

# CSP Initial research proposals 2021/22

CSP RAG 8 March 2021

## **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 2021. The prioritised proposals will be used to develop the CSP Annual Plan 2021/22.

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

- [CSP Strategic Statement](#)
- [DRAFT CSP Seabird medium term research plan](#)
- [DRAFT CSP Protected fish medium term research plan](#)
- [DRAFT CSP Marine mammal medium term research plan](#)
- [DRAFT CSP Protected coral medium term research plan](#)
- [CSP Annual Plan 2020/21](#)

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# Interaction Projects

## Ongoing projects

### **INT2019-02 Identification and seabirds captured in New Zealand fisheries**

This multi-year project was consulted on in 2019/20 and is due for completion in June 2022.

It is proposed to form part of the CSP Annual Plan 2021/22.

Full details are provided in the CSP Annual Plan 2019/20.

### **INT2019-04 Identification and storage of cold-water coral bycatch specimens**

This multi-year project was consulted on in 2019/20 and is due for completion in June 2022.

It is proposed to form part of the CSP Annual Plan 2021/22.

Full details are provided in the CSP Annual Plan 2019/20.

### **INT2020-02 Identification of marine mammals, turtles and protected fish captured in New Zealand fisheries**

This multi-year project was consulted on in 2020/21 and is due for completion in June 2023.

It is proposed to form part of the CSP Annual Plan 2021/22.

Full details are provided in the CSP Annual Plan 2020/21.

## Proposed projects

### **INT-1 Observing commercial fisheries**

**Term:** 1 year

**Guiding Objectives:** CSP Objectives A, B and 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 2021/22.

**Indicative cost:** TBD in consultation with FNZ

### **INT-2 Post-release survival rates of seabird bycatch in commercial fisheries**

**Term:** 1 year

**Guiding Objectives:** CSP Objectives B and C, CSP Seabird Medium Term Research plan, National Plan of Action- Seabirds.

**Project Objectives:**

- 1) To mine bycatch seabird health assessment data from existing MPI Observer Protected Species Interaction (PSI) forms and revise the Spatially Explicit Fisheries Risk Assessment (SEFRA) model estimates of seabird post-release survival.
- 2) To band and track black petrels released alive after interactions with fishing vessels/gear in FMA1 and FMA9 to better understand post-release survival rates.

The CSP Seabird medium term research plan outlines a five-year research programme to deliver on the seabird research component of CSP. It addresses relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. The current project delivers on recommendations arising from CSP INT2019-06 and aims to address knowledge gaps in post-release survival rates of high/very high risk protected seabird species after interaction with commercial fishing vessels and/or fishing gear (collectively referred to herein as bycatch). This project also builds on recommendations and feedback from an initial industry, Māori, and expert stakeholder discussion on this matter held in August 2020.

Commercial fishing provides opportunity for protected seabird species to interact with fishing vessels and fishing gear in search of food. Bycatch results in mortality or a degree of injury to seabirds. Birds which are assessed as alive are released, however, post-release survival rates are not well understood. The SEFRA model, managed by MPI, is the primary research tool currently used in fisheries management to estimate survival rates of live released seabirds, and to predict seabird population risk from bycatch. The last review was in 2017 (MPI New Zealand Fisheries Science Review 2017/2). Accurate estimation of protected species post-release mortality rates in New Zealand fisheries is critical to gaining a better understanding of bycatch impacts on changes in protected seabird populations and to accurately inform fisheries management decisions.

Currently, observers onboard commercial vessels are required to make a health-assessment of protected species bycatch and record information on the PSI forms. Observers reported around 1,100 seabird bycatch live releases between 2016-2019 (DOC/WMIL seabird ID database). It is noted that observers are not suitably trained to assess the full extent of injuries, which has likely resulted in underreporting of injuries (WMIL, 2020) and this would need to be accounted for in use of this data. This project aims to mine previously unused data from individual health status assessments recorded on PSI forms over the last five years for bycaught live released seabird species ranked as high or very high risk. The resulting dataset will then be included in the SEFRA model to compare the effect of the new data on historical post-release survival estimates and consider which at risk birds this is most meaningful for.

In addition to estimates, the project aims to use black petrels bycaught in FMA1 and FMA9 fisheries, as an exemplar species (given the large numbers of bycatch recorded as live releases on PSIs) to assess post-release survival rates. A group of uninjured, tracked petrels would be used as a control group. Data from tracked birds will then be used alongside survival estimates obtained from use of additional health assessment variables in the SEFRA model to better understand the numbers of individuals and the proportion of the black petrel population effected. Tracking data will also provide a secondary benefit in improving our understanding of habitat use for this species.

In essence, the project aim is to better understand the survival rates of live released bycatch seabirds in commercial fisheries.

**Indicative Cost:** \$50,000

### **INT-3 Review of commercial fishery interactions with New Zealand non-Chondrichthyan protected fish and marine reptiles**

**Term:** 1 year

**Guiding Objectives:** CSP Objectives A, B and C, CSP Protected Fish Medium Term Research Plan.

**Project Objective:** To update information on the commercial bycatch of **non-Chondrichthyan** protected fishes and turtles provided by Francis & Lyon (2012), Francis & Sutton (2012), Francis (2017) and Godoy (2016). Data for reported and observed catch will be groomed to remove duplicates and records incorrectly assigned protected species codes. For each species catch will be reported by year, method and FMA. The spatial distribution of captures will be mapped for each species. Where sufficient data exists interannual changes in the spatial distribution of catch, and seasonal and long-term trends in catch will be described.

**Indicative Cost:** \$20,000

### **INT-4 Collection and curation of tissue samples from protected fishes and turtles**

**Term:** 3 years

**Guiding Objectives:** CSP Objectives B, C and E, CSP Protected Fishes Medium Term Research Plan, NPOA Sharks.

**Project Objective:** To enable the ongoing collection and curation of tissue samples from these protected species, particularly great white sharks and basking sharks, by observers and fishers for genetic research (population structure and connectivity, population size) and stable isotope analyses of habitat preferences and feeding ecology. This project represents a continuation and extension of INT2018-04.

**Indicative Cost:** \$20,000 per annum

### **INT-5 Behaviour of Hector's dolphins around set nets at Kaikōura**

**Term:** 1 year

**Guiding Objective:** CSP Objective B, Marine mammal Medium Term Research Plan

**Project Objective:** To investigate and characterise the behaviour of Hector's dolphins around set nets at Kaikōura to understand the level of risk posed by this industry.

“Local areas with particularly high setnet fishery risk were identified along the Kaikōura coast, immediately north of Banks Peninsula and in the southern Canterbury Bight. These results indicate that, unless dolphins in these locations mix with neighbouring locations, these local populations would be expected to experience localised depletion to levels lower than the average”. While this research was undertaken prior to the extensions to the protected areas that came into force in 2020, there were only very small extensions to protected areas in the Kaikōura region, indicating that the results found by Roberts et al. (2020) are likely still true for the area. There is also genetic differentiation between Hector's dolphins to the north and south of Kaikōura indicating that these sub-populations should be managed separately (Hamner et al. 2016).

The underwater and acoustic behaviour of Hector's dolphins in the presence of fishing equipment has not been quantified in conjunction with the fishing industry. Autonomous hydrophone array systems attached to set nets should be used to collect information on dolphin presence and behaviour. Using purpose-built monitoring equipment, it is proposed that several individual net sets (the soak period) be monitored across different seasons over a year to establish presence, proximity, water column distribution, and acoustic

behaviour of the dolphins around the fishing equipment. Vessel based acoustic monitoring during the periods of activity – the setting and hauling, in addition to the monitoring of the soaks, is also required. Any proposal should consider at least 4 field trips of a 3-4 days each across the year.

This project aims to understand the presence of animals in the vicinity of the nets at the depth they are set, and where relative to the nets or vessel detected animals are in the water column, along with the potential for interactions during the active periods of fishing. This study would enable understanding the risk posed to animals from these fisheries and establish whether further mitigation or active monitoring is required, e.g., a precursor to “pinger” trials.

The successful tenderer would need to demonstrate previous experience in the hardware and software associated with localising high frequency marine mammal clicks from arrays, and their ability to simulate the performance of any proposed systems. System functionality would be required to be demonstrated prior to any deployments on active fishing equipment.

**Indicative cost:** Excluding costs for the vessel, estimated project costs would be 150-200k.

### **INT-6 Characterisation of protected coral interactions**

**Term:** 1 year

**Guiding Objectives:** CSP Objectives A, B and C, CSP Protected Coral Medium Term Research Plan.

**Project Objective:** To improve our understanding of the current extent and variation of protected coral bycatch across multiple fisheries and fishing methods. This will ultimately help understand the risks of fishing to protected coral groups and how those risks vary temporally and spatially and could help to focus mitigation efforts and inform development of a risk assessment.

This desktop project will examine and quantify coral bycatch from commercial fisheries by analysing observer and fisher-reported coral by area, target fishery, coral taxon, fishing method etc, and will identify areas where bycatch indicates the greatest relative fishing risk to corals. The project has a large GIS component, and will provide a snapshot into and overview of recent bycatch patterns. The project will update and build upon similar previous CSP research (e.g., INT2010-03), but will include both observer and fisher-reported data, will consider all fisheries and fishing methods for which a coral has been reported and/or collected, and will consider various reporting codes and taxonomic resolution in consideration and interpretation of the results. The quality and consistency of the available data will inform the time period and spatial extent included in analyses but would ideally be at least the past ten years (to compare with outputs of INT2010-03) and would consider bycatch from the EEZ and areas of the high seas fished by domestic trawl fleets. This project requires coral bycatch data from MPI, from both COD and fisher-reported databases. There may be benefit from examination of data derived from the digital monitoring programme.

**Indicative Cost:** \$30,000

# Population Projects

## Ongoing Projects

### **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 2021/22.

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

### **POP2019-03 Antipodes Island seabird research**

This one-year project was consulted on in 2019/20 and due to delays will be undertaken in 2021/22.

### **POP2019-04 Southern Buller's albatross: Snares/Tini Heke population project**

This multi-year project was consulted on in 2019/20 and is due for completion in June 2023.

It is proposed to form part of the CSP Annual Plan 2021/22.

Full details are provided in the CSP Annual Plan 2019/20.

### **Bio18 Antipodean albatross population monitoring, Antipodes Island**

This DOC Crown-funded project, outside of CSP, aims to continue population monitoring (mark-recapture and study plot census) and satellite tracking of birds to identify overlap with fisheries globally.

## Proposed Projects

### **POP-1 Age estimation of white sharks from New Zealand waters**

**Term:** 1 year

**Guiding Objectives:** CSP Objective E, CSP Protected Fish Medium Term Research Plan.

**Project Objective:** To provide robust age estimates for use in population assessments of New Zealand white sharks.

Few published age estimates for New Zealand white are available. Robust age and growth, and age at maturity data are required for any population assessment and are used to estimate parameters such as maximum age, natural mortality, age at 50% maturity and population growth rate. The 2018 assessment of the status of the Eastern Australian – New Zealand white shark population conducted by CSIRO also used sex-specific parameters estimated from genetic identification of half-sibling pairs. The detection of kin pairs requires knowledge of the year of sampling and age or estimated age (from length) at sampling. While the samples used in this analysis were obtained across the species' Australian – New Zealand range none of the sharks in the New Zealand sample were directly aged and there are no age-at-length data available for juvenile white sharks from New Zealand. This project will consolidate and archive white shark vertebral samples collected by New Zealand researchers and fishery observers and provide the first age and growth estimates for the species in New Zealand waters. In addition, ages of sharks used in the 2018 population estimate will be identified and the data provided to CSIRO for use in future population assessments.

**Indicative Cost:** \$50,000



## **POP-2 Understanding bycatch thresholds of great white sharks**

**Term:** 2 years

**Guiding Objectives:** CSP Objective C and E, CSP Protected Fish Medium Term Research Plan, NPOA Sharks.

**Project Objective:** To estimate the sustainable level of bycatch of great white sharks in New Zealand waters.

A considerable amount of information on the distribution, connectivity, size and demography of the New Zealand – east Australian great white population is available. This project will take this information and existing data on commercial and non-commercial catches in New Zealand and east Australia to determine population status and estimate sustainable levels of catch.

The first stage of the project will involve identifying and assessing the available data, characterising catches in New Zealand and Australian waters and identifying the most appropriate modelling approach. The second stage will involve developing the models, conducting sensitivity analyses and reporting.

In addition to commercial bycatch, there is also a significant recreational bycatch and a significant catch in commercial fisheries and beach protection programmes in Australia. SPC reports no bycatch in Pacific commercial fisheries.

**Indicative Cost:** \$80,000 per annum

## **POP-3 Determine protected deep-sea coral distribution from seabed imagery**

*This proposal was submitted by NIWA*

**Term:** 2 years

**Guiding Objectives:** CSP Objective E; CSP Coral Medium Term Research Plan.

**Project Objective:** To review, audit, and reconcile deep-sea coral records from existing seabed towed camera transects in the New Zealand region.

NIWA has collected seabed imagery since the 1990s using a variety of drop-cameras and towed camera platforms. However, since 2006 photographic surveys have been standardised with the development of NIWA's Deep-Towed-Image-System (DTIS). This system has now been deployed on 27 seabed surveys spanning the New Zealand region from Kermadec Ridge to Macquarie Ridge, from Challenger Plateau to the Louisville Seamounts, and south to the Ross Sea. On all DTIS deployments, video and photographic stills are captured simultaneously over a seabed distance of approximately 1 km, and substrate and faunal occurrence observations are logged with precise time and navigational data using Ocean Floor Observation Protocol (OFOP) software. However, while the standard recording protocols are consistent between voyages involving NIWA staff, the data captured in these log files represent a variety of projects, often with different research aims and emphasis, resulting in inconsistencies in the taxonomic levels at which some taxa are recorded. Thus, existing faunal identifications cannot be assumed to be comparable between voyages without appropriate auditing procedures. Fortunately, a major advantage of photographic samples is that existing log records can be checked and refined by direct reference to the original source imagery. We propose to interrogate the database of all existing seafloor observations for records of live coral and categorise the level of analysis and taxonomic identification (year one). Subsequently, in year two, records from selected regions of interest will be targeted for audit against the original source imagery to refine taxonomic identifications, estimates of abundance, habitat associations, and spatial coverage, to support specific DOC priorities.

### Outputs:

- Scoping study, year one: Outputs will include maps and tables of coral occurrence records from the DTIS observations database for the NZ region and sub-regions as appropriate. We will summarise a) the number of observations of live corals colonies, b) the number of images and lengths of video segments in which live coral colonies were observed, c) whether video and/or still images were analysed in detail, post-voyage, for the original project, and for which taxa, and d) the level of taxonomic identification recorded. Results will be written up in a technical report and presented to appropriate Working Group Meetings. This will link into discussions with DOC to derive recommendations for Stage 2.
- Data audit and analysis, year two: The scope of this stage will be determined by consultation with DOC following review of results from Stage 1. The primary aim, however, will be to audit existing observations of corals by direct reference to the original source imagery. This audit procedure would allow us to a) confirm presence of the taxon at the original observation location, b) confirm and align taxonomic identifications, and c) develop reliable estimates of within-transect and within-region population density. Outputs from this stage will include detailed distributional and abundance summary maps, tables, and plots, GIS layers, and files suitable for input to habitat suitability modelling.

**Indicative cost:** \$23,000 first year

### **POP-4 Identify protected coral hot spots using species distribution models**

*This proposal was submitted by NIWA*

**Term:** 1 year

**Guiding Objectives:** CSP Objective A, C and E; CSP Coral Medium Term Research Plan.

**Project Objective:** To identify hotspots for protected coral species in the New Zealand EEZ using predictions from abundance-based species distribution models.

The CSP Coral Medium-Term Research Plan, the workshop that informed the plan, and recent research has noted that most reliable species distribution models (SDMs) are likely to be those that model a single species, or species within a genus that have very similar environmental requirements (Bowden et al. in press). However, spatial predictions of regional-scale habitat suitability for protected corals in New Zealand waters have so far been based on SDMs using only presence-absence data (e.g., Anderson et al. 2020), as reliable catch weight or count data is generally not available in sufficient amounts.

For this project, SDMs will be produced for single species using only records with reliable abundance/biomass data. Currently, we expect these data to be for the habitat-forming species *Goniocorella dumosa*, *Enallopsammia rostrata*, *Madrepora oculata*, and *Solenosmilia variabilis* (Scleractinia), as well as data for at least one species from each of the other protected coral taxon groups. These data will include catch weight data from research trawl surveys and selected observer trawls, as well as newly available and standardised count data from image-based seafloor surveys. The latter data have not been used in previous EEZ-scale coral distribution modelling for DOC. Restricting input data to these sources may allow absence data to be treated as true absences and therefore modelling may employ a hitherto unused variable, fishing effort (or naturalness), as a potential predictor of current relative abundance, by determining the level of fishing effort preceding each record, at its location. This then allows a prediction, for the first time, of current levels of species relative abundance which accounts for spatial estimates of the historical effects of fishing. Depending on the influence of fishing effort in the models, the final models may be used to estimate pre-fishing (pre-1990) distributions by fitting a model with zero fishing effort (or 100% naturalness), thus providing a spatial representation of the historical

effects of fishing on the relative abundance of these species. Finally, the predicted distributions of each species will be combined to highlight the location of hotspots for protected corals in the New Zealand EEZ.

It is envisaged that this abundance data-based coral hotspot project will be the first step towards producing more sophisticated models that will contribute to wider research requirements addressing the objectives of the CSP Coral Medium-Term Research Plan. When some of the other data requirements of the plan have been met (see section below on Linkages with other research) a future project will be possible in which models are made that account for ecological processes. These types of models explicitly incorporate aspects of physiology, dispersal, demography and biotic interactions, with the use of a process-explicit model form (such as summarised in Briscoe et al. 2019). Such models can be used to understand coral productivity, connectivity, and the impact of fishing on the ecosystem services provided by deep-sea corals and inform risk assessments. Unfortunately, such models cannot be made until certain data requirements have been met.

**Outputs:**

A technical report will be produced that describes the development of spatial estimates of the current relative abundance of key species of protected corals within deep waters of the New Zealand EEZ, along with an appropriate set of maps in a standard GIS format. The focus on abundance rather than habitat suitability will provide improved identification of high-conservation-value hotspots for protected corals. The report will include any detectable changes in distribution of the modelled species due to the accumulated effects of bottom trawling since 1990.

**Indicative cost:** \$60,000

**POP-5 Impact of fishing on the ecosystem services provided by deep-sea corals in the New Zealand region**

*This proposal was submitted by NIWA*

**Term:** 2 years

**Guiding Objectives:** CSP Objective A, B and E; CSP Coral Medium Term Research Plan.

**Project Objective:** Determine the relationship between the abundance/biomass of protected deep-sea corals and the ecosystem services they provide, and compare the provision of these services in unfished, fished, and closed areas.

Deep-sea corals are recognised as providing important ecosystem services (Thurber et al. 2014). These include provision of habitat for a high diversity of associated invertebrate taxa (i.e., supporting service) (e.g., Henry & Roberts 2007), habitat and nursery grounds for commercially exploited fish (i.e., supporting and provisioning services) (e.g., D’Onghia et al. 2010), and carbon cycling and storage (i.e., supporting and regulation services) (e.g., Cathalot et al. 2015).

While there have been studies elsewhere to demonstrate the ecosystem services provided by deep-sea corals, there are no published studies that demonstrate that deep-sea corals provide ecosystem services in New Zealand waters. There has been one study focused on an unfished seamount of the Louisville Seamount Chain (just outside of the EEZ) that has established the relationship between the abundance of a habitat-forming coral species (*Solenosmilia variabilis*) and the diversity of associated invertebrate taxa, which identified a coral density threshold above which significant levels of biodiversity are supported (Rowden et al. 2020). However, this type of study has not been replicated for sites within the EEZ.

This proposed project will use already available video and still imagery data (from previously FNZ-funded and PhD research) from selected seafloor camera transects taken on the Graveyard and Andes seamount

complexes and elsewhere on the Chatham Rise to establish the relationship between the abundance of habitat-forming stony corals (*Solenosmilia variabilis*, *Madrepora oculata*, *Goniocorella dumosa*, *Enallopsammia rostrata*) and the abundance and diversity of associated invertebrates and fish, and use this information to establish coral density thresholds at which significant amounts of biodiversity are supported. Information on the size and behaviour of the imaged fish will be used to determine if there is evidence that habitat-forming corals provide a potential nursery ground for juvenile fish.

Furthermore, using established relationships between the abundance and biomass of the colonies of the study species, the imagery abundance data can be used to determine the coral biomass as a proxy for the carbon storage provided by coral habitat at particular coral densities. This information will be coupled with established oxygen consumption rates for the study species to also calculate the carbon turnover service provided by the corals (De Clippele et al. 2020). The study sites include areas that are unfished, have been and are subject to bottom trawling, as well as sites that have been closed to trawling. Comparisons of the analysed data/relationships from such different sites will therefore allow for an understanding of the potential impact of fishing on the aforementioned ecosystem services provided by habitat-forming stony corals, and the likely outcomes of mitigation strategies to avoid/minimise the adverse effects of commercial fishing on protected corals. The results of these analyses can be combined with the results from POP-4 to map the ecosystem services within the EEZ.

**Indicative cost:** \$70,000 per annum

#### **POP-6 Deep-sea protected coral reproduction**

*This proposal was submitted by NIWA*

**Term:** 2 years

**Guiding Objectives:** CSP Objective E; CSP Coral Medium Term Research Plan.

**Project Objective:** To address knowledge gaps in reproductive strategies for protected coral species in the New Zealand region by quantifying gross morphometrics of preserved corals and carrying out histological analysis of selected specimens.

This proposal seeks funding for Year 2 of the Coral Reproduction Project, specifically to carry out the reproductive research on selected preserved corals. The recommended study species that have been prioritised for future research scored medium to high in the summary of Productivity and Susceptibility scores in the pilot risk assessment by Clark et al. (2014). The overall risk value and ranking was high for the bubblegum coral *Pargaorgia* spp., and medium for all scleractinian branching stony corals and for the gorgonian octocoral *Primnoa* spp. The risk assessment along with the empirical data listing available samples currently held in the NIC, particularly those recently collected and appropriately preserved samples (formalin fixed then transferred to ethanol), have helped guide the recommendations in this proposal.

We have discussed with our International Collaborator, Dr Rhian Waller, the involvement of a student from New Zealand or the US, to help meet the major goals of a reproductive study. Details of these goals can be provided in more detail, but in summary we and a supervised student will describe and quantify the baseline reproductive biology and output at both the colony and population level, for the recommended coral species. Research approaches will include: Quantifying gross morphometrics of selected corals from archived specimens and collecting data on polyp density; carrying out histological analysis of preserved specimens to collect data on: male to female sex ratios, oocyte size distributions, fecundity per polyp, spermatocyst stage, and if possible, reproductive seasonality; examining archived video and images of the selected coral communities for: number of colonies, species distributions, and colony size.

The proposed project will occur during the 2021-2022 academic year to enable participation of a student from the US and or New Zealand and will correspond with the anticipated Year 2 aims of the current Coral Reproduction Project with CSP, Department of Conservation (DOC).

**Indicative cost:** \$40,000 per annum

### **POP-7 Investigating foraging plasticity for north-eastern New Zealand seabirds**

*This proposal was submitted by Chris Gaskin, NNZST*

**Term:** 2 years

**Guiding Objectives:** CSP Objective D; CSP Seabird Medium Term Research Plan.

**Project Objective:** To track birds to see whether the focal area of fisheries overlaps with seabird foraging hotspots, to analyse the diet of the seabirds, and to assess their breeding success.

We are developing a picture of how five selected indicator seabird species that breed within the inner and outer Hauraki Gulf utilise the surrounding inshore and offshore waters. Tracking and at sea observations suggests overlap between foraging areas for some species but not others. Diet studies indicate some of these seabirds (Australasian gannet) target fish also targeted by the commercial purse seine fishing fleet, or species of prey at lower trophic levels (Procellariiforms) that are also preyed on by target fish of the commercial fishery.

This project will explore whether foraging hotspots targeted by seabirds overlap with areas used by the commercial purse seine fishing fleet. We predict that for some seabirds, that target prey species of the commercially important fish we might expect overlap as both types of commercially important fish and seabirds are attracted to concentrations of invertebrates (krill). However, other seabirds that feed directly on the commercially important fish might avoid areas used by the fishing fleet due to the local depletion of these resources.

Determinations of foraging hotspots by birds from tracking data will be used to determine measures of foraging effort by seabirds (e.g., foraging time, foraging distance, adult condition) and potentially breeding performance (chick growth) to potentially evaluate the consequences for birds foraging at or away from these hotspots.

This project builds on earlier contracts investigating seabird species dependence on feeding in association with fish schools. Anecdotal evidence suggests a major decline in the abundance and occurrence of these fish schools. We currently do not know what impact this is having on seabirds. We suspect that some but not all seabird species that associate strongly with schooling fish may have the ability to switch prey. Through behaviour modelling, which can tell us the birds' time-budgets of foraging in those areas of fisheries activity, versus the time of foraging they spend at the other areas, there is potential to use this as an index to describe their prey-switching ability.

Australasian gannets from two study colonies in the Hauraki Gulf appear to exhibit spatial separation in terms of foraging distributions, based on preliminary tracking reinforced by diet studies. Recent aerial surveys show there has been a marked increase of the population of the outer Gulf colony (Mahuki) with what appears to be a corresponding loss to inner Gulf populations (Horuhoru Rock and Motukawao Islands). Potentially, this reflects a changing distribution of certain foraging resources between the inner and outer Gulf, species important for gannets and, also targeted by fisheries. Tracking, diet studies through regurgitations, and monitoring of breeding success are proposed to further investigate any changes.

Buller's shearwaters breed only on the Poor Knights Islands and is a species that does not appear to compete directly with fisheries. While commonly seen within Hauraki Gulf and Northland waters, including feeding in close association with tightly packed trevally and kahawai, and the more mobile mackerel and tuna schools, they also make long provisioning trips beyond local waters. This foraging

distribution, together with results of recent stable isotope studies showing feeding across three different trophic levels with krill, fish and squid identified in regurgitations, suggests a degree of plasticity during each stage of breeding.

Both fairy prions and fluttering shearwaters commonly forage around significant bathymetric and hydrodynamic features within continental shelf waters and in association with shoaling fish, with regurgitations showing close correlation to the prey the fish are also feeding on (ie. krill). In general terms fairy prions are something of a zooplankton specialist, although they do take larval fish. Besides krill, fluttering shearwaters also feed on small bait fish, often feeding in association with fast-moving kahawai schools. Fairy prions breed only on the Poor Knights Islands in northern New Zealand, whereas by contrast, fluttering shearwaters breed across multiple sites in the region, with the Hen & Chickens Islands and Mercury Islands their strongholds.

Northern diving petrels are another zooplankton and small fish specialist. However, unlike fairy prions, they do not associate with fish shoals. Their inclusion here is for a central place forager with contrasting foraging behaviours to fairy prion, and, to lesser extent, fluttering shearwater. Recent tracking (Dunphy et al 2020) has shown differences in foraging between birds breeding in the outer Hauraki Gulf (Burgess Island, Mokohinau Group) and Tiritiri Matangi in the Inner Gulf. The former birds were found to radiate out around the islands and their prey predominantly krill. By contrast, those from Tiritiri Matangi travelled further to forage, with fish dominant in their diet.

There is a need to better understand the foraging distribution and behaviours and diet of these species during breeding and assess how any variability in foraging distribution and effort affects breeding success. Foraging plasticity by seabirds may buffer any potential impacts from changing prey distributions, not only through fisheries impacts but also climate change. However, without 'baseline' data this cannot be tested. To test the hypotheses suggested above, a comprehensive tracking, sampling, and monitoring programme is required. Seabird foraging distributions will be overlaid with prey distributions targeted by many commercial fisheries, with data drawn from catch and vessel reporting.

**Indicative cost:** \$70,000 per annum

### **POP-8 Flesh-footed shearwater population monitoring**

**Term:** 3 years

**Guiding Objectives:** CSP Objective E; CSP Seabird Medium Term Research Plan, National Plan of Action- Seabirds.

**Project Objective:** To collect information on key aspects of the demography of an at-risk seabird species in order to reduce uncertainty or bias in estimates of risk from commercial fishing.

Flesh-footed shearwaters are one of the most at-risk species from commercial fisheries in northern New Zealand with birds regularly caught on long-lines. A project to collect better information about this species has been ongoing since 2016 on two sites (Lady Alice Island in Hauraki Gulf and Ohinau Island in Bay of Plenty). A large marked population of both adults and birds banded as chicks has been established at both sites. To capitalise on this huge banding effort, the opportunity now arises in the next three years to collect detailed information about the age of first return and age of first breeding in this species, plus juvenile survival rates from fledgling to first return. Previous studies from a small population has indicated the birds start breeding at 6 years of age. The banding of thousands of chicks in the past 6 years should greatly improve these estimates. In addition, banding of adults in marked study burrows has allowed for high return rates of birds to known sites to be monitored over 5 seasons. Over the next three years a large sample of banded adults will be recaptured, and new birds banded annually allowing for demographic studies on survival rates in two regions to compare with information collected in early 2000's

There has been extensive GPS tracking of this species in the past 6 years and also new surveys of breeding sites. There are no plans to continue tracking this species in the next three years. A population survey to estimate the current size of the southernmost colony on Titi Island in Marlborough Sounds will be undertaken during the period 2021-23 to compare with a past estimate from this site.

**Indicative cost:** \$60,000 per annum

### **POP-9 Seabird population research: Chatham Islands**

**Term:** 1 year

**Guiding Objectives:** CSP Objective E; CSP Seabird Medium Term Research Plan, National Plan of Action- Seabirds.

**Project Objective:** To collect information on key aspects of the biology of selected at-risk seabird species to reduce uncertainty or bias in estimates of risk from commercial fishing.

In January 2021, an opportunity became available to carry out work on three species of albatross and petrels on the Chatham Islands on the Forty-fours, a privately owned seabird island. The work replaced other projects planned for the subantarctic islands and called off due to COVID-19 concerns. Toroa Consulting Ltd had negotiated access to the Forty-fours with the landowners and they approved a programme of work to attach satellite tags to 30 northern royal albatross and 10 northern giant petrels. In addition, 55 GLS tags (archival tags) were placed on a sample of breeding northern Buller's albatross. Toroa Consulting Ltd also banded a large sample of northern giant petrel chicks as well as some adults of the two species of albatrosses. Trail cameras were left in situ to collect data on breeding success of these three species.

The 2021/22 field season will include retrieval of GLS tags from the northern Buller's albatross for analysis of at-sea distribution in the late chick rearing period, non-breeding season and incubation period in 2021/22. The trail cameras will also be retrieved to look at breeding success of the three species and return dates of northern giant petrels for nesting. Band recoveries from previous seasons will be attempted and a sample of newly banded birds will be added to increase the numbers of marked birds in this population to allow for future demographic studies on adult survival rates. Ongoing research at this site will be dependent on getting approval from the island owners to continue studies of these species and therefore this project will be assessed on an annual basis.

**Indicative cost:** \$60,000

### **POP-10 White-capped albatross research and monitoring – Disappointment Island (2021-24)**

**Term:** 3 years

**Guiding Objectives:** CSP Objective E; CSP Seabird Medium Term Research Plan, National Plan of Action- Seabirds.

**Project Objective:** Continue the collection of long-term demographic and at-sea tracking data to assess population trends and to understand the impacts of fisheries on white-capped albatross.

The largest population of white-capped albatross occurs on Disappointment Island in the Auckland Island group. Population trend data for this site has been gathered through use of aerial photography in 2006 to 2017. Since 2015 ground-based monitoring of a marked study colony on Disappointment Island has started to obtain data to allow for improved survival estimates for this species. Tracking of adults has also been

undertaken using GLS tags since 2018. The population study has primarily been an add on to the current work programme occurring with Gibson's wandering albatross. This has hampered the project in terms of only minimal days are spent on white-capped albatross data collection. This new programme of work aims to improve the quantity and quality of data by the following steps:

1. Carry out surveys of the Disappointment Island study colony at the start of the incubation period (Nov/Dec) and compare nesting activity in the main study area using both ground and aerial surveys (drone flights). Repeat this survey in late Jan/Feb (hatching) to compare number of active nests with those observed in Nov/Dec. This will help interpret past aerial photography data sets where images were taken both in December and late January.
2. Put out trail cameras to monitor breeding activity and timing of nest failures. This data will help determine whether birds occupying nests are successful breeders, failed breeders or non-breeders to help with understanding status of birds observed in past aerial images.
3. Collect band recovery data from study colony birds and continue to mark a sample of breeding birds to build up robust datasets for adult survival analysis.
4. Deploy and collect GLS tags from a sample of birds to look at extent of movements of birds in relation to annual variability in foraging conditions.
5. Apply a sample of GPS tags to track finer scale interactions between white-capped albatrosses and fishing vessels.

**Indicative cost:** \$40,000 per annum

#### **POP-11 Gibson's albatross- Auckland Islands seabird research and monitoring 2021-24**

**Term:** 3 years

**Guiding Objectives:** CSP Objective E; CSP Seabird Medium Term Research Plan, National Plan of Action- Seabirds.

**Project Objectives:**

- 1) To estimate adult survival and other key demographic parameters of Gibson's albatross
- 2) To estimate the population size of Gibson's albatross

This proposal delivers key components of the CSP seabird plan 2019 involving field work on Gibson's albatross. Gibson's albatross is a New Zealand endemic with NZ Threat status Threatened-Critical (Robertson 2017).

A long-term study site for Gibson's albatross at the Auckland Islands enables trends in population size and demographic parameters to be assessed (Francis et al. 2012; Elliott et al. 2018). The primary focus of this research is to estimate key demographic parameters via continued mark-recapture monitoring. This will follow established methods (Walker & Elliott 1999) to estimate survival, productivity and recruitment, and estimate the size and trend of the population. This suite of data allows more precise assessment of population trends than from simple nest counts. Drone-based aerial survey methods will be trialled for use to conduct wider population counts beyond the study plots.

**Indicative cost:** \$100,000 per annum



## **POP-12 Assessment of causes of low burrow occupancy rates in Westland petrels**

**Term:** 2 years

**Guiding Objectives:** CSP Objective E; CSP Seabird Medium Term Research Plan, National Plan of Action- Seabirds.

**Project Objectives:**

- 1) Examine burrow occupancy rates in Westland petrels and monitor nests to determine factors around why so many apparently suitable nests are bred in by this species.
- 2) Tracking adults and juveniles to determine year-round distributions and migration behaviour of fledglings.

Westland petrels only breed on the West Coast of the South Island at Punakaiki. The species is caught on commercial long lines and is rated as a medium-high risk species from commercial fisheries. There have been extensive long-term demographic studies of this species going back to 1970s by scientists from Te Papa and DOC. This included tracking of adult birds using GPS tags during the breeding season and a small sample of GLS tags on adults in the early 2000s to study their migration behaviour. A study published by Waugh et al. (2003) found that just 21% of burrows were occupied by breeding birds. The authors considered two hypotheses for this very low occupancy rate (compared to other seabirds). Either the population was in decline or there was a high number of non-breeding birds maintaining apparently active burrows. Either way the apparent low occupancy rates can have a large effect on total population estimates based around burrow counts. For example, the uncertainty is demonstrated in the survey undertaken by Wood and Otley (2012) who found 12,843 active burrows in 28 different colonies. Their occupancy assessments were based on marked study burrows where the occupancy rate was 40% yet a random sample in the same colony carried out along a transect only had an occupancy rate of 23%. This resulted in a large variation in the total estimated breeding population (range 2954 to 5137 pairs). More recent studies by Waugh et al. have indicated that burrow occupancy rates are still an area of high uncertainty in this species although occupancy was higher than in their earlier work. Understanding the factors around the accuracy of these burrow occupancy estimates is therefore crucial for understanding the species status and trends.

The status of the birds maintaining burrow sites but not apparently breeding in them is still unclear. Are they early failed breeders, former breeders skipping a season, prospecting non-breeders or some other animal species keeping disused burrows looking active? A large pool of non-breeding birds, especially of one sex may have implications for the risk assessment modelling for this species in terms of total population size estimates. If each vacant burrow is used by a single bird versus single birds maintaining multiple networks of vacant burrows, will influence estimates on the overall size of the species population.

This study is designed to understand the dynamics around this situation by closely monitoring a sample of burrows and looking at frequency of visits by individuals to a cluster of marked nests within a well-defined area. Technology options include trail cameras, PIT tags, alphanumeric tags to ID birds in trail cameras and burrowscopes to assess breeding versus non-breeding sites. Birds captured will be individually marked and sexed using DNA techniques to determine if skewed sex ratios occur in the population. Trail camera footage or PIT tag recorders will be assessed to examine bird behaviour associated with the nest clusters (looking for evidence of multiple burrow occupancy). The study will determine if the low occupancy rate found in 2001 and in subsequent seasons has changed over time and varies between different sub-colonies.

The study would be best conducted over two years with field monitoring from March to August 2021 (early chick rearing) and again in March-Aug 2022 with reports due in June 2022 and June 2023.

While at-sea tracking has been carried out on breeding adults using GPS tracking tags during the breeding season, there has been no recent assessment of year-round movements of this species. A sample of adults will be tagged with GLS tags to collect data on foraging range throughout the year to compare with studies

done in the early 2000's. A sample of GPS tracking tags will also be applied to fledglings in late 2021 to determine if this age class follows the same migration patterns of adults who visit Chile during the non-breeding season. This information will be used to inform risk assessments on this species by refining at sea distributions of two age classes.

**Indicative cost:** \$80,000 in Year 1, \$40,000 in Year 2

### **POP-13 Light-mantled sooty albatross population monitoring – Adams Islands 2021-24**

**Term:** 3 years

**Guiding Objectives:** CSP Objective E, National Plan of Action- Seabirds, ACAP data gaps

**Project Objective:** Develop a methodology to estimate the population size of light-mantled sooty albatross at Adams Island and allow future monitoring of population trend.

The Auckland Islands are thought to hold the largest global population of light-mantled sooty albatross, but almost nothing is known of the current population size or trend. Building on limited part-site counts of breeding pairs on Adams Island, this project will seek to establish a robust survey methodology to monitor the population. It is envisaged a mix of drone-based and ground-based methods would be used. Dependent on year 1 trials of drone-based methods, a population estimate may also be achievable. The ground-based element will focus on ground truthing drone-based survey and will allow the deployment of tracking devices on adult birds to assess their at-sea foraging range, to identify any fisheries overlap.

**Indicative Cost:** \$40,000 per annum

### **POP-14 Grey petrel population assessment – Antipodes Island**

**Term:** 1 year

**Guiding Objectives:** CSP Objective E, National Plan of Action- Seabirds.

**Project Objectives:** To provide an updated population estimate and assess the population trend in relation to previous surveys at the island.

Antipodes Island is thought to have by far the largest population globally of grey petrels, but the trend in population size over time remains unknown. This project builds upon prior work (POP2020-04) and involves undertaking a population assessment based on the recommended methodology. In order to obtain a grey petrel population size estimate on Antipodes a spatial coverage distance sampling approach is envisaged, with an extended season to survey census grids to allow for trend assessment against previous research. Cost-saving synergies will be utilised with other research at the island to the greatest extent possible.

**Indicative Cost:** \$80,000

### **POP-15 Southern royal albatross population research and monitoring – Campbell Island 2021-23**

**Term:** 2 years

**Guiding Objectives:** CSP Objective E, National Plan of Action- Seabirds.

**Project Objectives:**

- 1) To provide an updated population estimate and assess the population trend in relation to previous surveys at the island.
- 2) Describe the at-sea distribution and overlap with fisheries globally.

The southern royal albatross is near endemic to Campbell Island, with the last population estimate based on data from 2004-08. Initial research in 2020 (BCBC2019-03) suggested a potentially substantial decline in the Col study area. This project will build on the recommendations from BCBC2019-03, to conduct wider, representative counts of breeding pairs over two seasons to provide a robust comparison to the previous population estimate. The project will also allow for ground-truthing of a current initiative to investigate the utility of satellite images for monitoring this species. The field work will also allow for the deployment of satellite tracking devices to better understand the year-round foraging distribution and overlap with fisheries globally.

**Indicative Cost:** \$80,000

### **POP-16 Foveaux and Otago shag population research and monitoring 2021-24**

**Term:** 3 years

**Guiding Objectives:** CSP Objective E, National Plan of Action- Seabirds.

**Project Objective:** Provide an updated breeding population census and assess the population trend to adequately inform risk assessment and species management.

Endemic to Southern New Zealand coastal waters and harbours, Foveaux shag (*Leucocarbo stewartia*) and Otago shag (*Leucocarbo chalconotus*) populations are respectively 'Nationally Vulnerable' and 'At Risk - recovering'. There are thought to be less than 2500 Foveaux shag left and Otago shag may be in decline. Last population estimates are based on data from 1981 and early 1990's respectively. These estimates are out of date and critical to species management. Preliminary research has begun (BCBC2020-24) and will identify current colony locations and develop a methodology for population monitoring starting in 2022. Initial colonies investigated in 2021 include Sumpter Wharf in Oamaru, Taiaroa Head, Whero Rock, and Kanetotoe Island. This project will build on the findings from BCBC2020-24, to complete a full breeding population census over the next three breeding seasons to provide a robust comparison to the previous population estimates. Both species are known to be susceptible to incidental set-net fishery pressures and breeding colony disturbance. There are emerging threats to population stability arising from areas such as indirect fisheries pressures from the expansion of aquaculture in the Foveaux Strait region and plans to have more open seas aquaculture on the East and South Coasts in areas these species are known to utilise. Population data is urgently needed to guide risk management for these species.

**Indicative Cost:** \$30,000 per annum

## **POP-17 Black petrel research**

**Term:** 1 year

**Guiding Objectives:** CSP Objective E; CSP Seabird Medium Term Research Plan, National Plan of Action-Seabirds.

**Project Objectives:**

- 1) To monitor demographic parameters at the breeding colony of this threatened seabird to reduce uncertainty or bias in estimates of risk from commercial fishing.
- 2) Undertake at-sea capture of black petrels to determine proportions of banded birds and identify if current low juvenile survival rates are affected by any non-philopatric behaviour at the study colony.

Black petrels are one of the most at-risk species from commercial fisheries in northern New Zealand with birds regularly bycaught on long-lines. A project to gather demographic data about this species has been running annually since 1996. This long-term dataset helps with understanding the risk to this species from fisheries bycatch. Continuing the study is necessary to gather current rates of adult mortality, breeding success and rates of juvenile survival and recruitment until mitigation methods prevent capture of this species. This project has undertaken extensive GPS, satellite, GLS and TDR tracking of this species across age classes and over multiple years. This element will be dropped from the current work programme as the data is currently sufficient to determine spatial overlap with fisheries. Monitoring and surveys for black petrels on Aotea/Great Barrier and Hauturu/Little Barrier have also been undertaken. This will not continue in the current project. Research at the study colony will reduce to one trip to monitor nests and breeding birds during the incubation period and chick banding in April to assess breeding success.

A new element to the work programme will be to capture black petrels at sea around northern New Zealand to look at ratios of banded to un-banded birds to use for modelling of current population size of this species based on mark-recapture estimates collected away from the study colony. In addition, the bands of the birds will be matched against recoveries from the study colony to determine if there is a significant number of unknown surviving birds banded as chicks/juveniles in earlier years. This will be used to validate whether or not the current low survival rate for returning immature birds is an artefact of low philopatry levels and therefore low recapture rates at the study area or a genuine low juvenile survival rate. To achieve this target hundreds of birds will need to be captured at sea and checked for bands. This will be a major focus of this new project.

**Indicative cost:** \$75,000

## **POP-18 Fur seal population estimate and bycatch analysis, Cook Strait**

**Term:** 2 years

**Guiding Objectives:** CSP Objective B and E, CSP Marine Mammal Medium Term Research Plan.

**Project Objective:** Identify New Zealand fur seal colonies within the Cook Strait and increase the understanding of interactions between New Zealand fur seals and the commercial hoki fishery within this area.

New Zealand fur seals (*Arctocephalus forsteri*) are the most frequently bycaught marine mammal in New Zealand due to spatial and temporal overlap between fur seal foraging areas and commercial fishing areas (Mattlin 1987, Rowe 2009). Despite an estimated increasing population trend overall (Baker et al. 2019), high mortality rates in the Cook Strait area may be at an unsustainable level for local colonies. The hoki trawl fishery targets this area annually from late-June to mid-September, peaking effort in July and August. A range of mitigation methods have been trialled (such as a seal exclusion device) though further research and trials are needed.

This project will focus on fur seal colonies within the Cook Strait area that are believed to be impacted by the hoki fishery. It will provide colony estimates to enable an assessment of the impact bycatch may have on these colonies. It will include genetic analysis to confirm locations most impacted by the fishery. More information is also needed on when, how and what animals are caught and are most vulnerable to interacting with this fishery (Baird 2004). Previous analysis covering the period 1993-94 to 2005-06 (Smith & Baird 2009) identified that fur seals were at highest risk from July to September and during hours of low light (dawn, dusk and night). Project INT2019-03 also analysed fur seal interactions across all trawl fisheries 1993-94 to 2017-18. This project will provide a more localised analyses with observed and fisher reported bycatch of fur seals within this fishery to determine if patterns around bycatch of this species persist. This information paired with the colony information will guide where, when and how to focus mitigation research and efforts for fur seal bycatch going forward.

### **Deliverables:**

Year 1:

- Complete an assessment of the current status of fur seal colonies in the region, e.g. location, breeding or non-breeding, approximate number, accessibility (some data exists to supplement this) summer 2021. Could be conducted by boat surveys, and/or use of drone.
- Analyse protected species interaction data (fisher reported and observed) within the Cook Strait region to determine if spatial and temporal patterns in bycatch risk is occurring.
- Analysis of bycaught animals – genetic analysis to genotype back to region. This would confirm the colonies to focus on and help assess the level of impact of bycatch as you can then pair the proportion of bycatch for a region to the size of the potential colonies.

Year 2:

- Based on the analysis of protected species interaction data and genetic analysis of bycaught animals determine the colonies (breeding or non-breeding) that are likely to be impacted.
- Conduct more accurate counts at these locations to determine the level of impact of the bycatch at these colonies.
- Make recommendations for further mitigation work that might be required.

**Indicative cost:** \$100,000 total (likely split between \$60,000 in year 1 and \$40,000 in year 2)

### **POP-19 Genetic connectivity of Hector's dolphin across the top of the South Island**

*This proposal was submitted by Simon Childerhouse, Cawthron Institute*

**Term:** 1 year

**Guiding Objectives:** CSP Objective E, CSP Marine Mammal Medium Term Research Plan, Hector's and Māui dolphin Threat Management Plan.

**Project Objective:** To quantify genetic flow rates among dolphins in the top of the South Island to develop an improved understanding of the rates and mechanisms of connectivity (e.g., individual and genetic interchange) between the east and west coast South Island populations.

The Threat Management Plan Review for Hector's and Māui dolphins highlighted areas of potential concern that required more research to determine stock structure and dispersal (see Roberts et al. 2019). One of those areas is the top of the South Island where there are apparently small aggregations of dolphins that have possibly been exposed to higher entanglement risk over recent years.

It has generally been accepted that Hector's dolphin around the South Island form three genetically distinct populations. Recent indirect and direct evidence, however, points to the likelihood of a fourth regional, probably ranging along the north coast of the South Island. The indirect evidence comes from efforts to identify a source population for Hector's dolphins found in the regional habitat of Maui dolphins,

using genotype assignment methods (Hamner et al. 2013). While some individuals show clear assignment to the West Coast, South Island, others show partial assignment to all three of the South Island populations. One explanation for this incomplete assignment is the presence of an unsampled population with intermediate allele frequencies. Direct evidence comes from previous attempts to sample Hector's dolphins from the Golden Bay and Queen Charlotte. A preliminary report on the genetics of 21 Hector's dolphins from Golden Bay (n = 10 individuals, 2014-2015) and Queen Charlotte Sound (n = 11 individuals 2016) revealed reduced genetic diversity, possibly as a result of the small sample sizes, but worthy of further investigation (Baker et al. 2017).

The limited number of samples from both efforts showed distinct differences from the larger number of samples representing the West Coast and East Coast populations. The Threat Management Plan highlighted the importance of understanding and maintaining connectivity between sub-populations, and with the advance in genetic techniques, it is time to update Hamner et al. (2013) and use these findings to advise on current gaps in knowledge about Hector's dolphin connectivity across the top of the South Island.

Additional samples are needed, particularly from Golden Bay, to develop a reference database for improved genetic assignment and, in time, for improved estimates of abundance and subpopulation boundaries. Although it is difficult to estimate in advance the number of samples needed, we could expect improvement in the power of genotype assignment from collection of another 30-40 samples.

Examination of existing samples and targeted biopsy programme to collect the further necessary samples from Hector's dolphins at key locations across the top of the South from north of Karamea on the West Coast through to Cloudy Bay in the East.

**Indicative cost:** \$40,000

#### **POP-20 Acoustic monitoring of Hector's dolphin interactions with harbour set nets**

**Term:** 1 year

**Guiding Objectives:** CSP Objectives E, Marine Mammal Medium Term Research Plan, Hector's and Māui dolphin Threat Management Plan.

**Project Objective:** To determine the presence and movements of dolphins within certain west coast North Island (WCNI) harbours and determine the level of risk posed by fishing equipment in those areas.

There is a lack of understanding about the presence and movements of dolphins within certain west coast North Island (WCNI) harbours, which can be further extended to the level of risk posed by the potential negative interactions with fishing equipment.

WCNI harbours are challenging environments for monitoring programs, given high currents, complex sediment movements, fishing activity and shallow depths, and limited acoustic detection ranges for Māui dolphins.

To understand if certain harbours are used by Māui dolphins, and therefore if a risk of entanglement in set nets within a harbour exists, 'gateway' style monitoring programs offer the best way to build a long-term understanding. Such information can be used to refine the spatial extent of Māui dolphins on the WCNI. However, due to the complexity of the environment, and uncertainty of success, a 3-month pilot program focused on the season Māui dolphins are most likely to use a harbour is proposed.

The program should ideally consider a range of passive acoustic data collection methodologies and technologies to deliver information about presence over time and diurnal activity patterns. Given the complexity of the environment, programs should incorporate full spectrum acoustic recorders and not just rely on click detectors (i.e., CPODs).

Deliverables would include a detailed monitoring program design, including rationale for the selected approaches and technologies, the study itself, and a final report.

**Indicative cost:** \$150,000

# Mitigation Projects

## Ongoing projects

### MIT-2020-01 Hook-shielding use in the surface longline fishery

This multi-year project was consulted on in 2020/21 and is due for completion in June 2022.

It is proposed to form part of the CSP Annual Plan 2021/22.

Full details are provided in the CSP Annual Plan 2020/21.

## Proposed Projects

### MIT-1 Protected Species Liaison Programme

**Term:** 3 years

**Guiding Objectives:** CSP Objective A and B, CSP Seabird Medium Term Research Plan, National Plan of Action - Seabirds, National Plan of Action - Sharks.

#### Project Objectives

- To deliver on the vision and outcomes of the DOC Bycatch strategy/roadmap and relevant cross-government plans (NPOAs, TMPs, etc).
- Ensure all high-risk inshore and HMS commercial fishers are using practices that best avoid the risk of seabird bycatch
- Improve understanding of interactions in relation to mitigation use and identify knowledge gaps

#### Specific Objectives

Grow Liaison capacity across inshore and HMS fleets around the country including methods; surface longline, bottom longline, trawl, set net, and purse seine.

#### Project Description

To effectively reduce the risk of interactions with protected species, it is important for vessels to be using best practice mitigation and take all necessary steps both regulatory and non-regulatory measures to avoid interactions. To measure success of mitigation and identify areas where further development is needed across each fleet, there needs to be consistency in the mitigation measures used while still allowing for innovation. Through the Seabirds – NPOA a suite of best practice mitigation standards for each method have been developed, these Mitigation Standards will underpin the work that the Liaison Officers do and will be rolled out as part of the Liaison Programme through the Protected Species Risk Management Plans (PSRMPs).

The purpose of the PSRMPs is to outline the vessels' current practices and work towards achieving all the best practice Mitigation Standards. Liaison Officers will make note of where vessels are not able to achieve all the Mitigation Standards and why. These notes will be fed back to MPI for evaluation, where they will either reassess the Mitigation Standards or how we can better assist vessel operators to achieve the Mitigation Standards as written. Auditing of PSRMPs by MPI Fisheries Observers will then describe the steps the vessel is taking to meet the mitigation measures outlined in their plan and highlight where there is still work to be done.

Within the next two years the capacity of the programme is expected to grow substantially in size. The role of the Liaison Officers will largely remain the same, supporting and educating fishers in best practice mitigation and providing a vital interface between skippers, government, and researchers. The growth over the next two years will consist of additional Liaison Officers to expand into more fisheries and areas,



increased contact with high-risk vessels and fleets, development and delivery of a training programme for crew on protected species and mitigation and the hiring of a full-time Liaison Coordinator to ensure the operational oversight of the programme.

Improvements in the next phase of the project are needed to more accurately measure the success of the Protected Species Liaison Programme and overcome constraints in reporting capability. This will be addressed through database development and standardised procedures. There will also be increased engagement with quota holders to support the uptake of PSRMPs and Mitigation Standards.

#### **Project Deliverables/outcomes**

- Database including PSRMPs installed and updated, vessels visited, trigger responses, mitigation materials and training provided
- Creation of a Governance Group and Project Executives Group to work through challenges within the programme and report progress
- Development of management protocols and responses to triggers
- Regular reports back to relevant advisory groups detailing progress and any developments which have come from the fleet
- Annual written reporting will be provided as part of the NPOA Seabirds – Annual Research Report

**Indicative cost:** \$250,000 per annum

#### **MIT-2 Cetacean interactions with pot fisheries in New Zealand waters**

**Term:** 1 year

**Guiding Objectives:** CSP Objectives A and B, CSP Marine Mammal Medium Term Research Plan.

**Project Objective:** Update the previous analysis of cetacean entanglements and hold a workshop with fishers to explore mitigation options that could be implemented in New Zealand pot fisheries.

Conservation and animal welfare concerns exist around the entanglement of large whales in pot/trap and set net fishery lines worldwide. As whale populations continue to recover, the frequency of interactions with fisheries is likely to increase. In New Zealand, the most commonly entangled species are humpback whales (*Megaptera novaeangliae*) and orca (*Orcinus orca*). Previous analysis under project MIT2016-02 highlighted that reported entanglements appear to be spatially and temporally distinct, with humpback whales interacting with crayfish pot lines in the Kaikoura region primarily during the month of June (where the species northern migration and the peak of potting activity in CRA5 coincide). DOC implemented disentanglement training in the early 2000's and has personnel trained throughout the country to free whales that are reported as entangled safely. To compliment this approach, it is important to address the issue at the source by looking into options to reduce the chance of whales interacting with fishing gear in the first instance.

Given the widespread occurrence of whale entanglements, there has been a range of innovation and trials to attempt to mitigate this issue internationally. Despite lobster fisheries differing in practice across the world (soak times, setting depths etc) there may be mechanisms or practices that are proving effective elsewhere that should be considered within the New Zealand setting. The rock lobster fishery in New Zealand does not currently enforce any whale entanglement mitigation practices, however the industry body has published recommendations for fishers as a component of their *Whalesafe Identification Guide* (NZRLIC 2016) and are currently updating the industry *Whalesafe Manual*.

This project builds upon the research and recommendations in MIT2016-02 and INT2019-03. This project will start with an updated review of entanglement events since the 2016 report (an additional 3 years of data) and update the analysis of commercial effort in the lobster pot fishery. It will also involve a brief assessment of disentanglement events since training for this commenced (number of personnel trained, learnings, limitations etc). Following these preliminary steps, a workshop will be held with industry representatives and fishers to present this analysis, highlight research underway internationally and gauge interest in fishers trialling gear modifications in the future. This workshop will also include a facilitated 'blue sky thinking' session on addressing this issue and allow presentations from suppliers who have developed whale entanglement mitigation gear.

**Outputs:**

- Presentation on whale entanglements to date, disentanglement review and international research currently underway at a workshop to be held in Kaikoura
- Facilitation of workshop, blue-sky session and collation of feedback in a workshop report
- Awareness campaign targeting areas and times of high interaction to encourage fishers and the wider public to report sightings of entangled whales

**Indicative cost:** \$40,000

**MIT-3 Eliminating hoiho bycatch in set net fisheries**

**Term:** 1 year

**Guiding Objectives:** CSP Objective A, National Plan of Action-Seabirds.

**Project Objectives:** A comprehensive work programme to implement the preferred mechanism(s) for eliminating bycatch of hoiho in set net fisheries.

Hoiho populations have declined by 70% over the last ten years, and conservation managers need to take urgent action to prevent extinction. Entanglement in set nets is a known high mortality risk for hoiho where their range overlaps with set net fisheries (e.g., Darby & Dawson 2000). Previous research investigations have described the foraging range of hoiho around mainland New Zealand in detail (e.g., Moore 1999; Mattern et al. 2007 & 2013; Mattern & Ellenberg 2020) and have examined the overlap between hoiho and setnet fisheries (e.g., Abraham & Thompson 2015).

There have been numerous reviews of potential mitigation options for set net fisheries in New Zealand (e.g., Childerhouse et al. 2013, Parker 2017). Childerhouse et al. (2013) concluded that spatial and temporal management of set net fisheries was the most effective for reducing bycatch of protected species. A review by Parker 2017 was used as a basis for a workshop in 2018 led by the fisheries information group specifically to examine set net mitigation options for hoiho. The workshop concluded that management of set nets in time and space was the most viable option for reducing the bycatch of hoiho. Adequate testing of any mitigation methods is also infeasible given the low sample sizes (i.e., low numbers), the endangered status of hoiho and the absence of a real ecological equivalent (to a benthic feeding large vertebrate).

Here, we propose an investigation into the range of options and opportunities available to fishers that currently set net within hoiho habitat. An expert panel workshop will bring together fishers, industry, conservationists, researchers, and Government to review all the potential options. The workshop will a) investigate the pros and cons of set netting and alternate methods or mitigation options, b) set a framework for reporting and analysis. A report would include the pros and cons as discussed at the workshop and identify and rank alternative options using either a qualitative or quantitative evaluation. For example, an economic viability analysis (or cost-benefit analysis) could examine the direct and indirect benefits and consequences of set netting in different locations or at different times for different set net fisheries versus

alternatives. A second expert panel workshop would work cooperatively to discuss the report outputs and identify the mechanisms necessary for implementing the highest ranked options. The preferred option(s) should be progressed and implemented using the identified mechanism(s) to mitigate bycatch and support fishers to transition from current set net fishing practices.

**Indicative cost:** \$50,000

#### **MIT-4 Inshore trawl seabird mitigation project**

**Term:** 1 year

**Guiding Objectives:** CSP Objective A.

**Project Objectives:** Further identify, refine and/or test seabird mitigation in the inshore trawl fishery.

Inshore trawl poses a substantial portion of risk to seabirds from commercial fisheries. There remains uncertainty over the effectiveness of the various seabird bycatch mitigation options that have been used by some operators. Currently there are no mandatory mitigation requirements for trawl vessels <28m in length, and the mitigation standard introduced by the NPOA-Seabirds 2020 contains limited advice on the relative effectiveness of the warp mitigation options identified. This project aims to further identify, refine and/or test seabird mitigation in this fishery. The initial stage will be an expert and stakeholder workshop to determine direction of research.

**Indicative cost:** \$80,000

#### **MIT-5 Develop protocols for increasing sink rates for bottom longline**

**Term:** 1 year

**Guiding Objectives:** CSP Objective A.

**Project Objectives:** Further identify, refine and/or test methods for achieving the desired sink rates in inshore BLL fisheries set out in the NPOA-Seabirds 2020, to mitigate against seabird bycatch.

Inshore bottom longline fisheries pose seabird bycatch risk to some of the seabird species at highest risk from commercial fisheries, such as black petrel and flesh-footed shearwater. The mitigation standard introduced by the NPOA-Seabirds 2020 contains expectations around achieving sink depths of hooks by the end of the aerial extent of the tori line (10m deep at high risk times and 5m deep at other times). Achieving some of the standard sink rates has been challenging in some segments of the fleet. This project aims to further identify, refine and/or test methods for achieving the desired sink rates, to mitigate seabird bycatch. The initial stage will be an expert and stakeholder workshop to determine direction of research.

**Indicative cost:** \$80,000