Conservation Services Programme
DRAFT
Annual Research Summary
2023-24

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1. Introduction

1.1 Purpose

This report outlines the research carried out through the Conservation Services Programme (CSP) Annual Plan 2023/24 and provides updates on multi-year projects started in previous years.

The CSP is one component of the Department of Conservation (DOC)'s wider bycatch programme and describes those services delivered as 'conservation services'.

1.2 Background

The Department of Conservation has the statutory duty to protect certain marine animals as defined by the Wildlife Act 1953 and the Marine Mammals Protection Act 1978. While the sustainable management of fishery resources is the statutory responsibility of the Minister of Fisheries (Fisheries Act 1996), the protection and conservation of seabirds, marine mammals and other protected species is the responsibility of the Minister of Conservation.

Since 1995, the New Zealand government has been implementing a scheme to recover from the domestic commercial fishing industry, a proportion of funding required to investigate and mitigate the impacts of fishing on protected species of marine wildlife (Conservation Services). Conservation Services are defined in the Fisheries Act 1996 (as amended in 1999) as being outputs produced in relation to the adverse effects of commercial fishing on protected species, as agreed between the minister responsible for administering the Conservation Act 1987 and the Director-General of the Department of Conservation.

1.3. CSP Vision and Objectives

The CSP vision is that:

> "Commercial fishing is undertaken in a manner that does not compromise the protection and recovery of protected species in New Zealand fisheries waters".

The suite of research and other conservation services delivered as part of the CSP fall into three categories:

1. Understanding the nature and extent of adverse effects on protected species from commercial fishing activities in New Zealand fisheries waters.
2. Developing effective solutions to mitigate adverse effects of commercial fishing on protected species in New Zealand fisheries waters.
3. Developing population management plans, where appropriate.

Detailed objectives for CSP are provided in the Conservation Services Programme Strategic Statement[1].

[1] Available to download from: https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/resources/rag-resources/csp-strategic-statement-2020.pdf

1.4 Development of the Annual Plan

The Conservation Services Programme Annual Plan 2023/24[2] described the conservation services to be delivered as the Conservation Services Programme, and subject to cost recovery from the commercial fishing industry. As such, this Annual Plan formed the basis for levying the commercial fishing industry under the Fisheries Act 1996. For further background information on CSP, including extracts of relevant legislation, refer to the Conservation Services Programme Strategic Statement.

In the development of this Annual Plan a series of discussions were held with Fisheries New Zealand (FNZ) staff to harmonise the CSP and FNZ research programmes for 2023/24 and to ensure there was no duplication. A formal consultation process was also used as described below.

1.5 Consultation process

The Annual Plan took account of feedback from stakeholders, and was approved, along with the final costs to be levied, by the Minister of Conservation.

The collaborative processes used to develop the 2023/24 Annual Plan are as follows:

- Inshore observer coverage is based on a continuation of delivering objectives identified by a process conducted in preparation for the CSP Annual Plan 2023/24. This process was developed jointly by the CSP team at DOC and the Inshore Fisheries team at FNZ.
- Deepwater and Highly Migratory Species (HMS) observer coverage was developed jointly by the CSP team at DOC and the deepwater and HMS fisheries team at FNZ.

Key stages for stakeholder input, including formal consultation on this plan, were as follows:

22 December 2022	Updated medium term research plans, initial list of research proposals and CSP RAG prioritisation framework circulated to CSP RAG.
28 February 2023	CSP RAG meeting to discuss and prioritise initial research proposals.
15 March 2023	Additional feedback received from CSP RAG on research proposals and their prioritisation.
14 April 2023	Draft CSP Annual Plan 2023/24 released for public consultation.
15 May 2023	Public consultation period closed.
Early-June 2023	Summary of public submissions and response to comments completed.
Mid-June 2023	Director-General of Conservation conveyed the Conservation Services Programme Annual Plan 2023/24, amended in accordance with public submissions, to the Minister of Conservation for agreement.

1.6 Report structure

This report first describes the objectives and rationale for each project, then provides an update on project status and a summary of the key results and recommendations from the projects. A project logistics summary statement is included detailing the service provider, project budget (excluding administration costs) and review milestones. Additionally, a citation and weblink are provided to access the final research reports online.

[2] Available to download from: https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/plans-and-submissions/202324/final-csp-annual-plan-2023-24.pdf

Conservation Services Programme activities in 2023/24 were divided into three main areas:

1. Fisheries interactions projects
2. Population studies
3. Mitigation projects

2. Interaction Projects

2.1 Observing commercial fisheries

Project objective

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

Specific objectives

1. To identify, describe and, where possible, quantify protected species interactions with commercial fisheries.
2. To identify, describe and, where possible, quantify measures for mitigating protected species interactions.
3. To collect information relevant to identifying levels of cryptic mortality of protected species resulting from interactions with commercial fisheries.
4. To collect other relevant information on protected species interactions that will assist in assessing, developing and improving mitigation measures.

Rationale

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 contributes to the assessment 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 continued to purchase baseline services for offshore fisheries from Fisheries New Zealand Observer Services (Observer Services), given the scale of their operation, which allowed observers to be placed strategically across New Zealand Fisheries. For the purposes of providing costings, the rate provided by FNZ Observer Services has been used.

Project status

Observed protected species interaction data analysis is delayed and will be added to this report at a later date.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $1,221,685. Services were provided by Fisheries New Zealand Observer Services.

2.2 INT2021-04 Collection and curation of tissue samples from protected fishes and turtles

Project objective

1. To provide coordinated storage and curation of tissue samples collected from protected marine fishes and sea turtles by researchers, Fisheries Observers, and fishers.
2. To ensure all relevant meta-data is associated with each sample, that samples are accessible to bona-fide researchers, appropriate cultural controls on the use of samples are in place, and that the use of samples and publications arising from their use are tracked.

Rationale

Biological sampling or retention of carcasses of protected species taken as incidental bycatch in commercial fisheries can be difficult, particularly for large pelagic species such as basking sharks, great white sharks, devil rays and some turtles. In addition to operational constraints, health and safety considerations can make examination or necropsy of dead animals difficult or impossible. However, genetic and stable isotope analyses that use small tissue samples can provide valuable information on population structure, connectivity and size, and habitat preferences and feeding ecology, respectively.

Project status

Completed.

Summary of the methods and key findings

The Protected Species Tissue Archive (Fishes and Turtles) is currently held at Tāmaki Paenga Hira Auckland War Memorial Museum and has been running for 18 months. The archive is an extension of project INT2018-04, improving the collection of data and samples from bycatch basking sharks (Francis 2019, Finucci et al. 2021). It ensures appropriate curation of tissue samples obtained from protected fishes and turtles, improved visibility of and access to samples by researchers, and will track the fate of samples, as well as the outputs of research that they are used for

A total of 699 samples from 166 individuals of protected fishes and reptiles were curated in the tissue archive during the project (December 2021 – June 2024; Figure 1; Appendix A). Only 16 samples from six individuals were collected by the fisheries observer program. The Department of Conservation is currently working to give fishers authority to collect tissue samples from deceased specimens of fishes and reptiles, for vessels where no observers are onboard, and by doing so hope to significantly increase the sampling effort over time. As a result of the low numbers of samples initially received in this project, a decision was made by the Museum and the DOC Marine Species Manager to instead focus on existing samples held by the Department of Conservation and from Massey University.

During this project two loan requests have been completed in consultation with the DOC Marine Species Manager. One of tissue samples from sharks and rays (3 subsamples) to The University of Otago and the second of leatherback turtles (4 subsamples) to the Australian Museum.

The initial 3-years of the program has been a success over all, resulting in 699 tissue vials from 166 individuals. The Archive acts as a central repository for samples and their data that is managed long-term. The Protected Species Tissue Archive is an essential tool for ongoing protected species management in both NZ and Internationally. Museums are ideal places for tissue archives, providing

greater stability in the long-term care and management of collections. The Archive holds great potential to be expanded to other species groups such as protected and threatened fauna.

Recommendations

Recommendations include continuing and expanding the tissue archive, consolidating all tissue samples currently held by various locations by DOC, and provide for fishers to collect tissue samples from deceased specimens of bycatch protected fishes and reptiles.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $22,000 per annum over three years.

Review milestones

- Draft final report was made available on the CSP webpage in July 2024.
- Final report was made available on the CSP webpage in July 2024.

Citation

Bray, R. 2024. Collection and curation of tissue samples from protected fishes and turtles (2021-2024). INT2021-04 final report prepared for Conservation Services Programme, Department of Conservation. 33 p.

Weblink

Final report: INT2021-04 Collection and curation of tissue samples from protected fishes and turtles 2021-2024

2.3 INT2022-02 Identification of seabirds captured in New Zealand fisheries

Project objective

To determine which seabird species are captured in fisheries and the mode of their capture.

Rationale

Large numbers of seabirds frequent New Zealand waters. 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 age-class, sex and provenance of captured individuals requires necropsy in most cases. Historically, all dead seabird specimens collected by observers have been returned for necropsy where possible. However, in many cases, the taxon can be confirmed through expert examination of photographs taken by observers, and this can be achieved at a lower cost than returning carcasses and performing necropsy. To maximise cost efficiencies, a new protocol has been developed to determine which specimens are returned for full necropsy. This protocol aims to strike a balance between returning birds for full necropsy (for rarer species and in less observed fisheries) and photographing birds for determination of taxon (for commonly caught species in well observed fisheries). A new addition to this protocol is the collection of feather samples from bycaught seabirds to allow genetic determination of identification for difficult species groups.

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, 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 NZ 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.

Project status

Year 1 (2022/23) reporting is complete, Year 2 (2023/24) reporting is in progress and due in June 2025.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $80,000 per annum over three years.

Weblink

Year 1 (2022/23) final report: INT2022-02 Identification of seabirds captured in New Zealand Fisheries: 1 July 2022 to 30 June 2023

2.4 INT2022-03 Identification, storage and genetics of cold-water coral bycatch specimens

Project objectives

1. To confirm or update bycaught coral identifications determined at-sea by Fisheries Observers to the lowest taxonomic level (i.e., to assign codes to coral specimens at the species level wherever possible, or to genus or family level if not possible).
2. To record all identified coral specimens and their metadata (including haplotype/genetic data) and ensure storage of the physical specimens in an appropriate taxonomic collection.
3. To update relevant government coral identification and observer databases.
4. To update and provide input into coral-relevant resources for Fisheries Observers, including reference material and observer training.

Rationale

The overarching aim of this ongoing project is to continually improve information on the nature of coral bycatch reported and collected through the Fisheries Observer Programme. 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); stony corals (all species in the order Scleractinia); and hydrocorals (all species in the family Stylasteridae). Expert verification of coral bycatch that is difficult or inconsistently identified by 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, fisheries characterisations, benthic risk assessments, connectivity studies and management of benthic marine protected species.

Project status

Year 1 (2022/23) reporting is complete, Year 2 (2023/24) reporting is in progress and due in June 2025.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $80,000 per annum over three years.

Weblink

Year 1 (2022/23) final report: INT2022-03: Identification and storage of cold-water coral bycatch 1 July 2022 - 30 June 2023

2.5 INT2022-04 Risk assessment for protected corals

Project objectives

1. Develop a semi- or fully quantitative coral risk assessment model, incorporating updated coral distribution and abundance data.
2. Implement the model to determine relative risks and vulnerabilities of different coral taxa to fishing activity.

Rationale

The 2010 amendment of Schedule 7A of the Wildlife Act 1953 protects all hard corals and some soft corals in New Zealand waters, including: black corals (all species in the Order Antipatharia), gorgonian corals (selected species in the Order Alcyonacea), stony corals (all species in the Order Scleractinia) and hydrocorals (all species in the Family Stylasteridae). Nonetheless, a clear understanding of species-specific vulnerabilities and areas to fishing impacts remains elusive. The aim of this project is to undertake an inventory of applicable data, develop methodology for, and conduct a quantitative coral risk assessment, following on from a pilot risk assessment undertaken in 2014 (POP2013-05). The current lack of a risk assessment is noted as the most needed and important gap in the CSP Coral Plan and is a priority for CSP.

Project status

Year 2 in progress, due for completion in Nov 2024.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $75,000 per annum over two years.

2.6 INT2022-05 Determining the resilience of Fiordland corals to fisheries impacts

Project objectives

1. Increase understanding of the ecology and impacts of fishing on protected corals in Fiordland, including the black coral Antipathella fiordensis and stylasterid (lace) corals.
2. Improve our understanding of the distribution of Fiordland corals inside and outside of protected areas and determine patterns and likely routes of connectivity.
3. Use varied approaches (modelling, surveys, repeat monitoring of field stations) to inform our understanding of black coral resilience to fishing impacts and threats in Fiordland, which can then be applied to these taxa in a wider context.

Rationale

This research feeds into a wider Victoria University of Wellington study that aims to increase understanding of the ecology of protected corals in the Fiordland region and to determine how they will respond to environmental impacts, such as fishing, climate change, and changes in land use. The focus of the project will be the black coral species *Antipathella fiordensis*, with additional opportune sampling of stylasterid (lace) corals, both of which are protected and have widespread distribution within the fiords. The shallow distribution (and therefore accessibility) of *A. fiordensis* in Fiordland provides a unique opportunity to study and monitor it regularly in light of these pressures, and the species can then be used as a model to ascertain black coral resilience more widely. The CSP aspect of the project focuses on how they are impacted by fishing activity. Commercial fishing is prohibited in the inner waters of Fiordland, however, rock lobster potting and trawl fishing for blue cod is known to occur in the outer areas of the fiords, where *A. fiordensis* is abundant and there is virtually no fisheries observer presence.

Project status

Year 2 in progress. This is a multi-year project due for completion in June 2025.

Summary of the methods and key findings

Three research cruises in year 1 (to June 2023) were completed, and a further three cruises in year 2 (to May 2024) were completed. One, possibly two, further cruises are expected where data will be collected for this project in year 3.

In 2023/24 four main activities were undertaken:

1. The development of a Whole Genome Sequence for *Antipathella fiordensis*;
2. The collection of shallow and deep *A. fiordensis* samples from multiple sites in Fiordland for genetic analysis, and extracting DNA from these samples;
3. Collecting more *A. fiordensis* abundance data from deep and shallow locations in Fiordland; and
4. Securing the data for building a population model for *A. fiordensis*.

Project logistics summary statement

Year 1 and 2 of this project were 100% crown funded, year 3 was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $20,000 over three years.

Weblink

Year 1 progress report: INT2022-05 Determining the resilience of Fiordland corals to fisheries impacts 22/23 progress update

Year 2 progress update: INT2022-05 Determining the resilience of Fiordland corals to fisheries impacts 23/24 progress update

2.7 INT2023-02 Species identification of camera-detected protected species captures in New Zealand fisheries

Project objectives

1. To determine, through examination of camera footage clips, the taxon and, where possible, sex, age-class and provenance of protected species captured in New Zealand fisheries (for live captures or dead specimens discarded at sea).
2. To assess the taxonomic resolution of cameras during processing of camera footage.
3. To inform future process of delivery once cameras are fully deployed.

Rationale

The accurate determination of the taxon of protected species captured in New Zealand fisheries is vital for examining the potential threat to population viability posed by incidental fisheries captures. Historically, at-sea identification has been undertaken by Fisheries Observers, however with the rollout of cameras on inshore commercial vessels, experts will be required to assess records of protected species interactions captured via camera footage to identify species to the lowest possible taxonomic level. Data from this project will inform ongoing bycatch estimation, risk assessment, research, and modelling of the effects of fisheries bycatch on protected species populations. This project also acts as a pilot to assess the incoming information associated with having cameras on vessels, including the extent to which protected species can be identified (i.e., taxonomic resolution) from camera footage, as well as to project the anticipated scale of work once cameras are fully deployed. The outcomes of this project will identify any barriers to smooth operations and inform how protected species identification from camera footage is managed in the future. The project will also recommend any other areas for possible future analysis or investigation.

Project status

Delayed due to cross-government procurement procedures and scheduling conflicts.

Project logistics summary statement

This project was 100% MPI funded. The planned cost for the project was $60,000.

2.8 INT2023-03 Characterising surface longline fishing fleet behaviour for sea turtle bycatch

Project objective

To characterise and understand the behaviour of the commercial surface longline fishing fleet operating off the eastern North Island so that spatial mitigation strategies for turtles can be evaluated.

Rationale

This project builds upon outcomes from CSP project INT2021-03 (Review of commercial fishing interactions with marine reptiles). That project, and research subsequently conducted by NIWA (Dunn et al., submitted), has shown that a recent increase in leatherback turtle captures was most likely associated with a change in fisher behaviour. The change in fisher behaviour was unlikely to be related to turtles, but rather to a change in the fishing practices or distribution of the target species, tuna and swordfish. The 2020–21 fishing year saw a considerable increase in reported leatherback captures to 50 individuals, which is also likely to be an underestimate (Abraham et al., 2021; Dunn et al., 2022). Leatherback turtles around New Zealand most likely originate from the western Pacific population, which has been declining at an estimated rate of 6% per year (Martin et al., 2020). The total regional population, based on the annual number of nesting females, is poorly estimated but is likely to be around 2,000 individuals (Martin et al., 2020). Leatherback captures in New Zealand appear to be adults and therefore, assuming a 50:50 sex ratio, New Zealand captured perhaps 1.25% of the adult population in 2020–21 (Dunn et al., 2022).

Project status

Completed.

Summary of the methods and key findings

Leatherback turtles (Dermochelys coriacea) are the most frequently reported turtle bycatch in New Zealand commercial surface longline fisheries. Leatherback turtles are protected under the Wildlife Act 1953. This project updated the fishery captures of leatherbacks in New Zealand waters up to, and including, the 2022–23 fishing year and attempted to identify any temporal changes in fishing practices and/or catch composition associated with changes in leatherback bycatch.

Most surface longline fishing effort targeted southern bluefin tuna (*Thunnus maccoyi*), followed by bigeye tuna (*T. obesus*), and swordfish (*Xiphias gladius*). The surface longline fishery started in northern waters around October and moved south as the season progressed and waters warmed, returning to more northern waters as winter approached. In summer months, the southern bluefin tuna fishery extended to the southeast of the South Island, while the swordfish fishery occurred on the southeast North Island and west coast South Island. Bigeye tuna catches were centred further north, rarely extending beyond the Bay of Plenty and East Cape.

Leatherback captures have been centred in the Bay of Plenty. The leatherback spatial ‘hotspot’ and season (the ‘hotspot’) occurred between latitudes of 36° S and 38° S from January to April. Bigeye tuna, and then swordfish fishing, had the greatest spatial and temporal overlap with the leatherback hotspot. The southern bluefin tuna fishery had very little overlap. About 75% of the bigeye tuna catch, 80% of the swordfish catch, and almost all the southern bluefin tuna catch, ware taken outside of the

leatherback hotspot. The greatest leatherback captures were reported from 2021 when fishing effort was relatively low, but more focused on the east coast North Island than usual.

The fisheries characterisation using reported commercial catch and effort data indicated the strongest interaction was between leatherbacks and the fishery targeting bigeye tuna. An alternative analysis based on clustering of catch compositions produced a different result, with the strongest association being between leatherbacks and swordfish. This difference was because the reported target species did not always accurately describe the catch composition. The catch composition analyses did not isolate the Bay of Plenty region as a specific fishery subunit, meaning there was nothing apparently unique about the fishing in and around the leatherback hotspot.

A Generalised Additive Model (GAM) was developed to investigate the potential reasons for trends in leatherback captures in 2021. The GAM analysis was updated to 2023 with additional environmental and fisheries variables included and restricted to the east coast North Island. The updated GAM explained more of the variability in leatherback bycatch probability, but with a different set of predictor variables. The variables used were proximity to steep sea surface temperature (SST) gradients (fronts), mixed-layer depth, water depth, strength of the west-to-east current, number of hooks between floats (an alias for fishing depth), number of light sticks used between floats, and moon phase. Further GAMs predicting leatherback occurrence and fish catch rates from environmental conditions found the closest association was between leatherbacks and swordfish. A close association between swordfish catch rates and leatherback captures is consistent with international leatherback capture mitigation focusing on swordfish target fisheries.

Comparison of vessels reporting and not reporting leatherbacks was made and found the greatest difference was in location fished. Overall, fishing location was the most persistent and important factor determining the likelihood of a vessel capturing a leatherback.

Recommendations

- Leatherback size should be recorded wherever possible. There may be important differences in foraging behaviour between adults, which make regular migrations to nesting beaches, and juveniles, which do not.
- Further consideration of spatiotemporal closures to protect leatherbacks should be deferred until after the aerial survey has been completed in 2025.
- If a SDM is required for risk assessment and/or informing potential aerial closures, then research needs to be completed to identify the most robust SDM approach and data set, and variables should be included in SDMs only when they have plausible predicted effects.
- Variables describing distance from land or particular isobaths might be tested as potential additional predictor variables (DiMatteo et al. 2024) and as criteria for fished-area restrictions.
- A tool to show areas outside leatherback bycatch hotspots where target catch could be maintained for swordfish and tuna could be developed, similar to the US West Coast fisheries EcoCast product.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $50,000.

Review milestones

- Draft final report was made available on the CSP webpage and presented to the CSP TWG in July 2024.
- Final report was made available on the CSP webpage in August 2024.

Citation

Dunn, M.R., Finucci, B., Sutton, P., Pinkerton, M.H. (2024). Characterising surface longline fishing fleet behaviour in relation to leatherback bycatch. NIWA Client Report 2024214WN. 80 p.

Weblink

Final report: INT2023-03 Characterising surface longline fishing fleet behaviour in relation to leatherback bycatch

2.9 INT2023-04 Identification of marine mammals, turtles and protected fish captured in New Zealand fisheries

Project objective

To determine, primarily through examination of photographs, the taxon and, where possible, sex, age-class and provenance of marine mammals, turtles and protected fish captured in New Zealand fisheries (for live captures and dead specimens discarded at sea), and their mode of capture.

Rationale

The accurate determination of the taxon of marine mammals, turtles and protected fish 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 marine mammals, turtles and protected fish at sea with high precision and assessment of the age-class may require expert knowledge. Information gained through this project will link to Fisheries New Zealand databases and will inform ongoing bycatch estimation, risk assessment, research and modelling of the effects of fisheries bycatch on marine mammals, turtles and protected fish populations. This project is designed to complement the existing seabird and coral identification projects. Observers routinely collect samples of genetic material from these taxa which can be used to resolve uncertain identification determinations from photographs.

Project status

In progress.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $15,000 per annum over three years.

2.10 INT2023-05 High-resolution estimates of species diversity for a protected coral family commonly occurring as trawl bycatch

Project objective

To use high resolution genomic data to determine the first assessment of the number of species of *Paramuriceidae* (sea fans) in areas impacted by deep sea trawling.

Rationale

The diversity and relationships of protected octocoral species impacted by deepwater fisheries is not currently understood since morphological identification by Fisheries 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 continue to use genetic approaches to establish how many distinct and potentially new/cryptic species are present among octocoral bycatch and allow estimation of potential impacts of deep-sea trawling on octocoral diversity.

Project status

Complete.

Summary of the methods and key findings

Theme 1 of the CSP Medium-Term Research Plan (MTRP) for protected corals highlights requirements for species-level data in determinations of susceptibility to commercial fishing impacts. However, most protected gorgonian corals (*Cnidaria: Anthozoa: Octocorallia*) known to occur in the territorial seas of Aotearoa New Zealand have not been documented at species-level and many represent undescribed taxa. Sea-fans of the family *Paramuriceidae* are recognised as one of the most diverse groups of gorgonians within the EEZ but there are currently only two records of described species from this group, despite being a regular component of bottom trawl bycatch.

This research addresses Biodiversity and Distribution aspects of Theme 1 of the coral MTRP, using genetic delimitation of species distributed across spatially explicit regions relevant to commercial fishing. Genomic DNA sequencing using target-bait enrichment was applied to available specimens of *Paramuriceidae* held in the NIWA Invertebrate Collection, which were obtained from both bycatch and non-bycatch sources on the Chatham Rise (FMA4) and Campbell and Bounty plateaus (FMA6). DNA sequencing was used to determine the number of distinct taxa present in each region and examine fishing-related impacts on protected coral diversity. 51 specimens were successfully sequenced, and 32 distinct taxa were discriminated, including a distinct genetic lineage that may represent a new family of protected gorgonians. The two FMA regions shared representatives of most major lineages, but one lineage was confined to the Chatham Rise and members of the tentative new family were confined to the Campbell and Bounty plateaus, where they were obtained primarily as bycatch. Overall, all major genetic lineages were represented among sampled bycatch, except the lineage found only on the Chatham Rise. In combination with previous genetic characterisation, the current project brings the total number of genetically detected or confirmed protected octocorals represented in trawl bycatch to 43 taxa (genera and species) distributed amongst at least seven families (five described, one in question, one undescribed).

The continued use of genomic approaches in the characterisation of coral bycatch is supported by its ability to produce large amounts of data that can resolve relationships at multiple taxonomic levels, and its resilience to highly degraded sample sources. While current and previous studies support target-bait enrichment as an effective means of characterising identity and relationships of bycatch specimens, recent advances and cost reductions in whole genome 'skimming' make this an attractive method.

Recommendations

Recommendations for further research improvements in bycatch documentation and characterisation:

- Incorporation of larger UCE and genome skimming datasets from international studies, to resolve the taxonomic status of OTUs and place unrecognised families of protected gorgonians in broader context. Datasets have already been obtained and are ready for use (A. Quattrini, pers. comm.)
- Genetic characterisation of more reference and bycatch specimens of *Paramuriceidae*, to represent the breadth of genus-level diversity in New Zealand and improve distributional records for OTUs.
- Summarisation of distribution and taxonomic status (described vs. undescribed taxa) for well-documented taxa of gorgonian octocorals, and identification of taxa in need of further characterisation/study.
- Investigation into feasibility of incorporating biomass, frequency and genetic characterisation into bycatch documentation and associated considerations of fishing impacts.

Recommendations for operational considerations in bycatch characterisation and potential mitigation:

- Incorporation of uncertainty and potential for undocumented or cryptic species diversity in risk assessments and habitat suitability and hotspot modelling.
- Consideration of diversity (documented and cryptic) and potential for regional endemism when assessing fisheries impacts on protected gorgonian corals.
- Promoting increased coral bycatch sampling by fisheries observers and exploring means for reducing sampling logistics (e.g. eliminating cold-chain requirements in favour of dried specimens and ethanol-preserved vouchers/sub-samples).

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $58,000.

Review milestones

- Draft final report was made available on the CSP webpage and presented to the CSP TWG in July 2024.
- Final report was made available on the CSP webpage in September 2024.

Citation

Bilewitch, J. 2024. High-resolution estimation of species diversity for a protected coral family commonly occurring as trawl bycatch. INT2023-05 final report prepared by NIWA for Department of Conservation. 31 p.

Weblink

Final report: INT2023-05 High-resolution estimation of species diversity for a protected coral family commonly occurring as trawl bycatch

2.11 INT2023-06 Investigating the impact of fisheries on endangered hoiho diet, microbiome, and disease susceptibility

Project objective

The main research objective is to investigate the relationship between hoiho microbiome and susceptibility to illness and changing diet, as a result of bottom trawling fishing practices.

Rationale

Hoiho are classified as Nationally Endangered (NZCTS) and could be functionally extinct on the mainland of Aotearoa New Zealand within a few decades (Mattern et. al, 2017). Despite extensive conservation efforts to improve the status of the northern hoiho population (NZ South Island and Rakiura), progress has been impeded in part by poor animal health. In recent years disease has played a more significant role in the declining numbers of adults and chicks (Seddon et. al, 2013). Recent research has indicated major changes in hoiho diet over the last 30 years; whereas in the 1980s hoiho were feeding largely on small oily fish species such as sprat, immature red cod and āhuru, now blue cod, a fish very low in oil, makes up most of their diet (Young et. al, 2020). The reasons for this change remain unexplained, but fishing practices such as bottom trawling may have altered hoiho feeding habits. For example, GPS tracking suggests that some hoiho are following furrows carved by bottom trawlers, where the damaged ocean floor could be providing food for scavengers such as blue cod (Young et. al, 2020). Crucially, the loss of important prey species could play a role in the increased disease vulnerability in the Northern population. Moreover, rising sea temperatures can alter the microbiome of threatened species by reducing microbiome diversity and promoting opportunistic pathogenicity in previously benign microbial taxa (West et. al, 2019). Thus, fishing practices may be having a larger impact on hoiho health and survival than previously suspected. The recent changes in hoiho diet due to fishing practices, and exacerbated by climate change, may have led to an imbalance in the hoiho microbiome and, as a result, their susceptibility to disease. This research will determine links between hoiho diet, microbiome health and disease, and will inform conservation management approaches to ensure the continued survival of hoiho across their range

Project status

In progress.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $50,000 per annum over two years.

2.12 INT2023-07 Expert identifications of protected coral

Project objective

To determine the distribution and taxonomic composition to the lowest level possible of protected coral samples and data currently identified by parataxonomists and held by the NIWA Invertebrate Collection (NIC).

Rationale

A description of the full range of coral species diversity in the New Zealand region is incomplete, which impedes our understanding of the impacts of commercial fishing on coral diversity. This project would use expert identification of coral samples and descriptions of their geographic locations to produce identifications and maps at the lowest taxonomic level (mostly to species) for select coral groups. The project builds on POP2022-04 that prioritised identifications by parataxonomists to Family level.

Project status

Completed.

Summary of the methods and key findings

The work described here acts on a recommendation of the POP2022-04 'Deep diving into decades of uncatalogued corals' CSP project (Mills et al. 2023), by bringing an international taxonomic expert to New Zealand to confirm and revise identification of protected coral specimens in the NIWA Invertebrate Collection.

Dr Kirrily Moore (KM) from the Tasmanian Museum and Art Gallery, is a taxonomic expert in deep-sea coral species in the gorgonian octocoral families *Mopseidae* and *Victorgorgiidae*, plus genera previously contained in family *Anthothelidae*: *Anthothela*, *Icilogorgia* and *Solenocaulon* (genera now reassigned to families *Alcyoniidae* and *Melithaeidae*). During her visit (24 June–5 July 2024), Dr. Moore identified 240 sample jars (295 colonies) and taught the higher-level identification of these gorgonian groups at a workshop held at the NIWA Wellington campus on 4 July 2024.

Amongst the samples identified were ten described species, six new genera and 15 new species, collected from within the New Zealand Exclusive Economic Zone. There is still work to be done to verify some of the identifications with genetic analyses, and eventual taxonomic descriptions of the identified new genera and species is required. The identifications completed for this project add to and improve our knowledge of protected coral fauna in the New Zealand region and wider region within Australian, International, and Antarctic waters that connect to our zone.

Recommendations

The project team recommend that two new family level MPI species codes are created for the families *Keratoisididae* and *Mopseidae*, and that the taxonomic name and descriptive notes are updated for the code AND, which currently represents the anthothelid corals. We also recommend that additional protected coral taxonomic experts are invited to New Zealand in future to continue to identify and describe under-studied octocoral groups where we have a lack of understanding of the genus and species level diversity.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $30,000.

Review milestones

- Dr. Moore's visit to undertake the research and host a workshop was held from 24 June – 5 July 2024
- The draft final report was made available to CSP in July 2024.

Citation

Mills, S., Bilewitch, J., Moore, K. (2024) INT2023-07 Expert identifications of protected corals: Mopseidae, *Anthothela*, *Victorgorgia* and kin. Prepared for Conservation Services Programme, Department of Conservation NIWA Client Report 2024234WN. 56 p.

Weblink

Final report: INT2023-07 Expert identification of protected corals: Mopseidae, Anthothela, Victorgorgia and kin

2.13 INT2023-08 Albatross diet: composition of natural prey versus fisheries bait/waste

Project objective

1. Identify prey (species level) from existing albatross scat/stomach samples using established DNA metabarcoding techniques for dietary analysis.
2. Obtain information on vessel bait/discard species in the surface longline fishery (SLL) from the FNZ Centralised Observer Database and compare with DNA results to identify proportion of naturally foraged vs fisheries related prey.
3. Conduct a literature review and use findings from the current study to inform current knowledge about the reliance of albatross on fishing vessels for foraging, especially during breeding season.
4. Develop recommendations for future work that could better inform seabird bycatch risk assessment and identify potential for improved mitigation efforts to reduce attractiveness of vessels to seabirds.

Rationale

During breeding season, albatross alter their foraging behaviour and typically exhibit shorter flight durations to reduce time spent away from nests. It is well understood that fishing vessels are supplementary food sources and provide an easy foraging option, especially if found in areas nearer to breeding colonies. What is less understood are the impacts to albatross populations if adult birds incubating or feeding chicks are increasing their reliance on fishing vessels as food sources. Dietary plasticity resulting in increased interaction and reliance on vessels correlates with increased risk of bycatch. For breeding birds, this has extremely poor outcomes for the egg or chick left in the nest and therefore the breeding population, given the k-type reproductive characteristics of albatross species. Fisheries management actions to deter albatross interactions with vessels, particularly in the SLL fishery, include mitigation efforts to reduce bait depredation (e.g., hook-shield devices) and implementation of policies around managing vessel waste and fish discards to reduce attractiveness of vessels to seabirds. It is important to monitor changes in foraging preference (i.e., reliance on fishing vessels vs naturally foraged food) to better inform risk assessment and mitigation for albatross species. Previous methods to study diet have largely been done at a trophic level (e.g., stable isotope analysis) or via gross morphological studies (e.g., fish, squid). By using DNA metabarcoding to identify prey at a species level, and using easily obtainable scat samples, we can extrapolate far more detail than has previously been achieved. This is an exciting new area of research to help better inform both conservation and fisheries management for vulnerable albatross species.

Project status

Completed.

Summary of the methods and key findings

Seabird injury or mortality caused by interactions with New Zealand commercial fishing activities is a major conservation concern with the majority of interactions occurring in the surface longline (SLL) and trawl (TWL) fisheries. Albatrosses (*Diomedeidae*) are among the most threatened seabirds and the majority of these long-lived, large seabirds have broad geographic ranges. Seabirds are attracted to fishing vessel activity as an additional food source and this puts them at risk of interacting with vessel structures and fishing gear. This includes incidental capture whilst feeding on bait and discards.

It is not clear to what extent the diet of albatrosses consists of naturally foraged prey in comparison to fisheries bait/waste associated with fishing activity, and ultimately their reliance on commercial fisheries as a food source.

In this dietary study, scat from colony birds and stomach contents from necropsy samples (commercial fishing mortalities) were used to detect taxa consumed by 10 albatross species using DNA metabarcoding. Scat samples (n=86) were opportunistically collected from four subantarctic islands between January 2019 to April 2024. Albatross necropsies (n=72) took place from September 2022 to February 2024. Based on the frequency of occurrence, the diet among all albatross samples consisted largely of fishes (> 50% deep-sea and beyond known albatross diving depths) and to lesser extent cephalopods. Differences in prey diversity (higher in necropsy samples) were found to be significant between sample type, however, no specific prey species were found to be responsible for this difference. Observer and fisher reported bait and discard species were predominantly squid and mackerel.

Overall, the majority of fish and cephalopod species identified in both colony scat and necropsy samples overlapped extensively with species that were most likely to be made available through SLL and TWL fisheries activities, i.e., discard/species targeted/bait used. These results suggest that albatrosses are heavily reliant on fisheries as a food source whether they were sampled from fishing vessels (i.e., necropsy) or from nesting sites (i.e., scats).

Recommendations

- Improved data collection on specific bait species in the COD
- Future species-specific DNA diet studies using GPS tracking of breeding pairs in conjunction with scat collection and overlaid with fishing vessel activity
- Biochemical analysis of the nutritional composition of wild versus fisheries derived prey supported by reconciliation of existing catch and processing data from 1990
- Retain all albatross bycatch from the deepwater trawl fishery
- Provide COI sequence data to GenBank for all albatross species to increase species matches
- Further develop the methodology for DNA genetic sex identification in albatrosses and ground truth with morphological examinations
- Greater auditing of low observer coverage fisheries to look for improvements in management practices to further reduce vessel attraction to seabirds around discard / fish waste.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $40,000.

Review milestones

- Draft final report was made available on the CSP webpage and presented to the CSP TWG in October 2024.
- Final report was made available on the CSP webpage in November 2024.

Citation

Van der Reis, A.,Tham, F.F., Jeffs, A. 2024. Albatross diet: Composition of natural prey versus fisheries bait/waste. INT2023-08 final report prepared for Conservation Services Programme, Department of Conservation. 42 p.

Weblink

Final report: INT2023-08 Albatross diet: Composition of natural prey versus fisheries bait/waste

2.14 INT2023-09 Understanding the extent and usage of coral rubble reporting codes by fisheries observers

Project objective

To improve our understanding of coral rubble reporting by Fisheries Observers, and to use those findings to inform current understanding of the distribution of and target fisheries involved in bycatch of coral rubble.

Rationale

This project will help us to understand the extent and accuracy of coral bycatch reporting of coral rubble and to determine any necessary refinements to observer reporting guidelines, or to develop post-collection data grooming steps that improve coral reporting accuracy.

Project status

This project was cancelled due to delays and funds will be returned to industry.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $30,000.

2.15 INT2023-10 Understanding coral bycatch – assessing large catches

Project objective

To improve our understanding and ground truthing processes for reporting of coral bycatch by Fisheries Observers, and to assess and map reported large catches (e.g., 500 kg–1 tonne/event or trip).

Rationale

For reports of large coral bycatch events, it is difficult to disentangle what is feasible but unlikely from what is potentially erroneous; closer examination of such reports will improve understanding of the extent of genuine large catches. These outputs could inform management efforts and build a more confident picture of coral bycatch across the EEZ.

Project status

Delayed, due for completion June 2025.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $40,000.

3. Population Projects

3.1 POP2021-04 Flesh-footed shearwater population monitoring

Project objectives

1. To collect key demographic parameters of flesh-footed shearwater at Lady Alice Island/Mauimua and Ohinau Islands, especially juvenile survival and recruitment.
2. To estimate the current population size of flesh-footed shearwaters at Tītī Island, Marlborough Sounds.

Rationale

The CSP Seabird medium term research plan (CSP seabird plan) 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 extends on the work initiated under POP2015-02 and continued under POP2018-04 to address priority population estimate gaps and better estimate key demographic rates of this at-risk species, including new information about juveniles. Previous reports recommended that recapture efforts of breeding adults and non-breeders need to be consistently large scale to provide a robust mark-recapture dataset. Tītī Island, Marlborough Sounds, has not been monitored for shearwaters for almost a decade. A repeat survey of this sole Cook Strait breeding colony will inform recent population trends in this region.

Project status

Complete.

Summary of the methods and key findings

During the 2023/24 season 263 and 291 study burrows were monitored on Ohinau Island and Lady Alice Island respectively. Of these 71.5% and 71.8% were breeding burrows for Ohinau and Lady Alice respectively. 61% of breeding birds in burrows on Ohinau Island were identified and 86% of burrows on Lady Alice Island.

Determining breeding success was not a deliverable for this season. On Ohinau, 5.1% of chicks which have been banded since monitoring began have been recaptured at the colony and on Lady Alice 11.8% of banded chicks have been recaptured.

Burrow transects were carried out on both Ohinau Island and Lady Alice Island to gather data for an updated population estimate for these islands. On Ohinau, 116 transects, each aiming to cover 40m², were completed within eight different colonies on the island. It is estimated that there are a total of 3,722 occupied breeding burrows (1,881 – 5,566, 95% CI) on Ohinau Island which is a decrease of 4.17% since 2018. On Lady Alice Island 323 transects were completed within nine colonies. It is estimated that there are a total of 2,367 occupied breeding burrows (1,431-3,303, 95% CI) which is a decrease of 26.4% since 2019.

Tracked adults from Lady Alice foraged in similar areas to previous years during incubation. Travelling around the west coast of the North Island and out to the Louisville Seamount Chain. Birds were undertaking reasonably long trips with an average of 13 days. No devices were retrieved from Ohinau Island, with adults being away for 12 days or more.

Fledging chicks tracked from Tītī Island travelled north through the Pacific, taking two routes either east or west up the North Island and then into the South Pacific Ocean, migrating past Vanuatu, New Caledonia and the Solomon Islands. This work reveals that there is a clear demarcation of migration routes between different populations of flesh-footed shearwater fledglings within New Zealand (at least within the first 30 days after fledging). In previous years, fledging chicks tracked from Ohinau Island maintained a migration route along the Kermadec/Tongan Trench.

Recommendations

- Population monitoring on Ohinau and Lady Alice Islands be continued with 200 breeding study burrows monitored annually over two expeditions (Dec/Jan and Apr/May).
- The number of burrowscope burrows monitored annually continue to be 50 on each island.
- There is continued, focused effort to band and recapture as many flesh-footed shearwaters on the surface and in burrows on both islands.
- Tītī Island, Marlborough Sounds, be considered as a potential future monitoring location.
- Repeat population estimates on Ohinau Island, Lady Alice Island and Tītī Island be undertaken as soon as possible.
- Other breeding colony sites for flesh-footed shearwaters be considered for population estimates.
- Future tracking should use lighter devices with a maximum of 2.5% device body weight and be undertaken at Lady Alice, Ohinau and/or Tītī Islands.
- Trial harnesses for chick tracking.
- A survival analysis be undertaken to estimate adult survival on each island.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry and 50% Crown funded. The planned cost for the project was $60,000 for Year 1 and $70,000 for Year 2 and Year 3.

Review milestones

- Draft final report was made available on the CSP webpage and presented to the CSP TWG in July 2024.
- Final report was made available on the CSP webpage in September 2024.

Citation

Ray, S. Burgin, D., Lamb, S., Olsthoorn, M. 2024. Toanui/flesh-footed shearwater population monitoring and estimates: 2023/24 season. Unpublished Wildlife Management International Technical Report to the Department of Conservation. 58 p.

Weblink

Year 1 (2021-22) reports:
POP2021-04: Flesh-footed shearwater population monitoring and estimates: Ohinau and Lady Alice Island 2021/22
POP2021-04: Flesh-footed shearwater population monitoring and estimates: Titi Island 2021/22

Year 2 (2022-23) report:
POP2021-04: Flesh-footed shearwater population monitoring and estimate: Ohinau Island 2022/23

Year 3 (2023-24) report:
POP2021-04: Flesh-footed shearwater population monitoring and estimate: 2023/24

3.2 POP2022-01 Black Petrel population monitoring

Project objectives

1. To continue monitoring the key demographic parameters at the breeding colony of this threatened seabird to reduce uncertainty or bias in estimates of risk from commercial fishing.
2. To continue at-sea capture-recapture of black petrels to determine proportions of banded birds and identify if the current low juvenile survival rates are affected by any non philopatric behaviour at the study colony.
3. To update model estimates of key population demographic estimates and population size based on results from at-sea mark-recapture.
4. To satellite track juvenile black petrels for at least the full first year post-fledging.

Rationale

The CSP Seabird medium term research plan (CSP seabird plan) 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. Black petrels are the species at highest risk from commercial fisheries in northern New Zealand. The project builds on previous CSP project POP2021-01. Continuing research on this species is necessary to provide current estimates of adult survival, juvenile survival, recruitment, breeding probability, and breeding success. Continued at-sea captures are necessary to generate sufficient sample sizes for the independent estimation of population size and juvenile survival. New lightweight tracking tags allow for the tracking of juvenile dispersal and migration, a poorly understood cohort.

Project status

This is a multi-year project due for completion in June 2025. Year 2 (2023/24) reporting is complete.

Summary of the methods and key findings

Black petrel monitoring on Aotea /Great Barrier Island

During the 2023/24 breeding season, 482 tākoketai study burrows were monitored at Mt Hobson/Hirakimata on Aotea. Of these, 306 (63.5%) were occupied by breeding pairs, 58 (12%) by non-breeding birds, and 118 (24.5%) were unoccupied. A total of 222 chicks were produced from study burrows, representing a fledgling success rate of 72.5%, though this may drop to 70.9% due to underweight chicks.

Nine census grids accounted for 199 of the inspected study burrows, with 120 occupied by breeding pairs and 86 chicks produced, resulting in a fledgling success rate of 71.7%, potentially reducing to 69.2% due to poor chick condition.

During the season, 700 adults and 223 fledgling chicks were captured, with 274 adults and 223 chicks banded. Nocturnal surveys over the past three seasons increased to 6-8 hours nightly, resulting in higher recapture rates compared to ad-hoc and at-sea surveys.

A total of 461 returned chicks have been recaptured since they were banded prior to fledging, of which 126 were identified in the 2023/24 season. Monitoring of feral pigs and predators showed rat

presence but no feral cat predation. Continued pest control is essential to protect the tākoketai population.

At sea captures

This at-sea capture project continues work started in 2022 to look at survival and return rates of juvenile black petrels not visiting the main study areas. Capture, mark-recapture of black petrels in the Hauraki Gulf will also provide information from a random sample of birds away from the study colonies to help estimate current population size of this species. This report provides details of the methods used to capture black petrels, comments on what worked and what did not, and includes photographs illustrating the methods used.

Recommendations

Black petrel monitoring on Aotea /Great Barrier Island

- Continue intensive population monitoring on Aotea with three seasonal visits to track trends and impacts.
- Conduct multiple-night expeditions for nocturnal surveys to assess juvenile survival and recapture rates.
- Sex all tākoketai during recruitment expeditions and in study burrows to identify sex biases and survival differences.
- Perform consistent mark/recapture sessions over several nights to estimate population size.
- Undertake transect surveys across core tākoketai habitat to update population estimates.
- Implement satellite tracking of chicks to South American waters to determine migration routes and risks.
- Explore collaborative at-sea capture expeditions in Ecuador to assess juvenile presence and risks.
- Investigate colony areas at risk from rainfall events for climate resilience assessment.
- Model the effects of age, age differences in pairs, and experience on breeding success.
- Compare breeding success in public vs. non-public access areas to evaluate human disturbance impacts.
- Continue investigating predator deterrence methods, focusing on feral pigs and cats at Cooper's Castle.

At sea captures

- Continue using the net gun method for captures to reduce reliance on attracting birds to the main boat.
- Extend the capture season to the end of April, considering budget constraints and potential drop-in capture rates as non-breeders depart.
- Target events where black petrels feed with cetaceans to improve capture success and investigate this feeding association.
- Capture black petrels further offshore and in areas beyond Aotea to enhance population estimates.
- Maximize data return by taking blood and feather samples for additional analyses during captures.
- Preserve regurgitated samples for dietary analysis to understand prey targeting throughout the breeding season.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry and 50% Crown funded. The planned cost for the project was $70,000 for year 1 and $100,000 for year 2 and 3.

Review milestones

- Draft final report was made available on the CSP webpage and presented to the CSP TWG in July 2024.
- Final report was made available on the CSP webpage in September 2024.

Citation

Bell, E.A.; Lamb, S. & Ray, S. (2024). Key demographic parameters and population trends of tākoketai/black petrels (Procellaria parkinsoni) on Aotea/Great Barrier Island: 2023/24. Unpublished Wildlife Management International Ltd. Technical Report to the Conservation Services Programme, Department of Conservation, Wellington. 67 p.

Weblink

Year 1 report:
POP2022-01 Key demographic parameters and population trends of tākoketai/black petrels on Aotea/Great Barrier Island 2022/23

Year 2 reports:
POP2022-01 Key demographic parameters and population trends of tākoketai/black petrels (Procellaria parkinsoni) on Aotea/Great Barrier Island: 2023/24
POP2022-01 Black petrel population monitoring - at sea captures
POP2022-01 Black petrel population monitoring - at sea captures addendum

3.3 POP2022-02 Flesh-footed shearwater juvenile survival and dispersal

Project objectives

To track juvenile flesh-footed shearwaters to determine whether they are utilising the same foraging areas as breeding adults during their first year at sea.

Rationale

This project supplements current population monitoring under project POP2021-04 to fill additional data gaps utilising cost-saving synergies with the CSP project on Ohinau Island. This new project involves satellite tracking juvenile FFSW for at least the full first year post-fledging, using new lightweight solar powered tags. This will allow for the opportunity to improve our understanding of the at-sea range of this poorly understood cohort of birds and how they might overlap with fisheries throughout the annual cycle. One previous attempt to track juvenile flesh-footed shearwaters was not overly successful. The birds flew north to the tropics but then the tags progressively stopped working around one month post deployment. It was uncertain if the tags fell off the birds, or the tag interfered with birds' survival, or if the birds encountered high risk fisheries in the central tropics (tuna longline fisheries). There has been a lot of development of tracking technology in the past five years with new lightweight tags and different attachment methods that allow birds to be monitored across multiple years.

Project status

Completed.

Summary of the methods and key findings

Seven nearly fledged flesh-footed shearwater chicks on Tītī Island (Marlborough Sounds) were fitted with Lotek Sunbird satellite tags on 8 May 2024. The original plan was to attach these tags using a wing harness design used on other seabirds. In the field it was found that the prominent sternum on the breast of this species could create problems for these birds and made using this design of harness unsuitable for long term deployment. Instead, the tags were attached to the central back feathers with a standard tape on attachment method. These tags had a solar panel and were expected to last for up to a year.

Six fledglings tracked from Tītī Island travelled north through the western Pacific (one tag failed around departure time). The birds took two routes, either east or west up the North Island and then into the South Pacific Ocean, migrating past Vanuatu, New Caledonia and the Solomon Islands. The birds reached an area with high densities of surface longline fisheries east of Vanuatu. All tags ceased transmitting within 2 months for unknown reasons. This work reveals that there is a clear demarcation of migration routes between different populations of flesh-footed shearwater fledglings within New Zealand (at least within the first 30 days after fledging). In previous years, fledging chicks tracked from Ohinau Island maintained a migration route along the Kermadec/Tongan Trench and reached the equatorial central Pacific with one bird travelling as far east as Tahiti.

The results of this project and POP2021-04 Flesh-footed shearwater population monitoring were merged into one report which is cited below.

Recommendations

Trial harnesses for chick tracking.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $30,000 per annum for two years.

Review milestones

- Draft final report was made available on the CSP webpage and presented to the CSP TWG in July 2024.
- Final report was made available on the CSP webpage in September 2024.

Citation

Ray, S. Burgin, D., Lamb, S., Olsthoorn, M. 2024. Toanui/flesh-footed shearwater population monitoring and estimates: 2023/24 season. Unpublished Wildlife Management International Technical Report to the Department of Conservation. 58 p.

Weblink

POP2021-04: Flesh-footed shearwater population monitoring and estimate: 2023/24

3.4 POP2022-03 Deep-sea protected coral reproduction study

Project objectives

1. Address knowledge gaps in reproductive strategies for protected coral species in the New Zealand region.
2. Use available life history and reproductive data to inform relative productivity/vulnerability parameters for relevant concurrent and future research.

Rationale

New Zealand has a rich complement of diverse and abundant deep-sea corals, yet very little is understood regarding their life history traits. Such data are important to understand potential population longevity and connectivity, as well as vulnerability and resilience to physical impacts such as those caused by bottom trawling. This project will examine coral reproductive strategies from archived specimens in the NIWA Invertebrate Collection to improve our understanding of the reproductive ecology of corals. This project follows on from DOC project BCBC2020-01 that demonstrated high levels of variability in reproductive modes employed by corals and will address knowledge gaps for key species in the New Zealand region. Results from this project can be combined with other life history data to inform and improve estimates for productivity parameters in a full Risk Assessment, can inform spatial models and biophysical dispersal models, can feed into coral recovery studies, can be considered alongside video imagery to inform site or population-specific reproductive outputs, and can act as a proxy for vulnerability assessments.

Project status

Completed.

Summary of the methods and key findings

The report builds on a previous literature review of the reproductive and larval processes of New Zealand protected deep-sea corals. In this review, the following species were identified as suitable for future reproduction studies: the stony cup coral *Desmophyllum dianthus* (Order Scleractinia), the stony branching reef-forming corals *Goniocorella dumosa* and *Enallopsammia rostrata* (Order Scleractinia), and the Scleralcyonacea gorgonian octocorals *Primnoa notialis* and *Paragorgia arborea*.

Within the current project, histological methods were used to understand reproductive strategies for the above species, together with additional histological samples of black corals (Antipatharia) and Hydrocorals (Stylasteridae), to attempt to obtain reproductive information covering all protected coral groups. It was confirmed that *G. dumosa* and *E. rostrata* collected within New Zealand are gonochoric (single sex within a polyp), with both species having either male or female specimens (i.e., all polyps on a specimen were the same sex).

It was also confirmed that *G. dumosa* is a brooder in wild populations on the Chatham Rise, a reproductive mode whereby gametes are fertilised and develop internally into larvae before being released into the surrounding water. Stage IV oocytes were present throughout the year and the limited number of male specimens examined had mature stage IV spermiaries present in both seasons sampled (April and August). We conclude, from the limited seasonal spread of available data, that there was no evidence of reproductive periodicity in *G. dumosa* and that it may have the ability to reproduce year-round when environmental conditions are favourable. Previous observations of larvae

in aquaria from September to November 2020 (Beaumont et al. 2024), and with a consistent food supply, support this theory.

Although there was a limited seasonal spread of data for *E. rostrata*, there was no evidence of seasonality with mature or maturing oocytes present in all female specimens examined (sampled in April, June and August). There was no evidence of larvae nor brooding and as such, *E. rostrata* are considered broadcast spawners. Mature (stage IV) spermaries were observed in male specimens from all seasons sampled (April, June and August). We, therefore, suggest that *E. rostrata* could be a continuous or aperiodic spawner, rather than a seasonal spawner, though further sampling would be required to confirm this.

E. rostrata had a lower estimated fecundity than *G. dumosa* though they had a similar sized maximum oocyte diameter (although morphologically there are differences as *E. rostrata* oocytes are long and thin and *G. dumosa* are more rounded). However, *E. rostrata* is considered likely to be a broadcast spawner and *G. dumosa* a brooder. This goes against the general assumption that brooders have fewer but larger oocytes/larvae.

The inclusion of black corals (Antipatharia) and hydrocorals (Stylasteridae) in this study were as a trial only to assess the quality of histological sections that could be prepared from fixed specimen samples in order to enable clear observations of reproductive data. Our trials on the black corals *Leiopathes bullosa* and *Sibopathes sp.* showed that it will be possible to assess the reproductive state of future sections of these species. However, hydrocorals proved problematic due to their extensive calcification, with more than 95 % of the animal being comprised of hard carbonate skeletal matrix and therefore difficulty in obtaining adequate tissue for examination.

The histological analyses of the stony cup coral *Desmophyllum*, and the two gorgonian octocoral species *Paragorgia* and *Primnoa* planned for this study are being carried out by a PhD student at the University of Gothenburg, but these results have been delayed, and as such will be added to this report as an addendum when available (expected early 2025).

Specimens used within this study were historic (some dating back to 2000) and many had not been preserved with histological analyses in mind. While we were able to get some data from all specimens used, in some cases the quality of data was compromised by the quality of histological sections. In addition, the variability observed in reproductive data between polyps and specimens highlights the importance of replicate samples across multiple time points when investigating reproductive mode, seasonality and fecundity. We recommend that, where possible, deep-sea coral specimens are collected and placed into an appropriate preservative to enable further histological analyses to address knowledge gaps.

There remain questions regarding the reproduction of corals that can only be addressed by observations of live animals, such as larval behaviour, pelagic larval duration and settlement preferences.

These data and results have been communicated to relevant concurrent research projects (e.g., INT2022-04, risk assessment for protected corals) where they have been used to help evaluate scores for productivity attributes in Productivity Susceptibility Analyses (PSA). In addition, they will inform future research to support risk assessment and development of appropriate management options.

Recommendations

- Further histological analyses could elucidate seasonality and reproductive mode where this is not yet known. The variability observed in reproductive data between polyps and specimens highlights the importance of replicate samples across multiple time points. Specimens should be placed into an appropriate preservative to enable future histological analyses to address remaining knowledge gaps.
- Increased knowledge of environmental cues for settlement and recruitment are necessary to improve how we interpret the reproductive parameters in a risk assessment context. At present the best we can do is assume an even distribution of suitable habitat but know this isn't the case in the real world; further experimental laboratory studies could be a practical way to advance our knowledge about settlement cues (and larval behaviour and pelagic larval duration which are important aspects in determining dispersal potential).
- Analyses should be broadened to include more of the key coral groups that are able to be identified from imagery and hence used in abundance-based habitat-suitability models as applied in INT2022- 04: e.g., the stony corals *S. variabilis* and *M. oculata*, as they are key seamount species, and black corals as they also appear to have variable longevity and growth rates with region and species.
- An improved understanding of reproductive variability within higher taxonomic categories (e.g., at the species level) is especially important if risk assessment starts being carried out at smaller spatial scales, where the taxa will differ between such areas.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $40,000 per annum for two years. During year two of this project an extra $8,000 was added to the project and the reporting milestones delayed slightly to accommodate unforeseen cost and time increases.

Review milestones

- Draft final report was made available on the CSP webpage and presented to the CSP TWG in July 2024.
- Final report was made available on the CSP webpage in September 2024.

Citation

Beaumont, J., Marriott, P., Connell, A., Moreno Moran, D., Waller, R., Tracey, D. and Clark, M. 2024. Protected coral reproduction. POP2022-03 final report prepared by NIWA for Conservation Services Programme, Department of Conservation. 64 p.

Weblink

POP2022-03 Protected coral reproduction study

3.5 POP2022-08 Auckland Islands seabird research: Gibson's and white-capped albatross

Project objectives

1. To monitor the key demographic parameters of Gibson's albatross and white-capped albatross to reduce uncertainty or bias in estimates of risk from commercial fishing.
2. To estimate the population size of Gibson's albatross.
3. To describe at-sea distribution of Gibson's albatross and white-capped albatross.

Rationale

This proposal delivers key components of the CSP Seabird Plan involving field work on Gibson's albatross and white-capped albatross. A long-term study site for Gibson's albatross at the Auckland Islands has enabled trends in population size and demographic parameters to be assessed (Francis et al. 2012; Elliott et al. 2018). The largest population of white-capped albatross occurs on Disappointment Island in the Auckland Islands 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 white-capped albatross population study has primarily been an add on to the research programme on Gibson's wandering albatross, which has constrained the project in terms of limited days spent on white-capped albatross data collection.

Project status

This is a multiyear project due for completion in June 2025. Year 1 (2022/23) and Year 2 (2023/24) reporting is complete.

Summary of the methods and key findings

Gibson's albatross

Breeding success in 2023 was close to the mean (60%) though chick development was slower and fledging later than usual. The number of nesting pairs in three representative census blocks in 2024 was the lowest it has been since the 2006 population crash, likely due in part to the relatively high numbers nesting the previous summer. However, there are signs the number of breeding pairs of Gibson's wandering albatross is again in decline (2016 to present) after a slow but nearly significant growth rate for the decade 2006–2015.

The satellite transmitters taped to the back feathers of 22 juvenile Gibson's wandering albatross in December 2022 remained attached for an average of 291 days with the longest lasting 540 days, much longer than transmitters on adults, presumably because juveniles delay their first moult. Juveniles were found to spend much more time than adults foraging in tropical waters north of 30 degrees (2.4% cf 0.6%), which means juveniles have greater exposure to interactions with tuna longline fishing fleets. Two of the juveniles wearing transmitters appear likely to have been caught by longliners in winter 2023, one near an Australian-flagged vessel off Queensland within the Australian EEZ and one near a Chinese Taipei-flagged vessel in the high seas north-east of New Zealand. Twenty adult Gibson's wandering albatrosses were fitted with satellite transmitters in late December 2023, of which one breeding female was almost certainly caught in June 2024 in the mid Tasman Sea by a longliner flagged to Chinese Taipei.

Drone photographs were taken of 63% of the 4,040 ha of Gibson's wandering albatross breeding habitat on Adams Island, and the number of albatrosses on the ground seen in the photographs were counted. Concurrent ground calibration checks undertaken to determine the proportion of birds on the ground which had eggs provided a "correction factor" which varied from 30% to 88% depending on area and time of day, with an average 54% of birds on the ground having a nest with an egg. After correction for pretend breeders and failed nests, a total of 3,348 breeding birds were counted in the 2,565 ha of albatross habitat which was successfully droned, an area which in the past supported 80% of the population. Assuming the distribution of albatrosses has not changed, an estimated 4,181 pairs of Gibson's wandering albatrosses were breeding on Adams Island in 2024.

The western and eastern extremities of Adams Island are still to be droned; this will be undertaken in January 2025, when some of the already counted parts of the island will be re-counted, to account for differences due to interannual variation.

White-capped albatross

White-capped albatrosses are the most frequently incidentally bycaught albatross species in New Zealand commercial fisheries. The species ranks highly in New Zealand Government risk assessment, with uncertainty around the estimate of adult survival. A white-capped albatross mark-recapture study was established on Disappointment Island in January 2015 to improve estimates of adult survival, and other key population demographic parameters. A 3.5-day research trip to Disappointment Island was conducted 18–21 January; the tenth visit to the island for white-capped albatross survival rate research. Annual survival rates for white-capped albatrosses vary substantially year-on-year, ranging between 0.83 ± 0.06 (± SE) in 2015 to 0.96 ± 0.03 in 2020. Mean annual survival over that period was 0.89 ± 0.04 (excluding the estimate for 2018 which had particularly high variance). Robust estimates of survival and productivity of white-capped albatross require continued visits to Disappointment Island. Banding should be a high priority to ensure the core mark-recapture study is not compromised, since precision of survival estimates is reliant on it. Tracking devices, and cameras to assess productivity, were also recovered and deployed.

Recommendations

Gibson's albatross

- Monitoring the size of the population and its structure and trend on Adams Island remains a priority, as does more tracking to better understand the overlap and interaction of Gibson's albatross with longline fishing fleets to help understand causes of population changes.
- Population trends are best assessed from the mark-recapture study, and from the counts of parts of the island that are easy to census accurately and have been repeatedly censused.
- To obtain an updated population size estimate, census of the nesting population on Adams Island using drones showed the technique worked well and should be completed next summer.

White-capped albatross

- Continue visits to Disappointment Island for robust survival and productivity estimates of white-capped albatross.
- Prioritize banding to ensure the core mark-recapture study's precision.

- Extend annual trips for thorough resighting, banding, and other objectives (e.g., nest cameras, trackers, drone trials).
- Reinstate annual nest counts to complement survival data.
- Use drone photography for wider Castaways Bay colony coverage and count nests in orthomosaics.
- Collect nest-contents data during band resighting and drone overflights.
- Schedule mark-recapture studies in early February for optimal resighting rates.
- Include substantial weather contingency in work plans due to variable sea state conditions.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry and 50% funded by the Crown. The planned cost for the project was $160,000 per annum over three years.

Review milestones

- White-capped albatross draft final report was made available on the CSP webpage and presented to the CSP TWG in May 2024.
- Final report was made available on the CSP webpage in June 2024.
- Gibson's albatross draft final report was made available on the CSP webpage and presented to the CSP TWG in August 2024.
- Final report was made available on the CSP webpage in September 2024.

Citation

Elliott G, Walker K, Rexer-Huber K, Tinnemans J, Long J, Sagar R, Osborne J, Parker, G. 2024. Gibson's wandering albatross: demography, satellite tracking and census. Final Report Prepared for New Zealand Department of Conservation. 33 p.

Parker, G.C., Osborne, J., Sagar, R., Schultz, H., Rexer-Huber, K. 2024. White-capped albatross population study, Disappointment Island 2024. POP2022-08 Final report to the Conservation Services Programme, Department of Conservation. Parker Conservation, Dunedin. 14 p.

Weblink

Year 1 reports:
POP2022-08 Gibson's wandering albatross: population study and assessment of potential for drone-based whole-island census
POP2022-08 White-capped albatross population study: February 2023

Year 2 reports:
POP2022-08 Gibson's wandering albatross: demography, satellite tracking and census 2024
POP2022-08 White-capped albatross population study, Disappointment Island 2024

3.6 POP2022-10 Antipodes Island seabird research: Antipodean albatross and white chinned petrel

Project objectives

1. To monitor the key demographic parameters at the Antipodean albatross study site and reduce uncertainty or bias in estimates of risk from commercial fishing and measure the success of management interventions.
2. To estimate the total population size of the Antipodean albatross on Antipodes Island.
3. To describe the diet of the Antipodean albatross and assess signatures of nutritional stress.
4. To monitor the key demographic parameters of white-chinned petrels and reduce uncertainty or bias in estimates of risk from commercial fishing and measure the success of management interventions.
5. To estimate the total population size of white-chinned petrels on Antipodes Island.

Rationale

This project delivers on priority monitoring and data gaps as identified in the CSP Seabird Plan. Due to logistical costs involved in getting to Antipodes Island, the Antipodean Albatross and white-chinned petrel projects have been combined into one Antipodean Island seabird research project. Antipodean albatross is extremely vulnerable to bycatch and continues to decline at 5% per annum, with fisheries bycatch, both within and beyond the New Zealand EEZ, being the greatest known threat. The project would continue the demographic monitoring of Antipodean albatross conducted in previous years. In addition, this project will involve a (multi-year) population wide census, based on methods to be trialled in 2021/22. An Antipodean albatross population estimate is a major data gap, as the only previous independent estimate was conducted in 1994-1996. This project also aims to provide insights into the diet and potential nutritional stress in Antipodean albatross; currently a poorly known aspect of the ecology of this species. In addition to the Antipodean albatross work, this project also aims to estimate key vital rates and population size for white-chinned petrels on Antipodes Island, another seabird species vulnerable to bycatch.

Project status

This is a multiyear project due for completion in June 2025. Year 1 (2022/23) and Year 2 (2023/24) reporting is complete.

Summary of the methods and key findings

Antipodean wandering albatross

This season's field programme allowed updates to the trend in nesting population size, survival, productivity and recruitment. There are some signs that the rate of decline is slowing. The number of Antipodean wandering albatrosses breeding has been roughly stable for the past four seasons, and female survival shows some suggestion of improving since 2014 (4-year rolling averages), although it is still highly variable year to year (from 97% in 2014 to 84% in 2019). Breeding success in 2023 at 71% approached the average pre-crash nesting success of 74%, although the mean 2006–2023 rate remains comparatively low at 62%. However, the actual number of chicks produced remains small, even in good breeding-success years, since numbers nesting remain low. Recruitment is starting to draw from the (much smaller) cohorts produced since the crash, so population numbers will soon no longer be supplemented by higher recruitment rates seen over the past decade.

The last whole-island count of nesting Antipodean albatross took place during 1994–96. The first year of a two-year effort to update the whole-island estimate involved a combination of ground counts (27% of the 1,546 ha Antipodean albatross nesting distribution) and drone aerial photography for counts in orthomosaics (1,023 ha or 66% overflown). Drone counts were corrected for pretend-nesters (apparently nesting birds with no egg) using data from concurrent nest-contents transects, and both count types were corrected for nest failures occurring before the date of count. Part of the Antipodean albatross breeding range could not be covered this first season (356 ha or 23% not counted). Numbers nesting in these not-counted areas were estimated by categorising nesting-habitat quality across the island, then extrapolating nest densities by habitat-quality class to uncounted areas. The number nesting island-wide in 2024 estimated from drone and ground counts (3,383 breeding pairs with 95% CI 3,182–3,585) is similar to the figure estimated from the annual ground count since 1997 (15% of the island or 3,307 breeding pairs), indicating that the 15% of the island chosen for annual counts remains representative of the whole island.

Trends in nest numbers and demographic parameters from the core annual study indicate that the population has been approximately stable for the last four years. However, there is so far no evidence of any sustained improvement in Antipodean wandering albatross demography, as required for the population to recover, with tentative improvements recorded here merely slowing the decline.

White-chinned petrel

A mark-recapture study to estimate vital rates, survival in particular, was established in late 2022. This first season of band resighting highlighted the importance of quality monitoring data: banded white-chinned petrels were resighted at an unexpectedly low rate of only 0.243. Indeed, fewer study burrows were reoccupied than expected, and in new burrows, occupancy was lower than last year. Without quality monitoring data, we cannot yet tell whether these breeding rates are now normal for Antipodes white-chinned petrels, having shifted over the decade since the last study, or whether it has simply been a bad year. Substantial effort to grow the mark-recapture study this year mean there are now 301 banded white-chinned petrels in 156 marked burrows in the two study areas.

Recommendations

Antipodean albatross

- Ongoing mark-recapture monitoring of demographic and population-size trends
- The second year of effort toward the island-wide population size estimate, to complete whole-island coverage
- Research into causes of decline. More-targeted ongoing engagement is also needed to achieve better bycatch mitigation in line with ACAP best practice.

White-chinned petrel

- For accurate, precise survival estimates this marked population needs building further, along with recaptures at existing marked burrows for a minimum of three years.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry and 50% funded by the Crown. The planned cost for the project was $160,000 per annum for three years.

Review milestones

- Draft final report was made available on the CSP webpage and presented to the CSP TWG in August 2024.
- Final report was made available on the CSP webpage in September 2024.

Citation

Rexer-Huber K., Whitehead E., Parker G.C., Patterson, E., Walker K., Welch, J., Elliott G. 2024. Antipodean wandering albatrosses and white-chinned petrels 2024. Final report to the Department of Conservation. Parker Conservation, Dunedin. 29 p.

Weblink

Year 1 reports:
POP2022-10 Antipodean wandering albatross population study 2023
POP2022-10 Antipodes Island white-chinned petrel population size and survival study setup

Year 2 report:
POP2022-10 Antipodean wandering albatross and white-chinned petrels 2024

3.7 POP2023-01 Aerial survey of leatherback turtles off Northeast North Island

Project objective

1. Assess feasibility of using aerial surveys to monitor leatherback turtles in New Zealand waters.
2. To collect fishery independent information on the distribution, relative abundance and size of leatherback turtles in New Zealand waters.
3. To collect data on pelagic species associated with leatherback turtles in New Zealand waters.

Rationale

Western Pacific leatherback turtles are Critically Endangered due to a variety of anthropogenic impacts, including bycatch in commercial fisheries throughout their range. Leatherbacks are the sea turtle most regularly interacting with commercial fisheries in New Zealand waters, with the greatest number being caught on surface longlines targeting swordfish and bigeye tuna off the Northeast North Island (FMA 1, FMA 2) during summer and autumn. Interactions with surface longlines are also reported from FMA 7, FMA 8 and FMA 9. Fishery independent data on leatherback distribution and abundance are required to determine overlap with commercial fisheries, inform national and regional risk assessments for this species and identify potential environmental indicators that could be used to avoid or reduce fishery interactions. Identification of hot spots for the species would also assist the development of satellite tagging studies of free-swimming leatherbacks on their foraging grounds. Such studies would provide information on diving behaviour and long-distance movements and could potentially identify critical habitat in NZ waters and confirm source populations of leatherbacks interacting with New Zealand fisheries.

Project status

In progress. This is a multiyear project due for completion in June 2026.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry and 50% funded by the Crown. The planned cost for the project was $50,000 for year one, $100,000 for year two and $50,000 for year three.

3.8 POP2023-02 Southern Buller's population study

Project objective

1. Monitor key demographic parameters of southern Buller's albatross (*Thalassarche bulleri bulleri*) (adult survival, breeding probability, breeding success, and population size) on the Snares Islands to reduce uncertainty in risk estimates from commercial fishing and to measure the success of management interventions.
2. Provide updated, high-resolution insights into the at-sea distribution of adult southern Buller's albatrosses from the Snares and Solander Islands.
3. Provide an updated population estimate from Solander Island using an aerial survey.
4. Describe the diving behaviour of southern Buller's Albatrosses from the Snares Islands using time depth recorders (TDRs).

Rationale

The Conservation Services Programme Seabird Medium Term Research Plan (CSP Seabird Plan) 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 project delivers priority research components of the CSP Seabird Plan involving the estimation of key demographic parameters of southern Buller's albatross at the Snares and Solander islands and investigates at-sea distribution and diving behaviour. Three established study sites exist at the Snares, with substantial historic mark-resight effort (Sagar 2014), and demographic data having been collected annually at these sites annually since 1992, excluding 2018 and 2021.

Project status

This is a multiyear project due for completion in June 2026. Year 1 reporting is complete.

Summary of the methods and key findings

Population studies of southern Buller's albatrosses at Tini Heke / The Snares Islands and Hautere / Solander Islands

Demographic studies at the three study colonies on The Snares' Northeast Island have been undertaken annually 1992–2024, with the exception of 2018 and 2021. Estimates of the numbers of breeding pairs, made by recording the contents of each nest mound, decreased substantially in all three study colonies compared to 2023, with numbers in the Mollymawk Bay study colony being the lowest recorded during the current study. With the assumption that the combined total number of breeding pairs in the three study colonies was representative of Northeast Island as a whole, then the breeding population probably peaked in 2005–2006 and has since undergone marked annual variations, with decreases in the past two years. If the decreases of 27.3% to 34.8% in the three study colonies are reflected in the population as a whole, then this will be a major concern for the conservation status of the species.

A total of 315 birds that had been banded previously in the study colonies as breeding adults of unknown age were recaptured. A further 26 breeding birds were banded in the study colonies - these are presumed to be first-time breeders. Although the most recent estimate of annual survival of birds banded as breeders (0.93 ± 0.03) was similar to the previous year's estimate of 0.94 ± 0.01, the last

four estimates over the period 2018 to 2023 have varied between 0.84 and 0.94. During the period 1992–2004 all chicks that survived to near-fledging in the study colonies were banded and their survival to return to the study colonies in subsequent years has been monitored. This year, 92 of these birds were recaptured, with birds from cohorts banded from 1994 and 2002 recorded as breeding for the first time. This demonstrates the long-term monitoring required to obtain reliable estimates of survival of such known-age birds. In addition, five birds that had been banded as near-fledging in the study colonies during Sep 2013 and Sep 2014 were also recaptured for the first time.

At Solander, 20 trackers were deployed on breeding Buller's albatrosses to follow year-round at sea distributions. At the Snares Time Depth Recorders (TDRs), Global Location Sensing (GLS) light-based geolocators and IgotU Global Positioning System (GPS) data loggers were deployed on 13 breeding Buller's albatrosses to investigate diving behaviour and at sea distribution patterns. These deployments were short-term, and 12 of 13 devices were recovered during the trip. Eight Druid satellite transmitting tags paired with eight GLS were also fitted to breeding Buller's albatrosses and these were securely attached for long term deployments to inform year-round at sea distributions.

In 2020, 50 GLS tags were attached to the metal leg bands of breeding birds in the Mollymawk Bay study colony at The Snares; of these, 31 were retrieved in 2022, a further three during the 2023 field season, and one this year. A further 26 GLS tags were deployed at the Mollymawk Bay study colony in the visit reported here.

Twelve replacement trail cameras were deployed to upgrade those previously installed in 2022 at breeding colonies on The Snares and set to record one photograph every hour during daylight for a further year.

Population survey of Southern Buller's albatross on the Solander Islands

An aerial photographic survey of Great and Little Solander islands was carried out on 9 March 2024, mid-way through the Southern Buller's Albatross incubation period. Overall, 6771 individuals were counted in non-overlapping zones drawn on the images: 6215 (92 %) on Great Solander, 556 (8 %) on Little Solander. Of these, 4581 individuals were associated with occupied nests, 3845 (84 %) with a sitting bird alone (no assumptions being made about whether or not the nest contained an egg); the remaining 736 individuals (16 %) were in pairs, with one bird sitting. This means a further 368 occupied nests, giving an initial total of 4213 occupied nests, considered to be the minimum number.

Among other birds seen clearly, 583 were standing by empty nests (referred to here as occupied sites), 75 % as single birds. Loafers (145) comprised the balance of the definable birds. The status of a further 1462 individuals (22 % of the total birds counted) could not be determined directly. Assuming that their status was in the same proportions to those of the clearly observed birds, 1160 of these initially indeterminate individuals would be sitting on nests, giving an overall total of 5373 occupied nests, considered the maximum number.

Compared with the last survey in 2016, which combined aerial survey and counts of sitting birds from vantage points, the minimum estimate would loosely imply 25 % fewer birds at nests. But with the more likely number of occupied nests being c. 5373, the falloff since 2016 might only be about 4 %.

Surveys of 54 occupied nests along seven short transects found only 62.3 % on average had eggs (33 nests). The rest (21 nests, 37.7 %) had birds sitting on empty nests (Sagar et al. 2024). The status of

these latter birds is unclear. They could be pre-breeders returning to the islands prior to nesting for the first time; recent failed breeders that have not yet abandoned their nest; or breeders from previous years taking a break from breeding for some reason. Given the timing of the survey, about halfway through the incubation period, it is unlikely that any of these birds were yet to lay eggs. The proportion of birds sitting on empty nests had only previously been reported in the 2016 survey. If the 2024 ground survey is considered broadly representative of the population, then 27% fewer birds were breeding in 2024.

The number of birds associated with empty nests, both from the aerial survey counts and from the ground survey, together with the numerous empty nests and nest sites seen on the aerial photographs, suggests that many birds may not have bred in 2024.

Recommendations

- Additional trips to The Snares Islands in August–September to record breeding success and band fledglings.
- Attach plastic uniquely numbered alpha-numeric bands to all birds, in addition to metal bands.
- Plan for longer trips to enable recapture of a greater number of birds.
- Conduct satellite tracking of fledgling Southern Buller's albatrosses.
- More needs to be known about the nature of birds sitting on empty nests.
- As a population monitoring tool, future aerial photographic surveys may be better focused on comparing counts from images taken of several clearly demarcated, more-open areas on the two islands, interspersed at longer intervals with longer-duration, more intensive, combined ground and aerial censuses of both islands, as done in the past.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry and 50% funded by the Crown. The planned cost for the project was $150,000 per annum over three years.

Review milestones

- Draft reports presented to CSP TWG in June and August 2024
- Final reports made available on the CSP webpage in June and September 2024.

Citation

Sagar, P., Rexer-Huber, K., Thompson, D., Parker, G. 2024. Population studies of southern Buller's albatrosses at Tini Heke / The Snares Islands and Hautere / Solander Islands. Final report to the Conservation Services Programme, Department of Conservation. Parker Conservation, Dunedin. 13 p.

Frost, P., Baker, B.G., Fischer, J., and Sagar, P. 2024. Population survey of Southern Buller's Albatross T*halassarche bulleri bulleri* on the Solander Islands | Hautere, March 2024. Final report to the Conservation Services Programme, Department of Conservation. 25 p.

Weblink

POP2023-02 Population studies of southern Buller's albatrosses at Tini Heke/The Snares Islands and Hautere/Solander Islands

POP2023-02 Population survey of Southern Buller's albatross on the Solander Islands

3.9 POP2023-03 Updated population estimate and marine habitat utilisation of yellow-eyed penguins/hoiho breeding on Campbell Island

Project objective

1. To obtain an up-to-date estimate of abundance for Campbell Island hoiho (which may include mark-recapture methods and nest searches for breeding pairs).
2. To monitor the health status of hoiho on Campbell Island.
3. To collect data on the marine habitat utilisation and diet of hoiho for data deficient breeding and non-breeding periods as well as for different life history stages (adults, juveniles).

Rationale

The nationally endangered, yellow-eyed penguin/hoiho has experienced a more than 70% decline across its New Zealand mainland range over the past decade. This is likely due to a variety of threats including but not limited to disease, predation, climate change and fishing interactions. However, little information exists about the status of the southern population of hoiho breeding on the Auckland and Campbell Islands. While a coarse recent population estimate exists for the Auckland Island archipelago (577 breeding pairs; Muller et al. 2020), the last population estimate for Campbell Island dates back over three decades (350-460 breeding pairs; Moore 1992). Importantly, an up-to-date population estimate for the southern population is critical for assessing the species wide risk (i.e., combined northern and southern populations) from fisheries, particularly set netting, which constitutes a high risk for hoiho (Rowe 2013). Preliminary tracking of hoiho on Campbell Island indicates that birds forage as far as 100 kilometres away from the colony, highlighting the importance of collecting habitat use, diet and foraging distribution data for the southern population to inform any assessments of direct or indirect effects of trawling activities on hoiho. This project supports Te Kaweka Takohaka mō te Hoiho/the strategy for hoiho and Te Mahere Rima Tau/five-year action plan; specifically, actions 5c (provide knowledge about status and health of southern population), 6f (update SEFRA with new info), and 6h (assess the risk of bycatch from trawl fisheries).

Project status

In progress. This is a multi-year project due for completion in June 2025.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $90,000 per annum over two years.

3.10 POP2023-04 Campbell Island seabird research

Project objective

1. To provide updated counts of Southern Royal Albatross nests in representative study and index sites.
2. To monitor the key demographic parameters of Southern Royal Albatross and reduce uncertainty or bias in estimates of risk from commercial fishing and measure the success of management interventions.
3. To describe the at-sea distribution of Southern Royal Albatross to inform overlap with and risk from commercial fishing.
4. To provide updated population estimates through traditional photo point counts of Grey-headed Albatross.
5. To monitor the key demographic parameters of Grey-headed Albatross at study and index sites and reduce uncertainty or bias in estimates of risk from commercial fishing and measure the success of management interventions.
6. To map any Northern Giant Petrel nests located opportunistically during surveys of other priority species.

Rationale

Population counts conducted during time-constrained visits in 2019 (BCBC2019-03) and 2023 (POP2022-11) indicate that the Southern Royal Albatross population on Campbell Island has decreased over the last 20 years at a similar rate as the Antipodean Albatross, a species highly vulnerable to bycatch. Counts at Enderby Island mirror these trends. Therefore, dedicated and prolonged counts of Southern Royal Albatross nests on Campbell Island are needed to provide clarity on the species' decline. Demographic parameters (adult survival and productivity) should also be monitored to provide further insights into the drivers of Southern Royal Albatross trends. Similarly, the at-sea distribution of Southern Royal Albatross should be described to gain further information on fisheries risks. Additionally, this project also aims to provide updated estimates of population size and key vital rates (survival and reproduction) for Grey-headed Albatross, another seabird species vulnerable to bycatch. This project may also provide a platform for additional research on other seabird species as risk from bycatch (e.g., Northern Giant Petrel, Antipodean Albatross, Campbell Albatross, and White-chinned Petrels), but this is a lower priority than research on the species mentioned above and is dependent on logistics.

Project status

This is a multiyear project due for completion in June 2025. Year 1 reporting is complete.

Summary of the methods and key findings

Nests were counted in two study (Col and Moubray) and three index areas (Faye, Paris, Honey) to compare to historical counts. Additional aims were to resight marked birds, band up to 200 pairs in the Col study area, deploy PTT and GLS tags, and set up remote cameras on nests to monitor breeding success. Other species work included conducting photo point counts for Campbell and grey-headed albatross and to deploy remote cameras on grey-headed albatross nests. Accessible nest sites were searched for light-mantled sooty albatross, PTT trackers deployed, and remote cameras set up at nests. Opportunistic searches while traveling or within southern royal albatross study and index areas

were done for Antipodean albatross, and any unbanded birds were marked. Opportunistic searches and counts were also done for northern giant petrels and white-chinned petrels.

Nest counts for southern royal albatross showed an overall decline of 32.8% since the 1990s and a 26.5% decline since the 2000s. Paris index area had the highest percent change of -46.2% since the 1990s, and Col study area had the lowest at -23.6%. A total of 35 PTT trackers were deployed on southern royal albatross in the Col study area which show birds moving north to the Chatham Rise, west to Tasmania, south towards Antarctica, and to the Patagonian Shelf east of Argentina. Thirty-four GLSs devices were also deployed. For demographics, 113 nests have both birds of the pair marked within the Col study area, and 22 cameras were set up on nests to monitor breeding success. For Campbell and grey-headed albatross photo point counts, the percent change between 2019/20 and 2023/24 showed a decline in the total number of Campbell albatross (sitting and loafing birds) of 16.1% and a decline of 27.6% of grey-headed albatross. For breeding success monitoring of grey-headed albatross, five cameras covering 28 nests were deployed. For light-mantled sooty albatross, ten PTT trackers were deployed on non-breeding birds which show most birds travelling south towards Antarctica. A total of 11 cameras covering 14 nests were set up for breeding success monitoring. For Antipodean albatross, eight birds were found on the Moubray Peninsula, of which three were previously banded as chicks on Campbell Island in the 1990s.

Recommendations

- Deploy tracking devices on birds breeding in the Paris index area.
- Continue the capture-mark-recapture work for at least another year, but preferably annually to better understand the drivers of the population decline.
- Repeat the count efforts for southern royal, Campbell, and grey-headed albatross next year to account for the second cohort of breeders as well as annual variability, and then at least every 5 years, if not more regularly to keep a closer eye on the population
- Deploy tracking devices on Campbell albatross and grey-headed albatross to better understand what is causing the population declines.
- Re-start the capture-mark-recapture banding study on Campbell and grey-headed albatross to understand the drivers of the population declines.
- When traveling around the island for southern royal albatross study and index plot counts, spend a day or two in the given areas to focus solely on northern giant petrel counts and searching for white-chinned petrel burrows (following methods used by Rexer-Huber et al. 2020). This should include revisiting previously located sites for both species.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry and 50% funded by the Crown. The planned cost for the project was $90,000 per annum over two years.

Review milestones

- Draft report made available on the CSP webpage and presented to CSP TWG in June 2024
- Final reports made available on the CSP webpage in June and September 2024.

Citation

Mischler, C., Thompson, T., Moore, P., Philip, B., Wickes, C. 2024. Campbell Island Seabird Research. POP2023-04 final report prepared for Conservation Services Programme, Department of Conservation. 49 p.

Weblink

POP2023-04 Campbell Island seabird research 2024

3.11 POP2023-05 Auckland Islands New Zealand sea lions

Project objective

1. To estimate annual New Zealand sea lion pup production on Enderby Island, Dundas Island and Figure of Eight Island.
2. To mark a subset of pups following established protocol.
3. To collect tag resights at all locations to provide survivorship data for the demographic model.

Rationale

The New Zealand sea lion (Phocarctos hookeri), one of the world's rarest sea lions, is currently classed as Nationally Vulnerable, with a total population estimate of 10,000 individuals breeding mostly on the subantarctic Auckland Islands (Baker et al. 2019, Roberts & Edwards, unpublished research). New Zealand sea lions are incidentally bycaught in southern commercial trawl fishing operations targeting species including squid, scampi, and southern blue whiting. The foraging areas of New Zealand sea lions at the Auckland Islands have been shown to overlap with commercial trawl fishing activity, particularly SQU6T and SCI6A areas. Approximately 70% of New Zealand sea lions breed at the Auckland Islands, where population data have been collected since the mid-1990s, including estimates of pup production and resighting of marked animals. Since 2001, there has been a considerable decline in pup production at the Auckland Islands (Campbell et al. 2006; Chilvers et al. 2007). The New Zealand sea lion Threat Management Plan (TMP), first implemented in 2017, established a range of research and management actions to address the threats to the recovery of this species. A literature review to identify potential indirect effects of commercial fishing on the Auckland Islands population as part of CSP project POP2010-01 (Bowen 2012) highlighted several key information gaps that prevent a full understanding of any such potential indirect effects, including time series data of population dynamics as collected in this project. CSP project POP2012-02 analysed population data to determine the key demographic factors driving the observed decline of New Zealand sea lions at the Auckland Islands. This project found that low pupping rates, a declining trend in cohort survival to age 2, and low adult survival may explain declining pup counts in one studied population (Roberts et al. 2014). Demographic data from the Auckland Islands New Zealand sea lion population is vital to the ongoing assessment of direct and indirect risks to the species from commercial fisheries, as described in fisheries operational plans, and to determine the overall size and vulnerability of the population.

Project status

This is a multiyear project due for completion in June 2026. Year 1 reporting is complete.

Summary of the methods and key findings

The field team spent a total of seven weeks at the Auckland Islands undertaking the CSP project; six weeks at Enderby Island, three nights on Dundas Island, and a half day on Figure of Eight Island. Direct counts of pups were undertaken each day that the team were stationed at each of the colonies. At Dundas Island, the team conducted a mark-recapture analysis to determine a pup production estimate. All live pups (297 total) at Sandy Bay, Enderby Island, were double-flipper tagged and microchipped, and 200 pups were double-flipper tagged at Dundas Island.

Resightings of marked (flipper tagged/microchipped) animals of all age and sex classes were collected daily on Enderby Island. Total counts of pups, females, sub-adult males, and adult males were undertaken daily at Sandy Bay, and weekly around Enderby Island.

New Zealand sea lion pup production at the Auckland Islands in 2023/24 was estimated as 1457 ± 19 pups (mean ± 1 SE), slightly higher than the historic low of 1278 ± 23 pups reported in 2022/23 (Manno & Young 2023). As was the case in the previous season, this year's pup production estimate falls below the minimum level set to trigger reviews of both the New Zealand sea lion Threat Management Plan and the Squid 6T Operational Plan.

The past two field seasons have reported an unexplained and significant drop from the relatively stable pup production trend over the past decade. This could indicate a temporary reduction in breeding rate, or a decline in adult female survival or fecundity. Further research is needed to determine the cause of the decline and the management implications for the species. The continued lower level of pup production compared to previous seasons supports a review of the effectiveness of current management actions to recover New Zealand sea lions in their subantarctic range.

Recommendations

- Review and implement a new iteration of the NZ sea lion TMP with Te Rūnanga o Ngāi Tahu and Fisheries New Zealand as partners.
- Analyse tag resight data from 2022/23 and 2023/24 to investigate any changes in breeding rate or demographics of female New Zealand sea lions observed at Sandy Bay.
- Repeat this population survey in 2024/25, with an increased emphasis on tag resightings to provide quality data for an updated demographic model.
- Update the demographic model for the Auckland Islands New Zealand sea lion population in 2024, including quality resight data from 2022 - 2024.
- Investigate links between the continued low levels of pup production this year with oceanographic conditions and fisheries patterns.
- Conduct tracking of female New Zealand sea lions at Auckland Islands in winter and summer 2024/25, to provide insights into the observed decline in pup production.
- Determine evidence for nutritional stress from samples collected during tracking.
- Incorporate new information on population size and trajectory into assessment of threats and threat mitigation measures for New Zealand sea lions.

Project logistics summary statement

This project was 90% funded via Conservation Service Levies on the fishing industry and 10% funded by the Crown. The planned cost for the project was $150,000 over three years.

Review milestones

- Draft report made available on the CSP webpage and presented to CSP TWG in June 2024
- Final report made available on the CSP webpage in July 2024.

Citation

Manno KL, Whyte J, Young MJ. 2024. New Zealand sea lion/pakake/whakahao field research report Auckland Islands 2023/24. Dunedin: Department of Conservation, 30 p.

Weblink

POP2023-05 Auckland Islands New Zealand sea lions 2023/24

4. Mitigation Projects

4.1 MIT2021-01 Protected Species Liaison Project

Project objectives

1. To grow liaison capacity across inshore fleets around the country including surface longline, bottom longline, trawl, set net and purse seine.
2. To coordinate Liaison Officer effort and target protected species bycatch reduction by encouraging vessel operators to meet best-practice bycatch mitigation.
3. To deliver on the vision and outcomes of relevant cross-government plans (NPOAs, TMPs, etc).

Rationale

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 nonregulatory 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 NPOA-Seabirds, 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, and Liaison Officers will record where vessels are not able to achieve all standards and why. These notes will be shared with MPI for evaluation where they will either reassess the mitigation standards or investigate how to better assist vessel operators to achieve the set standards. Auditing of PSRMPs by Fisheries Observers will then describe the steps the vessel is taking to meet the mitigation measures outlined in their plan and highlight areas for improvement.

Project status

In progress.

Summary of the methods and key findings

In the 2023-24 fishing year (1 October 2023 - 30 September 2024), the liaison programme reviewed and updated 146 PSRMPs and established 11 new PSRMPs for inshore and Highly Migratory Species (HMS) vessels. A total of 27 PSRMP audits were completed by Observer services. These were comprised of 0 surface longline, 8 bottom longline, 12 trawl and 4 set net audit and 3 purse seine audits. The Liaison Programme received 214 triggers that were reported by 73 different vessels through NFPS-Catch reporting. Trigger follow-ups were made up of captures totalling 528 seabirds, 34 pinnipeds, 32 cetaceans, 10 turtles and 7 sharks/rays. The 10 turtle captures occurred within the surface longline fleet. From April 2023, turtle captures now also result in a questionnaire to inform the effects on post-release survival. Please note, all numbers listed are tentative and will be verified and finalised in the 2023-24 Liaison Programme Annual Report. Work is also underway to establish Electronic Monitoring Review reports that can inform Liaison Programme activities moving forward.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $250,000 per annum over three years.

4.2 MIT2022-01 Longline hauling mitigation devices

Project objectives

1. To promote uptake of haul mitigation in longline fisheries.
2. To further quantify the effectiveness of haul mitigation devices used.
3. Make recommendations for any modifications to haul mitigation devices to improve bycatch reduction effectiveness or increase uptake by fishers.

Rationale

Whilst seabird bycatch mitigation development and implementation has focussed on the setting of longlines, captures also occur on hauling. This is particularly evident when lines are set a night, as hauling is often by day when bird activity is higher, and the relative proportion of haul captures appears to be particularly high in New Zealand longline fisheries compared to other fisheries globally. This project will contribute to continual improvement towards zero bycatch as laid out in the National Plan of Action – Seabirds 2020.

Project status

Postponed by one year.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $70,000 per annum over two years.

4.3 MIT2023-01 Understanding the relationship between fishhook size and bait type with seabird and turtle captures

Project objectives

1. Literature review of available data on hook size and bait type for seabird and turtle bycatch rates across different target fisheries using existing information sources to provide recommendations for improved data collection.
2. Review international literature on current fisheries best practice to reduce the impact of hook size on bycatch.
3. Interview all SLL operators to identify preferred hook size and bait type as turtle/seabird deterrents to better inform protected species risk management plans (PSRMPs) and to help characterise current gear set-ups in SLL fisheries.

Rationale

Seabirds are caught on fishing hooks either by swallowing baited hooks, or by being hooked in the mouth or body by a bare hook. Research shows that the risk of seabird bycatch is reduced with the use of circle hooks instead of 'J' hooks, however little is known about the effect of hook size and bait type on bycatch rates for various seabird species. By comparison, research shows that the risk of turtle bycatch is also reduced with the use of circle hooks, as well as large hooks and fish bait instead of squid bait. This project is a pilot study aimed at using data collected through the CSP seabird necropsy programme, and other sources, to investigate the effect of hook size and bait type on seabird bycatch rates across different target fisheries. Results will enable us to provide consistent messaging on mitigation recommendations for reducing the risk of both seabird and turtle bycatch and meet our international commitments for the protection for these highly migratory species.

Project status

Complete.

Summary of the methods and key findings

Hook size and bait type affect seabird and sea turtle bycatch risk in longline fisheries. This report reviews published and grey literature that presented comparisons of bycatch rates for different hook and bait types to assess the effectiveness of certain hooks (e.g., circle hooks) and baits (e.g., fish) at reducing bycatch of seabird and sea turtle species. Literature on international best practices for hook and bait type was also reviewed. Additionally, this report summarises data collected through the Conservation Services Programme (CSP) seabird necropsy project as well other data sources, such as the Centralised Observer Database. These datasets were assessed for their suitability to obtain complete and representative information about sea turtle and seabird bycatch in relation to hook size and bait type. Lastly, results from a questionnaire administered to surface longline (SLL) fishers via the Department of Conservation are presented to understand current gear configurations being used in the New Zealand SLL fleet and the first-hand experience of fishers using different gear in response to seabird and sea turtle bycatch.

Internationally, squid, fish, or a combination are primarily used as bait in longline fisheries. Fish bait, particularly mackerel, reduced sea turtle interactions in eight studies compared to squid, although the effectiveness varies. Conversely, mackerel increased the number of shearwater, gannet, and gull captures in one study and was inconclusive in another. The impact of bait type on target species catch

rates was less clear, with similarly conflicting findings reported. The effectiveness of dyed bait remained mixed across studies, with some reporting lower seabird bycatch rates.

Studies consistently showed that larger circle hooks, such as 18/0, significantly decreased the capture rates of sea turtles and seabirds compared to traditional J hooks and improved post-release survival of captured turtles. However, the effectiveness of hook type and size varied depending on factors such as fishing effort, bait type, and regional differences in fishing practices. Mitigation measures such as Hookpods, which shield the hook during setting, have shown promising results in reducing seabird and sea turtle captures and are now required for the New Zealand SLL fleet.

A review of bycatch data obtained from several sources, which includes observer-reported data, fisher-reported data, and necropsy data, revealed that data may be insufficient to conduct robust statistical analyses on the effects of bait or hook type on protected species captures. Bait type and hook type were rarely reported, and the consistency in hook type (mostly 16/0) and bait (squid) used across the fleet in recent years could prevent a comparison of bycatch rates across different baits and hooks. It will also take considerable effort to link all the different tables across the different databases.

Based on the questionnaire responses, 17 operators in the New Zealand SLL fleet universally used circle hooks (14/0-17/0) baited with squid bait when targeting tuna and swordfish. Along with Hookpods, fishers employed various hook and line weighting and bait dying, especially during full moon phases, to mitigate seabird interaction risk. Little mitigation is focused on sea turtles at present.

Recommendations

Based on this review, recommendations in international guidelines adhere to the most current knowledge of the most effective hook and bait type for seabird and/or sea turtle bycatch mitigation. Typical recommendations include the use of large circle hooks (16/0 or larger) with offsets less than 10° and the use of fish bait where possible. It is also commonly suggested to use additional methods to reduce bycatch such as single hooking fish bait, reduced gear soak time, night setting, mitigation devices (e.g., tori lines, Hookpods), line weighting, and seabird/sea turtle hotspot avoidance. More research is required to determine if colour dyeing bait is effective at reducing turtle and seabird bycatch.

It is also recommended that New Zealand electronic catch and effort reporting for both surface and longline fisheries be at the trip and station level (not just associated with a protected species capture) and include additional information on hook type, size, offset, and manufacturer, along with information on bait species, hooking method, and bait state. Lastly, more research is required to understand how bait and hooks influence bycatch rates for both sea turtles and seabirds in New Zealand. Future analyses should quantify catch rates of target and non-target species using fish versus squid as bait and smaller versus larger circle hooks, considering different combinations of hooks and baits that are currently being used on longline vessels.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $40,000.

Review milestones

- Draft report made available on the CSP webpage and presented to CSP TWG in August 2024.
- Final report made available on the CSP webpage in October 2024.

Citation

Hickcox, R.P. Meyer, S., and MacKenzie, D.I. 2024. Effects of hook and bait type on commercial longline fisheries bycatch (MIT2023-01). Report for the Department of Conservation, Conservation Services Programme, Proteus Client Report: 187. Proteus, Outram, New Zealand. 98 p.

Weblink

MIT2023-01 Effects of hook and bait type on commercial longline fisheries bycatch

4.4 MIT2023-02 Understanding and mitigating seabird and turtle bycatch during the pelagic longline soak period

Project objectives

1. Characterise surface longline hook depth profiles throughout the fishing period via the deployment of TDRs.
2. Assess risk of captures during the soak period by identifying incidents of exposed hooks at the surface during the 'soak period'.
3. Compare depth profiles of sets with and without protected species captures and identify any apparent patterns.
4. Review international research and consider the effectiveness of existing mitigation practices on hook exposure during the soak period.

Rationale

Seabird bycatch mitigation development in pelagic longline fisheries has focused primarily on the risk during setting and more recently on the haul period. However, it is known that pelagic longlines can also be brought up to the surface during the soak, e.g., by hooked sharks, where exposed baited hooks can pose bycatch risk to seabirds. The extent of this risk is currently unknown as it is difficult to determine the point at which birds are caught during a fishing operation. Similarly, there is little information on the depth and time for which turtles are caught during the fishing period.

Project status

Literature review is complete. At-sea component in progress.

Summary of the methods and key findings

This literature review provides New Zealand's Department of Conservation (DOC) with an up-to-date synthesis of bycatch mitigation measures for seabirds and turtles during the soak period of surface longline fishing. A series of mitigation measures were collated, summarized, and analysed for their potential efficacy in reducing seabird and turtle bycatch in New Zealand, as well as any barriers to implementation they may be associated with. The findings from the literature review collation and analysis stages were summarized into a series of recommendations for the DOC to take forward, with focus being on future testing of new measures to reduce soak period bycatch of these focal taxa within the surface longline fishery.

This review identified a series of key challenges in reducing seabird and turtle bycatch during the soak, as well as recommendations outlining potential candidate measures to mitigate against the bycatch associated with them. Candidate measures identified with the potential to reduce the likelihood of mainlines shoaling include proper weighting of the mainline via weights at the base of float lines and the use of increased branchline weighting; using deep-set longlines where possible; and the potential use of line shooters where the mainline is kept out of vessels' propeller turbulence during setting. Measures to reduce the likelihood of seabirds and turtles interacting with baited hooks where they are exposed during the soak include night soaking, bait dyeing, using longer branchlines with weights close to hooks, the use of fish bait, and the use of novel hook designs to prevent ingestion. Finally, where bycatch rates reach concerning levels, the use of spatial and temporal management measures may be used to limit fishing effort in specific fisheries management areas, or during periods that are known to be associated with high bycatch rates. However, implementing these closures with any level

of confidence around their expected efficacy is challenging where historical observer data on seabird and turtle bycatch is limited. Despite a paucity of literature on experimental measures, this report recommends further investigation of the potential use of automatic release mechanisms, and the use of hook timers alongside TDRs to reveal how mainlines are brought to the surface and the scale of seabird interaction with them where they do shoal to the surface.

Recommendations

- Increased deep setting across the surface longline fleet where possible, using weighted longline configurations as described in the report.
- Increased branchline length and weighting, particularly towards the hook, using sliding weights to reduce the risk to crew in the event of fly back events.
- Continued use of circle hooks, with testing of larger hook dimensions with a minimum size 18/0.
- Further testing of the effects of bait dyeing and hooking technique.
- Test replacing squid bait with finfish bait and assess the extent which finfish bait increases shark bycatch.
- Where bycatch levels are at their highest, FNZ and the DOC might consider the use of LRPs and spatio-temporal closures or restrictions.
- Adjusting fishing operations to increase the proportion of the soak period in darkness hours ('night soaking').
- Investigate the use of hook timers to link target and bycatch capture.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $90,000.

Review milestones

- Final report made available on the CSP webpage in September 2024.

Citation

Peat, W., Vella, E. and Pearce, J. 2024. Literature Review of Soak Period Bycatch Mitigation Measures for New Zealand's Surface Longline Fleet. MIT2023-02B final report prepared by MRAG Ltd. 54 p.

Weblink

MIT2023-02B Literature Review of Soak Period Bycatch Mitigation Measures for New Zealand's Surface Longline Fleet

4.5 MIT2023-03 Describing the marine habitat utilisation and diet of hoiho to analyse the effectiveness of mitigation tools at a major breeding colony on Rakiura/Stewart Island

Project objectives

1. Study the habitat utilisation and diet of hoiho breeding at two sites during different breeding stages (guard, post-guard and pre-moult) to quantify the spatial overlap of hoiho with local fishing activities and fisheries target species (dietary overlap).
2. Investigate whether this can explain differences in breeding success between the two main breeding sites of the Neck area on Stewart Island/Rakiura.
3. Review the appropriateness of recently established voluntary set net closures adjacent to the Neck area.

Rationale

Fisheries activities can pose direct and indirect threats to seabirds. Direct effects include incidental captures in fishing nets and benthic disturbance, whereas indirect effects include resource competition when fisheries and seabirds target the same prey, potentially affecting seabird breeding success. The wider Neck area on Stewart Island/Rakiura harbours ~20% of the current breeding population of the nationally endangered hoiho on Rakiura making this an important breeding colony. Breeding areas on the Neck are concentrated at two main sites: Little Glory Bay, which lies on the Paterson Inlet side of the Neck, and Steep Head which lies on the seaward side. Based on previous tracking studies of hoiho breeding on islands in Paterson Inlet (POP2018-02, POP2020-05), it is assumed that hoiho breeding at Little Glory Bay will also forage in Paterson Inlet, whereas hoiho breeding at Steep Head are more likely to feed out at sea. Importantly, hoiho at Steep Head may face a higher risk from incidental capture in setnets compared to hoiho breeding at Little Glory Bay, Paterson Inlet and other sites (e.g., voluntary exclusion zones) where no set netting activity takes place. Furthermore, hoiho breeding at Steep Head have shown reduced breeding success in recent years compared to birds from Little Glory Bay, possibly due to less favourable foraging conditions.

Project status

In progress, this is a multi-year project due for completion in June 2025.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $40,000.

4.6 MIT2023-04 Synthetic trawl warps to mitigate seabird warp strikes

Project objectives

To assess whether brightly coloured synthetic trawl warps reduce seabird warp strikes.

Rationale

In trawl fisheries the highest unmitigated risk of seabird bycatch is typically through cable strikes (birds, typically larger species such as albatross, being hit by the trawl warp or other cables). The true extent of these interactions is poorly known as most interactions are cryptic, or not readily observed (most birds that are hit by cables are lost to the sea). This high level of cryptic mortality uncertainty drives a high bycatch risk for inshore trawl fisheries. Brightly coloured synthetic Dyneema warps are used by some inshore trawlers in place of traditional steel cables. It is possible that the characteristics of such material may influence the likelihood of warp strikes, for example by making the warps more visible to seabirds. However, no evidence has been collected to date to test this hypothesis.

Project status

Delayed due to lack of observer trips.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $60,000.

4.7 MIT2023-05 Enabling uptake of best practice seabird bycatch mitigation in the surface longline fishery

Project objectives

Increase uptake of seabird bycatch mitigation that is in line with Mitigation Standards for surface longliners by:

1. Assessing which surface longline vessels are not currently aligned with the Mitigation Standards and identify vessel-specific barriers.
2. Sourcing mitigation gear (e.g. novel line weighting options, hauling mitigation).
3. Coordinating, promoting and supplying mitigation gear suitable for vessel-specific operations and closely support its implementation.

Rationale

Monitoring the uptake and implementation of best practice seabird bycatch mitigation, as described in the Mitigation Standards under the NPOA-Seabirds 2020, has highlighted limited progress in the surface longline fleet. This is especially apparent with a lack of alignment to the recommended use of either hook-shielding devices on 100% of hooks or 3/3 mitigation (tori line, night-setting, and line weighting to ACAP standards). Seabird bycatch remains high in the surface longline fleet, and more support is required to facilitate the uptake of bycatch mitigation solutions that are practicable for each vessel's operations and are in alignment with best practice Mitigation Standards.

Project status

Complete. Outcomes documented in Liaison Programme reporting.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $70,000.

4.8 MIT2023-06 Underwater line setting devices for bottom longline vessels

Project objectives

To further develop and test one or more underwater line setting seabird bycatch mitigation device(s) to widen their potential application across small vessel bottom longline fisheries.

Rationale

The Mitigation Standards to reduce the incidental captures of seabirds in bottom longline fisheries set a requirement that hooks set during high-risk periods are protected by the aerial extent of the tori line until the hooks have reached a depth of 10 m, or 5 m outside of high-risk periods. Underwater setting has the potential to increase sink rates and reduce risk to birds. It is particularly relevant to meeting the Mitigation Standards, whilst maintaining flexibility of gear configuration for fishers. It also has the potential to effectively mitigate bycatch during higher risk periods. Previous projects, most recently that reported by Goad et al (2022), and further work currently underway as part of CSP project MIT2021-03, have focussed on two devices. The first was initially conceived by Dave Kellian and is described as the 'underwater setter'. It is towed behind the vessel at depth and the longline passes under a guide. The second device was conceived by Nigel Hollands and uses a roller held under the surface by a pole fixed to the vessel, with the longline passing under the roller. It is described as the 'line depressor'. These devices represent a novel new approach to mitigating seabird bycatch in longline fisheries.

Project status

In progress, this is a multi-year project due for completion in June 2025.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $75,000 per annum over two years.

4.9 MIT2023-07 Novel seabird bycatch mitigation for floated demersal longline fisheries

Project objectives

1. To identify potential novel options to mitigate seabird bycatch in floated demersal longline fishing gear.
2. To test one or more novel bycatch mitigation option(s) identified for floated demersal longline operations and assess the feasibility and practicality of commercial implementation.

Rationale

There are significant challenges for some floated demersal longline fisheries in achieving desired sink rates of gear to meet Mitigation Standards to reduce the incidental captures of seabirds in bottom longline fisheries. For example, the slow setting speeds typical in bluenose target fisheries limit the extent of aerial protection that tori lines can provide. Identifying and proving new bycatch mitigation options will allow for increased flexibility in how fishing operators can most effectively minimize seabird bycatch in their particular operation.

Project status

Complete.

Summary of the methods and key findings

The introduction of mitigation standards and subsequent changes to regulations require fishers to sink demersal longlines to a depth of five metres within the aerial extent of the tori line. Previous experimental trials without hooks identified gear modifications to reduce sink times to depth for 'floating' demersal longlines set with multiple floats attached between widely spaced weights. In combination with tori line improvements, these modifications were shown to meet regulations.

This project tested compliant gear configurations in a fishing context to examine their practicality, workability, and influence on catch rates compared to control gear set as per the skipper's normal practice. Deployment of modified floats with a seven-metre rope between the float and the longline and a small weight on the longline was successful. Increased line weight size and reduced line weight spacing were also employed. These measures resulted in reduced times to depth and, in combination with tori lines providing coverage up to 90 m astern, met the regulated depth of five metres at the end of the tori line.

The use of more weight and modified floats resulted in a marginal increase in workload for the crew, but did not hinder setting or hauling operations. Modified floats performed well, did not frequently tangle with the longline or tori line, and proved simple to set and retrieve.

Poor and patchy catch rates precluded firm conclusions on the influence of experimental gear configurations. However, if necessary, options were identified to more precisely control the height hooks fish above the seabed whilst meeting regulations.

Recommendations

Translating results from trips with a dedicated researcher on board measuring sink times to depth into normal fishing operations across the fleet could be facilitated by providing fishers with user-friendly TDRs to estimate depth at the end of the tori line.

Trips to sea with fishers are extremely productive, not only for quantifying performance of mitigation measures, as described above, but also supporting fishers to make changes with minimal impact on operations. All opportunities should be taken to join fishers at sea and, if fishers have particular concerns with meeting regulations, then demonstrating options at sea on a commercial trip can be hugely productive.

Further refinement of this approach particularly regarding line tension and use of floats directly on the backbone at the start of multi-float sections should be considered. However, this will not necessarily translate between vessels and skippers so should be part of supporting individual vessels in the fleet to improve sink times to depth where necessary.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $120,000.

Review milestones

- Draft final report made available on the CSP webpage in May 2024.
- Final report made available on the CSP webpage in June 2024.

Citation

Goad, D. 2024. Novel seabird bycatch mitigation for floated demersal longline fisheries. MIT2023-07A final report prepared by Vita Maris for the New Zealand Department of Conservation, Wellington. 22p.

Weblink

MIT2023-07A Novel seabird bycatch mitigation for floated demersal longline fisheries