is intended that these initial proposals, and any other proposals identified by the RAG, will be prioritised at the CSP RAG meeting of 8 March 2019. The prioritised proposals will be used to develop the CSP Annual Plan 2019/20.

These initial research proposals should be considered in light of the following key documents:

- [CSP Strategic Statement 2018](#)
- [CSP Seabird medium term research plan 2017](#)
- [CSP Protected fish medium term research plan 2018](#)
- [Draft Marine Mammal medium term research plan 2018](#)
- [CSP Annual Plan 2018/19](#)

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Interaction Projects

Ongoing projects

INT2017-03 Identification of marine mammals, turtles and protected fish captured in New Zealand fisheries

This multi-year project was consulted on in 2017/18 and is due for completion in June 2020. It is proposed to form part of the CSP Annual Plan 2019/20.

Full details are provided in the CSP Annual Plan 2017/18.

INT2018-02 Trialling innovative Electronic monitoring (EM) systems for small vessels

This multi-year project was consulted on in 2018/19 and is due for completion in June 2020. It is proposed to form part of the CSP Annual Plan 2019/20.

Full details are provided in the CSP Annual Plan 2018/19.

INT2018-03 Development of observer photograph protocols and curation

This multi-year project was consulted on in 2018/19 and is due for completion in June 2020. It is proposed to form part of the CSP Annual Plan 2019/20.

Full details are provided in the CSP Annual Plan 2018/19.

Proposed projects

INT-1 Observing commercial fisheries

Term: 1 year.

Guiding Objectives: CSP Objectives A, B, C; National Plan of Action – Seabirds, National Plan of Action – Sharks; New Zealand sea lion and Hector’s and Māui dolphin Threat Management Plans.

Project Objective: To understand the nature and extent of protected species interactions with New Zealand commercial fishing activities.

Understanding the nature and extent of interactions between commercial fisheries and protected species can identify where the most significant interactions are occurring and can be used to inform development of ways to mitigate those interactions and adverse effects. Such data contribute to assessments of the risks posed to protected species by commercial fishing and whether mitigation strategies employed by fishing fleets are effective at reducing protected species captures.

The CSP Observer Programme will continue to purchase baseline services for “offshore” fisheries from Fisheries New Zealand I Observer Services, given the scale of their operation, which allows observers to be placed strategically across New Zealand Fisheries. Inshore fisheries observer coverage will also be delivered by Fisheries New Zealand Observer Services, per a joint planning process.

Planning of observer coverage is undertaken jointly by Fisheries New Zealand and DOC as part of a separate process and will be consulted on as part of the consultation on the CSP Annual Plan 2019/20.

INT-2 Identification of seabirds captured in New Zealand Fisheries

Term: 3 years.

Guiding Objective: CSP objectives B, C, and E; CSP Seabird Plan; National Plan of Action Seabirds.

Project Objective: To determine, through examination of photographs, returned seabird specimens, and DNA analysis, the taxon (including sub-species or variants where applicable), sex, and where possible age-class and provenance of seabirds killed in New Zealand fisheries.

Birds with significant differences in conservation status can appear morphologically similar. The accurate determination of the taxon of seabirds captured in New Zealand fisheries is vital for examining the potential threat to population viability posed by incidental fisheries captures. Observers on commercial vessels are not always able to identify seabirds at sea with high precision and the assessment of the subspecies, age-class, sex and provenance of captured individuals requires autopsy and/or genetic analysis in the majority of cases.

Examining the causes of mortality and types of injuries incurred by individual seabirds returned from fisheries is necessary to help reduce future seabird captures in New Zealand fisheries by identifying gear risks. Linking this information to species (including sub-species or variants where applicable), age- and sex-class, and breeding status, helps identify if different groups of seabirds are vulnerable to different risks in fishing interactions.

Information gained through this project will link to Fisheries New Zealand databases, seabird bycatch estimates, and will inform ongoing risk assessment, research and modelling of the effects of fisheries bycatch on seabird populations. Further, the mode of capture and associated information will enable robust analyses to be made of the factors contributing to seabird capture events and inform the development of appropriate mitigation strategies.

Indicative cost: \$100,000 per annum

INT-3 Identification and storage of cold-water coral bycatch specimens

Term: 3 years.

Guiding Objectives: CSP Objectives B, C, and E.

Project Objectives:

1. Identify coral bycatch that cannot be identified by Government fisheries observers to the finest taxonomic level (assign codes to coral specimens to the species level wherever possible, when this is not possible; identify specimens to genus or family level).
2. Record all identified coral specimens and ensure storage in an appropriate taxonomic collection.

The 2010 amendment of Schedule 7A of the Wildlife Act 1953 protects all hard corals, including: black corals (all species in the order Antipatharia); gorgonian corals (all species in the order Alcyonacea (previously known as Order Gorgonacea)); stony corals (all species in the order Scleractinia); and hydrocorals (all species in the family Stylasteridae). Identifying coral bycatch that is unable to be identified by Government fisheries observers to the finest taxonomic level provides vital baseline information that can help to better inform research and marine protection such as predictive modelling, benthic risk assessments and management of benthic marine protected species.

Indicative cost: \$40,000 per annum

INT-4 Characterisation of marine mammal interactions

Term: 1 year.

Guiding Objectives: CSP Objectives A and B; New Zealand sea lion and Hector's and Māui dolphin Threat Management Plans.

Project Objectives:

1. To characterise the nature of marine mammal captures in New Zealand fisheries.
2. To identify and assess the current mitigation techniques for marine mammal capture domestically and internationally and make recommendations as to their applicability in the New Zealand market.

Marine mammals are bycaught throughout New Zealand fisheries. The methods of interactions vary between fisheries and the species involved.

The draft marine mammal risk assessment included 35 species of marine mammals that are determined to inhabit New Zealand waters. Six of these species are classified under the New Zealand Threat Classification System as Migrant, nine as Not Threatened, three as Nationally Endangered and five as Nationally Critical, with the remaining 12 species classified as Data Deficient as not enough information exists to properly determine their threat status.

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 of being bycaught. Due to the relative paucity of data for marine mammals in New Zealand, particularly relating to their population structure and the nature of interactions with commercial fishing, one of the proposed research priorities is the development of method and species-specific mitigation options for each protected marine mammal species known to interact with commercial fisheries.

This project will aim to characterise the nature of marine mammal captures in New Zealand fisheries. In addition, the project will identify and assess the current mitigation techniques for marine mammal captures, both domestically and internationally, and make recommendations as to their applicability in New Zealand fisheries. This work will aim to feed into the work being done through the International Whaling Commission's Bycatch Mitigation Initiative. While this work has been conducted for specific fisheries, including project MIT2012-03, there's a need for holistic analyses of the overall nature of interactions.

Indicative cost: \$25,000

INT-5 Coral biodiversity in deepwater fisheries bycatch

This proposal was submitted by Jaret Bilewicz, NIWA.

Term: 1 year.

Guiding Objective: CSP Objective E.

Project Objective: To use DNA sequencing of Observer-sampled octocoral specimens to genetically quantify the species-level diversity contained within deepwater fisheries bycatch, to improve understanding of fishery impacts

The diversity and relationship of protected octocoral species impacted by deepwater fisheries is not currently understood since morphological identification by observers and taxonomic experts often only places specimens within higher taxonomic rankings (e.g., to family- or genus-level), and relies on comparisons to existing species descriptions. This research would use genetic barcoding to establish how many distinct and potentially new/cryptic species are present among recent Observer collections deposited within the NIWA Invertebrate Collection (NIC), and their relationships to NIC reference material.

Under the DOC Coral Identification Project, coral tissue samples have been taken from Observer-collected bycatch specimens for genetic identification. The NIC holds at least 169 coral tissue samples, of which 74 are octocorals. Only 14 of these octocorals are assigned a species name. This project will use DNA sequence

data to infer the identity of the 74 octocoral specimens and their relatedness to similar NIC reference specimens, plus related species for which sequence data is available. The samples were collected following specific protocols for genetic study and thus should be amenable to DNA sequencing of two barcode genes that are capable of distinguishing species (*mtMutS* and 28S rDNA). Including reference material, 100 samples will be sequenced in total.

Indicative cost: \$22,000

INT-6 Characterising net captures of seabirds in deepwater trawl fleet

This proposal was submitted by Janice Molloy, SSST.

Term: 1 year.

Guiding Objectives: CSP objectives B and C; CSP Seabird Plan; National Plan of Action Seabirds.

Project Objective: To assess the value of using video camera(s) to help observers view net captures of seabirds from the bridge.

In earlier years, observers were allowed greater access to the deck area when nets were shot away and hauled on board. An increased safety focus means nowadays they mainly observe from the bridge during this period which can limit the view of the net. While observers can use binoculars to see seabird behaviour, the stern ramp obstructs the view of the net close to the vessel. A significant number of seabirds are brought on board alive, so they may be becoming caught out of the observers' sight close to the stern (unless riding the net up). Cameras mounted to view the net near the stern of the vessel may provide observers with a better view, and enable us to better understand how, where and when seabirds are getting caught.

This project looks to trial the placement of cameras to identify the best location to view the net and would provide either a live feed to observers or footage that can be viewed at a later date.

Indicative cost: \$80,000

INT-7 Estimating cryptic mortality rates of warp strikes

Term: 1 year.

Guiding Objectives: CSP Objective A, B, and C; National Plan of Action – Seabirds.

Project Objective: To estimate the cryptic mortality of seabirds by warp strike by retaining seabird corpses until hauling.

Currently, seabird bycatch estimates are based on the number of carcasses that are subsequently hauled aboard. Whilst multipliers have been developed to account for cryptic mortality in seabird bycatch risk assessment, the proportion of birds that are killed following warp strikes is poorly known as bodies are not recovered during hauling. Research into the nature of cryptic mortality is vital to better understand the relationship between heavy contacts of seabirds with trawl warps and mortality.

This project will aim to create and trial the use of a warp attachment device to investigate whether it would increase the probability that seabirds killed on trawl warps will be retained until hauling. A 'corpse catcher' device, has previously been trialled successfully on vessels in the waters of Falkland Islands (G. Parker *et al.* 2013). Given the limited observer coverage on inshore trawl vessels in NZ, the trialling of this device is a further development on warp strike interactions recommended in INT2013-05.

indicative cost: \$100,000

INT-8 Post-release survival of seabirds

Term: 1 year.

Guiding Objectives: CSP Objective B, C, and E; National Plan of Action – Seabirds.

Project Objective: To investigate tracking/tagging options for assessing the post-release survival of seabirds that interact with commercial fisheries in New Zealand

Currently, the fate of seabirds post-interaction are unknown beyond life state at release. With a high proportion of seabird interactions resulting in injuries, there is a limited likelihood of long-term survival. With reporting based on the immediate life status at release, the true mortality rate due to commercial fishing interactions is under-estimated. There is a need to reduce uncertainty around the fate of seabirds post-release across species and interaction types.

This project is a desktop study that aims to investigate the tagging or tracking options available to undertake a more comprehensive research project on seabird survival. This study will assess similar research conducted, both nationally and internationally, to ascertain a fit-for-purpose method/s for measuring seabird survival post-release. Options need to be assessed based on set criteria such as longevity, visibility, cost-effectiveness and impact to the animal. This study will also provide recommendations on the methodology and effective time-period for the subsequent research project.

Indicative cost: \$10,000

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Population Projects

Ongoing Projects

POP2017-04 Seabird population research: Auckland Islands 2017-20

This multi-year project was consulted on in 2017/18 and is due for completion in June 2020. It is proposed to form part of the CSP Annual Plan 2019/20.

Full details are provided in the CSP Annual Plan 2017/18.

POP2018-01 Improved habitat suitability modelling for protected corals in New Zealand waters

This multi-year project was consulted on in 2018/19 and is due for completion in June 2020. It is proposed to form part of the CSP Annual Plan 2019/20.

Full details are provided in the CSP Annual Plan 2018/19.

POP2018-02 Hoiho population and tracking project

This multi-year project was consulted on in 2018/19 and is due for completion in June 2020. It is proposed to form part of the CSP Annual Plan 2019/20.

Full details are provided in the CSP Annual Plan 2018/19.

POP2018-03 New Zealand sea lion: Auckland Islands pup count

This multi-year project was consulted on in 2018/19 and is due for completion in June 2022. It is proposed to form part of the CSP Annual Plan 2019/20.

Full details are provided in the CSP Annual Plan 2018/19.

POP2018-04 Flesh-footed shearwater: Population Monitoring

This multi-year project was consulted on in 2018/19 and is due for completion in June 2021. It is proposed to form part of the CSP Annual Plan 2019/20.

Full details are provided in the CSP Annual Plan 2018/19.

Proposed Projects

POP-1 Southern Buller's albatross: Snares/Tini Heke population project

Term: 3 year.

Guiding Objectives: CSP Objective E; CSP seabird plan 2017; National Plan of Action – Seabirds.

Project Objective: To estimate key demographic parameters of Southern Buller's albatross at the Snares.

An established study site for Southern Buller's albatross, with substantial historic mark-resight effort, exists at the Snares (Sagar 2014), one of the most accessible subantarctic island groups. This project will continue standard mark-recapture monitoring to further improve estimates of key demographic parameters, particularly adult survival which was noted as declining in the most recent data assessment by Sagar et al (2017). Breeding success will also be quantified through the deployment of trail cameras.

Indicative cost: \$60,000 per annum

POP-2 Antipodes Island seabirds research

Term: 1 year.

Guiding Objectives: CSP Objective E; CSP seabird plan 2017; National Plan of Action – Seabirds.

Project Objectives:

1. To estimate the population size of Northern giant petrel
2. To estimate the population size of White-chinned petrels

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. This proposal delivers priority research components of the CSP seabird plan 2017 involving field work at Antipodes Island. The proposal has been developed to maximise cost and logistical efficiencies between components. Research on Antipodean albatross is planned in 2018/19 outside of CSP, and will provide further cost and logistical efficiencies if progressed. Supporting rationale for all the components is summarised in the CSP seabird plan 2017. Methods will be developed and tailored to each species and site, and maximise comparability to previous estimates where they exist.

Indicative cost: \$80,000

POP-3 Campbell Island seabird research

Term: 1 year.

Guiding Objectives: CSP Objective E; CSP Seabird plan 2017; National Plan of Action – Seabirds.

Project Objectives:

1. To estimate the population size of Campbell Island and grey-headed albatrosses.
2. To estimate the population size of Northern giant petrels at Campbell Island.

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. This proposal delivers priority research components of the CSP seabird plan 2017 involving field work at Campbell Island. The proposal has been developed to maximise cost and logistical efficiencies between components. If research on New Zealand sea lions is undertaken at Campbell Island in 2019/20 further cost and logistical efficiencies will be possible. Supporting rationale for all the components is summarised in the CSP seabird plan 2017. It is envisaged that a variety of methods will be used, including photo-point counts (consistent with previous surveys of Campbell Island albatross) and ground-based counts, and possibly drone photo counts. Methods will be developed and tailored to each species and site.

Indicative cost: \$50,000

POP-4 New Zealand fur seal: Cook Strait habitat use assessment

Term: 1 year.

Guiding Objective: CSP Objective E.

Project Objectives:

1. To characterise and map fur seal breeding and haul out sites in the bottom of the North Island and top of the South Island.
2. To characterise fur seal habitat usage in the Cook Strait region.

3. To determine which fur seal colonies overlap with the Cook Strait hoki fishery.

New Zealand fur seals are bycaught throughout New Zealand fisheries. Fisheries such as West coast and Cook Strait hoki, and southern blue whiting are known to have high observed bycatch rates. While, over time, bycatch rates appear to have decreased in the West Coast hoki fishery; in the Cook Strait there has been more limited observer coverage and relatively high observed bycatch rates of fur seals for some years. There remains a high degree of uncertainty about the impact of this fishery on the New Zealand fur seal population, including which colonies are most at risk. The colonies most likely to be impacted are at the top of the South Island, and bottom of the North Island; little is known about the health of fur seal colonies in these regions. It is proposed to reduce uncertainty around the affected population in a staged manner.

This project will aim to characterise the New Zealand fur seal interactions observed in the hoki fishery in the Cook Strait region and identify key fur seal colonies. This will be done by analysing all bycatch records of fur seals from the area, and pull out records of tagged animals. The tagged animals will be matched to the New Zealand fur seal database to identify key colonies. Included in this project will be the updating of the New Zealand fur seal tagging database, which will include an update of the database interface and the upload of tagging data from recent years.

Indicative cost: \$20,000

POP-5 Spotted shag population review

Term: 1 year.

Guiding Objectives: CSP Objective E; CSP seabird plan 2017; National Plan of Action – Seabirds.

Project Objectives:

1. To review the taxonomic status of spotted shags in New Zealand
2. To review historic and recent population data on spotted shags breeding in northern New Zealand and make recommendations for any future field work required to improve the certainty of current population estimates

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. This proposal delivers priority research components of the CSP seabird plan 2017 involving spotted shags. Supporting rationale for all the components is summarised in the CSP seabird plan 2017. It is intended that the taxonomic review will be progressed as a collaborative project with a University or other research institute, and may involve genetic analyses. Objective 2 will be a desk-based exercise, drawing on all available data, and may inform a future field-based project on the northern populations.

Indicative cost: \$20,000

POP-6 The relative abundance and distribution of data-deficient Odontocete species in the Cook Strait region from passive acoustic data

This proposal was submitted by Dr Giacomo Giorli, NIWA. The proposal was submitted as four separate projects: 1) Hector dolphin, 2) Beaked whales, 3) “blackfishes” (i.e. long-finned pilot whales, short-finned pilot whales, killer whales, and false killer whales) and 4) sperm whales. For the scope of CSP, the projects have been combined into one proposal, and the estimated price combined. However, the scope and

objectives of the project can be discussed during the CSP RAG. In addition, the sperm whale project, was not included as the species is not known to be impacted by fisheries.

Term: 1 year.

Guiding Objectives: CSP Objective E; Hector's and Māui dolphin Threat Management Plan.

Project Objectives:

1. To estimate the seasonal/spatial occurrence and relative abundance of selected odontocetes, including species that were identified as data deficient by MPI's multi-species spatial marine mammal risk assessment.
2. To investigate the foraging behaviour and foraging strategies of odontocete species. This will provide information on the feeding habitats.

Knowing the feeding behaviour will help in developing strategies to minimise by-catch of species that approach the fishing vessel to exploit the fish trapped by nets. It can also help in regulating time of fishing activities according to the foraging behaviour of the marine mammals in an area.

Passive acoustic monitoring (PAM) of underwater ecosystems is an effective and relatively cheap means for the monitoring of the underwater soundscapes. Since odontocetes use echolocation signals to hunt prey, PAM detections can be used to describe the relative abundance of odontocete species, their seasonal distribution and aspects of their foraging behaviour (Au et al., 2014; Giorli, Neuheimer, Copeland, & Au, 2016; Küsel et al., 2011; Marques et al., 2013).

Between June 2016 and August 2017, NIWA collected one year of continuous passive acoustic data in the Cook Strait region at each of seven locations (Figure 1). One recording station (situated in Queen Charlotte sound, stn1 in Figure 1) was operative between July and December 2016. These locations were chosen to study the occurrence of marine mammals and anthropogenic noise around the Cook Strait region. Cook strait is a key area for fishing and aquaculture. In addition, a growing interest in mineral extraction in this region has raised questions about the effect of noise generated by human activities on cetaceans living in this region.

It is proposed to use this unique dataset to study the distribution, relative abundance and foraging behaviour of odontocete species that are either at risk of mortality due to bycatch in fishing operations, or data deficient in term of distributions and relative abundance, precluding the robust risk assessment of human threats, which typically vary in space and time.

Indicative cost: \$155,000

POP-7 Leopard seal: New Zealand distribution and occurrence assessment

This proposal was submitted by Dr. Krista Hupman, NIWA.

Term: 2 year.

Guiding Objective: CSP Objective E.

Project Objectives:

1. To characterise and map leopard seal distribution and occurrence in New Zealand waters
2. To determine which areas of leopard seal occurrence overlaps with New Zealand fisheries

Risk assessments are increasingly being used to identify and evaluate potential impacts of fishing-related mortalities, while also accounting for uncertainty. In New Zealand (NZ) waters, a spatial risk assessment framework has been developed to assess the impact of fisheries bycatch on marine mammal populations.

This framework estimates the risk of annual potential fatalities (APF) on the sustainability of different populations (referred to as population sustainability threshold; PST). The risk assessment also outlines species which are data deficient, and highlights important gaps in knowledge that require additional research to be conducted.

The only NZ pinniped not included in this assessment is the leopard seal (*Hydrurga leptonyx*). Between the fishing years 1995-96 and 2004-15, there were three observed captures in NZ's exclusive economic zone (southern blue whiting trawl n=1; unknown trawls n=2). As such, exclusion of leopard seals from risk assessments leaves a high degree of uncertainty about the impact of NZ fisheries on their populations within NZ waters, including which areas of their occurrence are most at risk. To illustrate; the population size of leopard seals is currently unknown but is anecdotally considered to be extremely small (fewer than 100 at any given time), and three observed captures have occurred. This suggests that the risks to leopard seals may be at a much higher level than currently indicated.

Additionally, no formal framework is provided to consider the effects of the "data deficient" status of this species. Leopard seals may have been overlooked due to the lack of published studies on the occurrence, distribution or breeding population size in NZ. As such the species is classified as a rare vagrant to New Zealand waters.

However, the recent establishment of the New Zealand Leopard Seal Database (NZLSD) by LeopardSeals.org has shown that leopard seals are a regular member of New Zealand's marine fauna. They occur year-round, show long-term residency (up to five years), and have been documented giving birth within NZ waters (Hupman et al. in prep.; Hupman and Visser in prep.). LeopardSeals.org has collated over 1,750 sightings, there has been no assessment of their distribution or occurrence within NZ. Consequently, there has been no examination of where fisheries have significant overlap with leopard seal populations. Furthermore, while a photo-identification catalogue of individuals within NZ has been established, it has not been examined to determine the minimum number of breeding age females which occur in NZ waters. This is despite evidence of their potential vulnerability to fisheries bycatch (as is evidenced by the number of bycaught pinnipeds in NZ) and other non-fisheries related threats. To assess the risk of commercial fisheries to leopard seals in NZ, this project will use the NZLSD to better understand the distribution and occurrence of leopard seals in NZ waters.

This project proposes to reduce uncertainty around the potentially affected population in a staged manner. Year one will involve a characterisation and mapping exercise, using data from the NZLSD to examine the distribution and occurrence of leopard seals in NZ waters in relation to fisheries. Based on this characterization, in the second year, key areas will be selected for a satellite tagging study to determine the foraging range of leopard seals and combined with fine scale fisheries data to describe the extent of spatial and temporal overlap between leopard seals and New Zealand fisheries.

Indicative cost: \$75,000 per annum

POP-8 Protected coral reproduction study

This proposal was submitted by Di Tracey, NIWA.

Term: 1 year.

Guiding Objective: CSP Objective E.

Project Objective: To determine the reproductive strategies of key protected corals in the New Zealand region.

In order to support a long-term plan to manage and conserve populations of protected corals in the New Zealand region, an understanding of reproductive strategies for a range of key coral taxa is required.

The ecological risk assessment for protected corals (Clark et al. 2014), considered various sources of information and data available for the age, growth, reproduction, colonisation, and dispersal of corals. This information was used to rank the “productivity” of a coral species or group, which reflects its ability to recover from trawling impacts. However, such information was scarce, and unlike their shallower counterparts, the reproductive strategies employed by deep-sea corals are generally poorly documented.

A lack of such information for corals of the region was also highlighted in the report from the recent CSP Protected Coral Workshop held in October 2017 and are also highlighted in the ‘State of Knowledge of Corals Report’ (Tracey & Hjørvarsdóttir, in prep).

This proposal will address the knowledge gap of coral reproductive strategies for key coral taxa for the region by:

1. Summarising the literature on deep-sea coral reproduction studies published after the review by Consalvey et al. (2010) and the State of Knowledge Report (Tracey & Hjørvarsdóttir in prep).
2. Selecting which of the key protected coral groups will be a focus of the study.
3. Designing an at-sea observer sampling protocol for obtaining and maintaining live polyps of key coral taxa for laboratory studies
4. Examining preserved coral specimens held in the NIWA Invertebrate Collection to assess what amount of reproductive information can be obtained from stored samples to supplement the at-sea collection programme.
5. Carrying out histological analyses of coral polyp samples to analyse mesenteries dissected from gonad tissue to ascertain mode, fecundity and periodicity of spawning. Eggs state may be the most appropriate information to be described.
6. Preparing a report on reproductive strategies for the corals examined.

Indicative cost: \$100,000

POP-9 Investigation of electronic device options to assess distribution, diving and foraging behaviour of Hector’s dolphins

This proposal was submitted by Tom Clark (FINZ).

Term: 1 year.

Guiding Objective: CSP Objective E.

Project Objective: To determine currently available electronic devices that would be suitable for assessing the distribution, diving and foraging behaviour of Hector’s dolphins

There is a need to reduce uncertainty around the spatial use of the ocean by Hector’s and Māui dolphins, this has the potential to assist in actions to reduce the chance of interaction with commercial fisheries.

This project is a desktop study that aims to investigate the tagging or tracking options available to undertake a more comprehensive research project on Hector’s dolphins. This study will assess similar research conducted, both nationally and internationally, to ascertain a fit-for-purpose method/s for measuring spatial use in small marine mammals. Options need to be assessed based on set criteria such as longevity, cost-effectiveness and impact to the animal. This study will also provide recommendations on the methodology and effective time-period for the subsequent research project.

Indicative cost: \$20,000

POP-10 Māui dolphin hybridisation

This proposal was submitted by Tom Clark (FINZ).

This proposal will not be taken forward into the CSP prioritisation process for this year as it does not sufficiently relate to CSP research objectives and is likely best prioritised through the Māui dolphin Research Advisory Group.

POP-11 Māui, Hector's dolphins and NZ sea lion prey availability in coastal and subantarctic waters- impacts of climatic and oceanic effects

This proposal was submitted by Tom Clark (FINZ).

This proposal will not be taken forward into the CSP prioritisation process for this year as it does not sufficiently relate to CSP research objectives and work on this subject is likely best prioritised through the relevant Threat Management Plans and Research Advisory and Marine Climate Change Groups.

POP-12 NZ sea lion diet and foraging behaviour

This proposal was submitted by Tom Clark (FINZ).

This proposal will not be taken forward into the CSP prioritisation process for this year as components of the project (i.e. Stewart Island and Auckland Islands regions) have already been undertaken through other means (i.e. Threat Management Plan research, DOC/MPI/FNZ contracts, etc). Further work on NZ sea lion diet and foraging behaviour is suggested for Campbell Island but planning is to be prioritised through the Threat Management Plan's Research Advisory Group process.

POP-13 NZ fur seal: Bounty Islands population assessment

Term: 1 year.

Guiding Objective: CSP Objective E.

Project Objectives:

1. To determine the population trend of fur seals at the Bounty Islands, to the extent possible using existing data.
2. To recommend future data collection protocols to better estimate the population size and trend of fur seals at the Bounty Islands.

New Zealand fur seals are captured in the southern blue whiting trawl fishery around the Bounty Islands at one of the highest rates of any trawl fishery, however, information on their population level and trend at this site is poor. Data on fur seals has been collected during a number of surveys of other species at the Islands, notably Salvin's albatross. This data exists as on ground observations and aerial photographs and may be informative in assessing population trends. This project will assess existing information to determine its suitability for estimating the population trend of fur seals and make recommendations on future data collection that may allow a better assessment of fur seal population level and trend. In particular, these recommendations will seek to collect data in association with other potential future monitoring (such as for Salvin's albatross) to maximise cost efficiencies.

Indicative cost: \$20,000

POP-14 Fish shoal dynamics in North-eastern New Zealand

Term: 3 year.

Guiding Objective: CSP Objective D.

Project Objectives:

1. Continue collecting zooplankton and fish samples from surface fish shoals to compare with the samples collected in 2017-19 to gain a better understanding of annual, seasonal, and spatial variation in samples, in relation to different species of shoaling fish
2. Utilise the purse seine fishery spotter plane database to explore fish work up relationships with bathymetric and oceanographic features, temporal changes in fish stocks and contrasting environmental conditions.

North-eastern North Island waters, from the Three Kings Islands to East Cape, are notable for large numbers of seabirds gathering and feeding in association with concentrations of zooplankton and fish, variously known as a 'fish shoals', 'work ups', 'boil ups', 'bust ups', or 'bait balls'. While the mega marine fauna feeding activity has been described to varying degrees, the zooplankton and fish responsible for these events and the dynamics which drives them is poorly understood in New Zealand. This project extends upon past projects (INT2016-04 and POP2017-06) which highlighted how little is known about fish shoaling activity. There is the need to understand the processes that determine different fish shoaling activity. This project aims to assess the content of zooplankton in fish shoals utilising a combination of zooplankton nets and underwater video to identify key species involved in triggering fish shoaling. The presence of these organisms will then be related to observations of other marine fauna, numbers and feeding behaviours. These data will be examined in relation to inter-annual, seasonal and spatial parameters.

The purse seine fishery spotter database (aer_sight) contains records of search effort and sightings of pelagic schooling species (mainly skipjack tuna, kahawai, blue mackerel, jack mackerel and trevally) dating from June 1960 to the present day. This project will update the aer_sight database with data since 2013 (recorded separately) and explore fish shoaling relationships with bathymetric (reefs, channels, shelf edges) and topographical (islands, island groups and headlands) features, oceanographic features (currents), temporal changes (annual, seasonal) and environmental conditions such as ENSO events.

Indicative cost: \$50,000 per annum

POP-15 North-eastern New Zealand seabird tracking and dietary analyses

Term: 2 year.

Guiding Objective: CSP Objective D.

Project Objectives:

1. GPS tracking of four seabird species (Buller's shearwaters, fluttering shearwaters, fairy prions and Australasian gannets)
2. Ongoing collection of faecal and regurgitation samples from six seabird species (Buller's shearwaters, fluttering shearwaters, fairy prions, Australasian gannets, white-fronted tern and red-billed gull)

This project aims to further investigate dependence on feeding in association with surface fish shoals during different stages of the breeding cycle. These are four of the species covered in the current POP2017-06 contract (i.e. the other two species - red-billed gulls and white-fronted terns - would not be included in the tracking study). Tracking would utilise study sites on Tawhiti Rahi (Poor Knights), Lady Alice Island, Burgess Island, Mahuki, and Motukaramarama (Motukawao Islands) and Korapuki (Mercury Islands).

Dietary analyses build on work undertaken in POP2017-06. This work proposes to collect samples from all six species over two further seasons to complement the tracking component of this study and the fish shoal dynamics project.

Indicative cost: \$80,000 per annum

POP-16 Blood feather samples from flesh samples from flesh footed shearwaters to investigate ecophysiology, nutrition and foraging ecology variables

This proposal was submitted by Chris Gaskin (Northern NZ Seabird Trust). It will be addressed in the current CSP flesh footed shearwater project POP2018-04.

POP-17 Black petrel population project

Term: 3 years.

Guiding Objectives: CSP Objective E; CSP seabird plan 2017; National Plan of Action – Seabirds.

Project Objectives:

1. To estimate juvenile recruitment of black petrel at Great Barrier Island.
2. To estimate the population size at Great Barrier and Little Barrier Islands
3. To estimate other key demographic parameters of black petrel at Great Barrier Island.
4. To describe the foraging range of poorly known ages classes of black petrel at Great Barrier Island.

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. This proposal delivers priority research components of the CSP seabird plan 2017 involving field work on black petrel. Black petrels are the seabird identified as at highest risk from commercial fisheries bycatch in New Zealand.

The primary focus of the research will be to better estimate juvenile recruitment. This has been the parameter causing greatest uncertainty in population modelling. The first milestone for this project is proposed to be a technical workshop to develop appropriate and achievable methods to investigate this parameter. Continuation of established mark-recapture methods to estimate parameters such as adult survival, and additional distributional research are also proposed. During 2018/19, under contract to Fisheries New Zealand, new methods are being applied to better estimate the total population size at Great Barrier Island. Further work to apply these methods across all habitat types is proposed.

Indicative cost: \$120,000 per annum

POP-18 Understanding potential interactions and indirect effects between commercial fisheries and NZ king shag foraging activity, diets and population trends

Term: 1 year.

Guiding Objectives: CSP objectives D; CSP Seabird Plan; National Plan of Action Seabirds.

Project Objectives:

1. To examine the potential indirect effects of commercial fisheries on New Zealand King shags by reviewing past and present fisheries commercial harvests in the Marlborough Sounds region
2. Assess the diet of king shags to determine potential overlap with commercial fisheries
3. Assess the foraging activity of king shags to determine potential overlap with commercial fisheries

The New Zealand king shag is a rare endemic shag species confined to a small number of breeding colonies only found in central New Zealand in the outer Marlborough Sounds. Recent surveys have found that the world population had declined from 830 birds in 2015 to 630 birds in 2018, a 24% decline over three years. Winter census flights of all breeding colonies organised by DOC from 2015 to 2018 indicates that the total breeding population is just 150-200 pairs. The two largest colonies are on Duffers Reef in Pelorus Sound and the Trio Islands in Cook Strait.

Recent marine farming consents have required the industry to take account of potential impacts of marine farming on king shag populations. A requirement of the King Salmon marine farming consent was to produce a king shag management plan and conduct a three-yearly census of king shags starting in 2015. If numbers decreased by more than 5% than annual monitoring was required. The 25% drop in numbers between 2015 and 2018 now requires that annual census flights will be undertaken each year in February prior to shag breeding in autumn/winter. The summer population census and winter breeding counts have revealed that king shag populations breeding within the Sounds (closer to the marine farms) are doing better than the colonies in Cook Strait such as the Trios, and Sentinel Rock where birds have not attempted to breed in recent years. This result was unexpected as marine farming was thought to be reducing the available foraging habitat for this species and colonies further offshore would be doing better. There is now a concern that other factors may be reducing the population of this species. These include changes in the water quality (sedimentation), sea temperature rises with climate change, increasing storm frequency events and potential changes in preferred forage species. The extent to which king shags might be affected by commercial fishing activities is unknown but there may be indirect effects on food availability.

King shags diets are not well known but the birds have been recorded eating witch flounder as a dominant species at some sites, but also a variety of other benthic prey at other breeding sites (e.g. sole, opalfish, triplefins, blue cod, red cod and red scorpionfish). There is a concern that commercial harvests of some of these fish species (either through changes in their stock numbers or changes to the benthic habitat by different capture methods) may be reducing the prey availability to king shags, especially in the more open water areas of Cook Strait. King shags are a diving species that need to locate their food on the sea floor and therefore are spatially limited by regional bathymetric parameters (they are expected to dive to about 50m but their capability is untested) as well as seabed habitat type and quality. The shags already face some competition for foraging space with marine farms placed in the shallower inshore bays plus any effects of outflow sedimentation from land uses such as farming and forestry (which can restrict diving efficiency through reduced underwater visibility).

A study is needed to determine if competition with commercial fisheries is a factor in recent declines in the population. A desktop review is needed of the nature and extent of commercial fishing activities in the outer Marlborough Sounds (both spatially and temporally across different fish stocks). Then a comparative study with the king shags assessing their diet at a sample of breeding colonies by collection of regurgitated pellets (which includes mucus for DNA analysis of species and an assessment of indigestible bones to determine prey size ranges) plus collection of fresh excreta for DNA analysis of more easily digested prey species not found in pellets. A remote tracking study (using GPS tags and time-depth recorders) from an outer Sounds colony and an inner Sounds colony would allow the extent of the species foraging range to be determined and compared between sites. The study will examine daily foraging effort and activity (time spent sitting on the water and diving versus time in flight and roosting ashore, dive profiles, frequency and depths compared with the underwater bathymetry at each foraging location). This species information

would then be compared with the commercial fishing data to determine if king shag prey species, foraging zones and dive depths significantly overlap with the available fishing effort data. This will allow us to assess if commercial fishing may be a potential risk factor in the recent population declines and the shifts to more inshore breeding colonies or can be eliminated as a potential threat to king shags.

Indicative cost: \$120,000

Mitigation Projects

Ongoing projects

MIT2017-01 Protected species liaison project

This multi-year project was consulted on in 2017/18 and is due for completion in June 2020. It is proposed to form part of the CSP Annual Plan 2019/20. Full details are provided in the CSP Annual Plan 2017/18.

MIT2018-01 Protected species engagement project

This multi-year project was consulted on in 2018/19 and is due for completion in June 2020. It is proposed to form part of the CSP Annual Plan 2019/20. Full details are provided in the CSP Annual Plan 2018/19.

Proposed projects

MIT-1 Review of mitigation techniques to reduce benthic impacts of trawling

Term: 1 year.

Guiding Objectives: CSP Objective A, and E.

Project Objective: To develop practical modification for the trawl system used in the inshore trawl fleet

Trawl induced habitat modifications have been suggested to negatively affect benthic foragers that depend on an intact benthic ecosystem, such as the yellow-eyed penguin. The most common mitigation method for these effects have been closures of sensitive areas to trawling. However, in recent years studies that test modified fishing gear to reduce the effects of trawling on seafloor communities have been emerging, with several showing promising results (e.g. Rose et al. 2010). Bottom trawling uses numerous types of gear designs, sizes, rigging and operational methods. Therefore, impact on the bottom habitat will differ among the various bottom trawl fisheries, and mitigation techniques will depend on the gear used.

This desk-based study aims to review literature on mitigation techniques used to reduce benthic impacts of trawling in various bottom trawl fisheries and make recommendations that are relevant to the New Zealand trawl fisheries. This study may lead on to a project focusing on trialling modified trawl gear in the inshore fleet.

Indicative cost: \$20,000

MIT-2 Underwater bait setter for surface longline vessels

This proposal was submitted by Janice Molloy (SSST) and Oliver Wilson (FINZ).

Term: 1 year.

Guiding Objectives: CSP Objective A, and E.

Project Objective: A feasibility trial to determine the operational performance and effectiveness of the underwater bait setter as a new seabird bycatch mitigation method for use in the surface longline commercial fishery in New Zealand.

There is increasing focus on the fishing industry to minimise the environmental impacts of fishing such as impacts on benthos, protected species and fish bycatch. Furthermore, there is interest from both government and industry to develop the fishing industry in a way that both minimises its impacts on the environment whilst maximising the value of the industry.

Innovation is seen to be a key solution for the fishing industry as it faces increasing pressures, including but not limited to: operating more sustainably, reducing the negative impacts of fishing, increasing efficiencies which will increase on-board and/or harvesting and processing productivity and maintaining a social licence to operate.

The Minister of Fisheries has specified his interest in innovation and challenged the industry to further innovate. An innovative device that sets baited hooks by stealth, at depths below seabirds' diving ability has the potential to mitigate this risk and provide another valuable mitigation method for the industry to utilise.

This deliverables/outcomes for this project would be:

1. Information on whether the underwater bait setter is durable and practical for NZ surface longline vessels
2. The effect of setting baited hooks underwater by stealth on seabird ship following, at different bait release depths
3. The effect of the bait setter on seabird ship following behaviour with and without other types of mitigation.

Indicative cost: \$200,000

MIT-3 Reducing slow sinking hooks near floats in demersal longline gear

This proposal was submitted by Janice Molloy (SSST).

Term: 1 year.

Guiding Objectives: CSP Objective A, and E.

Project Objective: To optimise float buoyancy and sink rate to minimise seabird captures and achieve fishing objectives.

Hooks in close proximity to floats sink slowly during the set because the float holds the line-up. This is probably a bigger issue for demersal gear compared to surface longline gear. This is because the snoods are short on longline gear, and therefore close to the mainline. If floats hold up the mainline, they hold the baited hooks up too. With surface longlines the snoods are 10 - 30m long so baits are free to sink longer until the snood is fully extended.

Long float lines have been suggested in various CSP reports as a way to deal with this issue, but fishers are concerned about the potential of float lines tangling with the mainline during hauling. This could potentially increase the risk to seabirds on the haul because the whole hauling process could get slowed and line come to the surface.

TDRs could be used to test different sized floats and different spacings (with and without weights), as well as slightly lengthened float lines, to determine the smallest/least buoyant floats and spacings to achieve the particular fishing objective (baits off the sea floor, fishing over rough ground etc).

Trials would be required in each fleet, because of different fishing gear, and fishing objectives.

Note: components of this research are to be delivered under current and planned CSP projects.

MIT-4 Dolphin Deterrent Device Mitigation in inshore fisheries

This proposal was submitted by Tom Clark (FINZ).

This proposal will not be assessed by the CSP RAG for the 2019/20 Annual Plan as there are not currently enough captures to merit this work at this time.

MIT-5 Lighting adjustments to mitigate against vessel impacts

Term: 1 year.

Guiding Objectives: CSP Objective D.

Project Objective: To investigate if lighting adjustments (colour and strength) have the potential of reducing the occurrence of vessel impacts in the Hauraki Gulf.

Artificial light at night (ALAN) has been identified as a threat to petrel and shearwater species. It is a threat at sea with highly illuminated vessels moving near seabird breeding islands. Light attraction disproportionately impacts fledglings, who haven't yet learned to avoid it. Lights on fishing vessels can cause bird-strike of species that aren't otherwise caught as bycatch, such as diving petrels and storm petrels, which can become injured when they strike the vessel, oiled by deck equipment, and die of exposure if not found and released. Vessel lighting at night is essential for safety on both recreational and working vessels. Identifying which colours of light have the least impact on seabirds will assist in maintaining safety standards while minimising the impacts of light spill on seabirds, reducing the likelihood of them crashing on vessels.

This project would involve an analysis of observer data on vessel impacts at night and a land-based island trial in the Hauraki Gulf (potential sites being Hauturu or Mohikinau Islands) recording seabird activity by thermal imaging software. Following the outcomes of this project, recommendations may warrant a vessel-based trial.

Indicative cost: \$20,000

MIT-6 Optimum batching interval for discharge management inshore fisheries

Term: 1 year.

Guiding Objectives: CSP Objective A, and E.

Project Objective: To investigate the offside batching intervals of discharge in reducing seabird interactions around fishing vessels

Batching intervals are currently utilised as a discharge management measure across commercial fisheries, yet no data is collected on this practise e.g. time between discharge outfalls. Following recommendations from MIT2017-02, this project aims to investigate varied batching intervals with the objective of determining if an optimum batching discharge interval exists in reducing seabird activity around working

fishing vessels and seabird interactions with fishing gear or the vessel. Batching may be beneficial in disrupting the flow of attractant for seabirds to fishing vessels; therefore, reducing abundance and potential capture during haul and the subsequent set of fishing gear. The key aspects of batching discharge involve: a holding period of fish waste, offal, returned baits and swift discharge as opposed to continuous discharge (Pierre et al. 2012; Kuepfur and Pompert 2017). The timing (in relation to set/haul), location (haulside, offside), type (offal, whole fish, baits) and efficacy of batching will be investigated across the SLL, BLL and trawl fleets. The extent of batching is known for northern longline fleets, but further information is required on how common batching is in other regions also.

Indicative cost: \$20,000

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