

Conservation Services Programme DRAFT Annual Plan 2023/24

Conservation Services Programme
Department of Conservation
PO Box 10 420
Wellington
www.doc.govt.nz/csp

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Statement on Conservation Services

Conservation services are defined in section 2 of the Fisheries Act 1996 as follows:

“Conservation services means outputs produced in relation to the adverse effects of commercial fishing on protected species, as agreed between the Minister responsible for the administration of the Conservation Act 1987 and the Director-General of the Department of Conservation, including–

- (a) Research relating to those effects on protected species:*
- (b) Research on measures to mitigate the adverse effects of commercial fishing on protected species:*
- (c) The development of population management plans under the Wildlife Act 1953 and the Marine Mammals Protection Act 1978.”*

We agree that the outputs described in the following pages, to be delivered in 2023/24, are “conservation services” in accordance with this definition. Cost recovery principles have been applied in accordance with section 262 of the Fisheries Act 1996.

Hon. Willow-Jean Prime
Minister of Conservation

Penny Nelson
Director-General of the Department of Conservation

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1. Overview

1.1 Introduction

The Conservation Services Programme (CSP) has operated under the administration of DOC since 1996, with the aim of avoiding, remedying, or mitigating the adverse effects of commercial fisheries on protected species. The Conservation Services Programme Annual Plan 2023/24 (Annual Plan) outlines the conservation services to be delivered as the Conservation Services Programme (CSP), and subject to cost recovery from the commercial fishing industry in the 2023/24 financial year. As such, this Annual Plan forms the basis for levying the commercial fishing industry under the Fisheries Act 1996. For a summary of the legal basis of levied work described in this Annual Plan, refer to the Conservation Services Programme Strategic Statement¹ (Strategic Statement).

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*”. To meet this vision, the following CSP Objectives, as described in the Strategic Statement, have been identified:

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

1.2 Format

The format used to specify the conservation services in this Annual Plan includes an outline of the objectives and rationale for each project, and the anticipated outputs. Guiding objectives, both CSP Objectives and relevant management plans, are identified for each project. The project specifications also indicate cost recovery information, i.e., indicative project costs (excluding administration costs), relevant provisions within the Fisheries (Cost Recovery) Rules 2001 that determine cost recovery allocation, and relevant fish stocks to which cost recovery is applied. Costs are summarised in the Appendix. All financial amounts appearing in this document are exclusive of GST.

1.3 Guiding frameworks, research planning and prioritisation

The Strategic Statement describes the process through which each annual plan of conservation services will be developed and delivered. It provides detail on the wider management context, the research planning and prioritisation processes used by CSP, and the way CSP is implemented by working with others.

The CSP planning considers and works in parallel with other relevant planning and management processes such as the National Plans of Action (NPOAs) for seabirds and sharks, and the

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

Hector's and Māui dolphin and the New Zealand sea lion Threat Management Plans (TMPs). The iterative and inclusive planning process ensures that gaps are identified, and research synergies are maximised.

The CSP Research Advisory Group (RAG), was established in 2013 following finalisation of the Strategic Statement and provided guidance for the development of this Annual Plan. Five medium term research plans² have also been developed as part of the work of the RAG: the CSP seabird medium term research plan (CSP Seabird Plan), the CSP protected fish medium term research plan (CSP Fish Plan), the CSP marine mammal medium term research plan (CSP Mammal Plan), the CSP sea turtle medium term research plan (CSP Turtle Plan) and the CSP protected coral medium term research plan (CSP Coral Plan). These plans have been used to inform and guide relevant sections of this Annual Plan.

A summary of the planning and prioritisation milestones, in accordance with the Strategic Statement, undertaken in developing the Annual Plan 2023/24 can be found in the Consultation section below.

1.4 Observer planning

Observer coverage is planned and prioritised based on specific monitoring objectives for protected species interactions with fisheries and achieving adequate coverage levels for high-risk fisheries to allow detection of changes in bycatch over time. These objectives are balanced with other fisheries management objectives, available resources of the observer programme and feasibility of delivery.

Widescale camera roll-out across the New Zealand fishing fleet is planned to occur in stages throughout 2023/24 and will significantly increase verification in inshore fisheries. Electronic monitoring is intended to increase information available on protected species interactions. With 2023/24 being a transitional year, the verification approach will be a hybrid model dependant on specific electronic monitoring rollout dates, and work is currently underway to determine in what circumstances observers would be deployed to vessels with cameras.

1.5 Consultation

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

19 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 closes.
Early-June 2023	Summary of public submissions and response to comments completed.
Mid-June 2023	Director-General of the Department of Conservation conveys the CSP Annual Plan 2023/24, amended in accordance with public submissions, to the Minister of Conservation for agreement.

² These are available to download from <http://www.doc.govt.nz/csp-rag>

1.6 Administrative costs

The administrative requirements of each project differ, as does the time required to address these. Currently, administration charges are distributed in a pro-rated fashion across projects, in accordance with the cost of the project, except for INT2023-01 (Observing commercial fisheries) where the administration cost is fixed at \$110,000. This approach is appropriate, as the highest cost project (INT2023-01) incurs the majority of administration expenses including observer training programmes, training materials, data management, briefing and debriefing, liaison at sea and with other agencies when necessary, and reporting. For other projects, the administration component may be significantly less. Administration also includes charges for the use of Departmental facilities and services.

DOC is continually striving to maximise efficiencies and the administration costs for delivering conservation services. We welcome stakeholder views on different ways to attribute administration costs across projects. These have been reduced in previous years to the current level of \$240,000, which has been in place since 2011/12.

1.7 Iwi engagement

Relevant iwi, hapū and whānau will be engaged with on a project-by-project basis, where appropriate in accordance with Section 4 on the Conservation Act 1987³.

³ [Conservation Act 1987 No 65 \(as at 12 April 2022\), Public Act 4 Act to give effect to Treaty of Waitangi – New Zealand Legislation](#)

2. Interaction Projects

2.1 Observing commercial fisheries

Details on the observer coverage envisaged for the financial year 2023-24 are to be finalised shortly and consulted over separately. More detail will be posted through the Fisheries New Zealand website.

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NOTE: This multi-year project was consulted on in 2021/22 and is included here for completeness

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

Project Code: INT2021-04

Start Date: 1 July 2022

Completion Date: 30 June 2024

Guiding Objectives: CSP Objectives B, C, E; CSP Fish plan; National Plan of Action- Sharks.

Project Objectives:

1. To provide co-ordinated 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.

Research approach

This project represents a continuation and extension of INT2018-04. Tissue sample collection will be extended to all protected fish and sea turtle species taken as bycatch in commercial fisheries. Sampling kits and sampling instructions will be provided to interested commercial fishers and Fisheries Observers deployed in fisheries likely to catch protected species. Costs of returning samples and unused kits will be met by the project. Legal authority to collect and retain samples from protected species will be provided to participating fishers. Sample storage and curation will be consistent with accepted international standards and data standards and tracking will be interoperable with national and international initiatives such as IraMoana, Genomics Aotearoa and GEOME.

Access to archived samples will be moderated by the Marine Species Manager, Department of Conservation.

Outputs

1. Archived tissue collection and associated electronic metadata.
2. Annual report on tissues housed in the archive, the use or fate of archived samples, and any publications arising from their use.
3. Final report describing the structure of the database, including use of Traditional Knowledge and Biocultural Labels and Notices.

Note: A three-year term is proposed

Indicative Research Cost: \$22,000 per annum

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish stocks: BIG1, BUT5, CDL6, GUR1, HAK1, 4, 7, HOK1, HPB1, JMA7, LIN5, 6, OEO6, ORH1, 2A, 2B, 3B, RCO3, SBW61, 6B, SCH1, 5, SCI6A, 6B, SKI1, SKJ1, SNA1, 8, SOD3, 5, SQU1T, 6T, STN1, SWA3, 4, SWO1, TAR2, TOR1, TRE1, WWA5B.

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NOTE: This multi-year project was consulted on in 2022/23 and is included here for completeness

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

Project Code: INT2022-02

Start Date: 1 July 2022

Completion Date: 30 June 2025

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

Project Objective:

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

Specific Objectives:

1. To determine, through examination of returned seabird specimens, the taxon, sex, and where possible age-class and provenance of seabirds killed in New Zealand fisheries (for returned dead specimens).
2. To detail the injuries, body condition and stomach contents and, where possible, the likely cause of mortality (for returned dead specimens).
3. To report any changes in the protocol used for the necropsy of seabirds (for returned dead specimens).
4. To determine, through examination of photographs, the taxon and, where possible, sex, age-class and provenance of seabirds captured in New Zealand fisheries (for live captures or dead specimens discarded at sea).

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. Fisheries 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 protocol was 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).

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.

Research approach

Specific objectives 1-4

Deceased birds returned by Fisheries Observers will be delivered, suitably packaged, and labelled, to the research provider. Observers make note of the circumstances of capture and provide a tentative identification. Seabirds returned will be examined to determine the following:

- Species identification and classification
- Sex
- Moults and brood patch development (as a partial indicator of breeding status)
- Age
- Provenance (origin) (where possible)
- Subcutaneous fat score as an index of body condition
- Stomach and gizzard contents, and
- General body condition including any signs of injury and cause of death (where possible).

The data will be reported on by species and fishery stratum (fishing method, fishery area and target species). The methodologies used in examining the specimens and categorising them into different groups shall be fully described. Differences in research protocols compared to previous necropsy research on New Zealand seabirds returned from fisheries shall be fully detailed and the implications of any differences discussed.

Specific objective 5

Where Fisheries Observers record an incidental bird capture and no specimen is retained (either live captures or discarded dead birds), all photographs obtained, by specimen, will be delivered to the contractor in electronic format. Details of the date, time, location, and fishery of capture will also be provided. Photographs will be examined to determine the following:

- Identification and classification, to the lowest taxonomic level possible
- Sex (where possible)
- Age (where possible), and
- Provenance (origin) (where possible).

These data will be reported by taxon and fishery stratum (fishing method, fishery area and target species). When a specimen is identified and separated from similar species, the identification features used shall be fully described.

Outputs

1. A summary of results will be reported, for circulation to stakeholders, on a quarterly basis.
2. Information requested by CSP will be provided within a reasonable timeframe (usually 10 working days).
3. Annual report(s) of confirmed identification, sex, age, provenance, and all other data collected, of all specimens examined. To the extent possible, the final report will also identify potential interactions between seabirds and fishing gear and identify factors that may have contributed to seabird mortality. Data will be reported by fishery stratum (fishing method, fishery area and where possible target species).
4. Presentation of six monthly and annual reports to the CSP TWG.
5. Provision of all data collected in electronic format, suitable for updating Fisheries NZ databases and/or other relevant databases.

6. Provision of seabird specimens, where requested by iwi for cultural purposes, as stated in section 1.4 of the CSP Strategic Statement.

Note: A three-year term is proposed

Indicative Research Cost: \$80,000 per annum

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish stocks: BAR_{1, 7}, BIG₁, BNS_{1, 2, 3, 7}, BUT_{5, 7}, BWS₁, ELE_{3, 5, 7}, EMA_{1, 3, 7}, FLA_{1, 2, 3, 7}, GMU₁, GSH_{1, 3, 4, 7, 8, 9}, GSP_{1, 7}, GUR_{1, 2, 3, 7, 8}, HAK_{1, 4, 7}, HOK₁, HPB_{1, 2, 3, 4, 7, 8}, JDO_{1, 2, 3, 7}, JMA_{1, 3, 7}, KIN_{1, 7, 8}, LEA_{1, 2, 3}, LIN_{1, 2, 3, 4, 5, 6, 7}, MAK₁, MOK_{1, 3, 5}, MOO₁, ORH_{1, 2A, 2B, 3A, 3B}, OEO_{1, 3A, 4, 6}, PAR_{1, 9}, POR₁, POS₁, RBM₁, RSN_{1, 2}, RIB_{1, 2}, RCO_{1, 3, 7}, RSK_{1, 3, 7, 8}, SBW_{6A, 6R, 6I, 6B}, SCH_{1, 2, 3, 4, 5, 7}, SCI_{1, 2, 4A, 6A, 6B}, SKI_{1, 3, 7}, SNA_{1, 2, 3, 7, 8}, SPD_{1, 3, 4, 5, 7, 8}, SPE_{1, 3, 4, 7}, SPO_{1, 3, 7, 8}, SQU_{1T, 6T}, SSK_{1, 3, 7, 8}, STA_{1, 3, 4, 5, 7}, STN₁, SWA_{1, 3, 4}, SWO₁, TAR_{1, 2, 3, 4, 5, 7, 8}, TOR₁, TRE_{1, 2, 7}, TRU_{3, 4}, WAR_{1, 2, 3, 7, 8}, WWA_{2, 3, 4, 5B, 7}, YEM_{1, 8, 9}

NOTE: Pending the results of the camera rollout occurring in 2023/24, the stocks presently allocated may be revisited in future.

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NOTE: This multi-year project was consulted on in 2022/23 and is included here for completeness

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

Project Code: INT2022-03

Start Date: 1 July 2022

Completion Date: 30 June 2025

Guiding Objectives: CSP Objectives B, C, E; CSP Coral plan.

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.

Research approach

A catalogue of Observer-collected coral samples will be created and maintained. These samples will be verified taxonomically by domestic experts at regular intervals throughout the year. In addition to this (when possible and as needed), international coral experts will refine the taxonomic identification even further. The updated taxonomic identification of the bycatch samples will then be shared with Fisheries New Zealand for them to update this information in the COD database.

In addition to taxonomic verification of returned specimens and photographs, the project will incorporate funding to facilitate genetic analysis of bycatch. Genetic methods can further elucidate the extent of diversity, refine taxonomic resolution, and distinguish cryptic species. Genetic analyses can also be applied to archived specimens for targeted research on specific taxa or target fisheries.

Observer briefings, manuals, and training material will be revised based on outputs of this project to continue to improve the accuracy of at-sea identification, and thus continually provide higher-quality data for downstream usage.

Outputs

1. Records and imagery of previously unidentified cold-water coral bycatch obtained by government funded Fisheries Observers within the New Zealand EEZ.
2. Creation and maintenance of a catalogue of Observer collected coral samples.
3. Report(s) detailing confirmed identification, provenance, and all other data collected, for all specimens examined. Data will be reported by fishery stratum (fishing method, fishery area, and, where possible, target species).
4. Updated coral identification guides and other resources for use in training government Fisheries Observers.

Note: A three-year term is proposed

Indicative Research Cost: \$80,000 per annum

Cost Recovery: F(CR) Item 4B (100% Industry)

Fish stocks: BAR_{1, 5}, BYX_{1, 2}, HAK₁, HOK₁, JMA_{3, 8}, LIN_{1, 5, 6}, ORH_{1, 2A, 2B, 3A, 3B}, OEO_{4, 6}, SBW_{6A, 6R, 6I, 6B}, SCI_{4A}, SQU_{1T, 6T}, SWA_{3, 4}, WWA_{5B}

NOTE: Pending the results of the camera rollout occurring in 2023/24, the stocks presently allocated may be revisited in future.

NOTE: This multi-year project was consulted on in 2022/23 and is included here for completeness

2.5 INT2022-04 Risk assessment for protected corals

Project Code: INT2022-04

Start Date: 1 July 2022

Completion Date: 30 June 2024

Guiding Objectives: CSP Objectives C and E, CSP Coral Plan.

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.

Research approach

This will be a two-year project, with an initial focus on collation of data and model inputs, methodology exploration, alignment with and consideration of related research and pilot testing, prior to fully running the assessment in the second year. The chosen methodology will be guided by the tendering process and recommendations/value add suggested by the successful supplier, in addition to refinement during the first year. The assessment will include multiple species and multiple groups representative of, for example, the four protected coral groups, corals of varied threat status in the New Zealand Threat Classification Scheme, corals with various morphological and life history traits, and potentially taxa with varied amounts of available data. Risk will be determined against varied fishing-related metrics, for example target fishery, fleet/vessel category, fishing gear.

Depending on new data available and their adequacy to improve the Productivity-Susceptibility-Analysis (PSA) approach used in the pilot that considers the extent of impact on the relevant species due to fishing activity ("susceptibility"), and the potential of the species to recover from the impact ("productivity"), a similar approach may be used (but more nuanced and detailed). Preferably, a fuller more quantitative approach incorporating methods more akin to those employed in shark, mammal or seabird risk assessments will be used. There is an expectation that methodology development and progression of the project will align with related coral research and outputs (e.g., most recent species distribution models), and parametrisation will be agreed through a targeted CSP Technical Working Group to ensure consistency in use of definitions and values (e.g., for naturalness, catchability, selectivity etc.). Risk assessment outputs will be used in future research, and as a guide for prioritisation of coral conservation and fisheries management. The success and feasibility of this project depends heavily upon data

uniformity and its scalability EEZ-wide; this will be ascertained during the first year of the project and will decide whether more information is required to meet the project aim.

Outputs

1. Annual progress reports and presentation to the CSP Technical Working Group.
2. A final technical report and summary of results will be provided to and reviewed by the CSP Technical Working Group, and made available online.
3. Groomed data and maps in electronic formats.
4. Recommendations on future research and conservation management implications of the research for corals.

Note: A two-year term is proposed

Indicative Research Cost: \$75,000 per annum

Cost Recovery: F(CR) Item 4B (100% Industry)

Fish stocks: BAR_{1, 5}, BYX_{1, 2}, HAK_{1, 4, 7}, HOK₁, JMA_{3, 8}, LIN_{1, 5, 6}, ORH_{1, 2A, 2B, 3A, 3B, 7A, 7B}, OEO_{1, 3A, 4, 6}, SBW_{6A, 6R, 6I, 6B}, SCI_{4A}, SQU_{1T, 6T}, SWA_{3, 4}, WWA_{5B}.

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NOTE: This multi-year project was consulted on in 2022/23 and is included here for completeness

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

Project Code: INT2022-05

Start Date: 1 July 2022

Completion Date: 30 June 2025

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

Project Objectives:

1. Increase understanding of the ecology and impacts of fishing on protected corals in Fiordland, including the black coral *Antipathella fiordensis* and stlyasterid (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 stlyasterid (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.

Research Approach

To increase our understanding of *A. fiordensis* and support its management, the project will include fieldwork, lab work and modelling approaches, and employ an ROV to expand sampling capacity beyond the limits of SCUBA. There are four main components to the project:

1. Fisheries impacts - compiling data from fisher surveys, abundance surveys and creation of a database of colony health status/observed fishing impacts.
2. Distribution patterns - based upon SCUBA and ROV surveys, coral size and abundance will be determined at multiple locations in Doubtful, Dusky and Breaksea Sounds, and resulting data combined with environmental correlates to ground truth and develop species distribution models.
3. Long-term monitoring plots will be established and SCUBA and ROV surveys, and 3D photogrammetry, will be used to determine population dynamics, recruitment, recovery from physical damage and growth through time.
4. Connectivity patterns between coral populations will be determined across vertical gradients, and between fished and unfished areas using genetic approaches.

Outputs

1. Annual progress reports and presentation to the CSP Technical Working Group.
2. A final technical report and summary of results will be provided to and reviewed by the CSP Technical Working Group, and made available online.
3. Groomed data and maps in electronic formats.
4. Recommendations on future research and conservation management implications of the research for black corals.

Note: A three-year term is proposed

Indicative Research Cost: \$30,000 per annum

Cost Recovery: 100% Crown funded for year 1 and 2 of the project. The cost recovery of year 3 of the project will be considered and consulted on in developing the CSP Annual Plan 2024/25.

Fish Stocks: N/A (for year 1 and 2 of the project).

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

Project Code: INT2023-02

Start Date: 1 July 2023

Completion Date: 30 June 2024

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

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.

Research approach

Where electronic monitoring identifies an incidental protected species capture, all footage obtained, by specimen, will be delivered to a suitable taxa expert in electronic format on a regular basis. Details on each capture, including the date, time, location, fishery will also be provided.

Camera footage will be examined to determine the following:

- Species identification, to the lowest taxonomic level possible
- Sex (where possible)
- Age (where possible), and
- Provenance (origin) (where possible).

These data will be reported by taxon and fishery stratum (fishing method, fishery area and target species). When a specimen is identified, the identification features used shall be fully described. The level of confidence in each specimen’s identification (and associated age and sex information) will also be recorded.

Outputs

1. A technical report(s) that details a summary of the species identification results.
2. Provision of all data collected in electronic format, suitable for updating Fisheries New Zealand databases and/or other relevant databases.
3. A technical report(s) that describes the degree to which camera footage obtained allows for species level verification, identifies barriers (if any) to achieving fine scale taxonomic resolution, projects workload for protected species identification following the full deployment of cameras on boats, and provides recommendations for an approach to cameras-detected species identification projects in future years.

Note: A one-year term is proposed

Indicative Research Cost: \$60,000

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish stocks: ALB1, BAR1, BIG1, BNS1, ELE3, FLA3, GUR1, 3, 7, 8, HOK1, HPB1, 3, JDO1, 7, LIN1, 5, MOK3, ORH1, RCO3, RSN2, SCH1, 3, 5, 8, SNA1, 7, 8, SPO3, 7, STA3, 5, STN1, SWO1, TAR1, 3, 8, TOR1, TRE7

DRAFT

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

Project Code: INT2023-03

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objective A; CSP Sea Turtle Medium Term Research Plan

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).

Research approach

This project will (a) combine and analyse commercial and comprehensive environment data to characterise spatial and temporal patterns of fishing and catch, and (b) determine the relative contribution of specific fishing grounds to fisher catch and effort, and to turtle bycatch. Interviews will be conducted with fishers operating in the region to better understand patterns, and better understand observed patterns in the captures of sea turtles.

By providing data to better understand fishing behaviour, the value of different fishing grounds, and the overlap between fleet and turtle distributions, the potential trade-offs of restricting or modifying fishing in certain times and places to mitigate turtle captures can be better evaluated.

Outputs

A technical report describing:

1. A characterisation of SLL fishing off the east coast North Island, using 'fishing units' including catch composition, location, time, and environmental conditions such as currents, sea temperatures, primary productivity, ocean mixing, proximity to ocean fronts;
2. Known turtle interactions within each fishery unit; and
3. Evaluation of the potential costs (to catch, by weight) and benefits (to avoidance of turtle capture) that would have been incurred from removing fishing effort in alternative fishery units.

Note: A one-year term is proposed

Indicative Research Cost: \$50,000

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish stocks: BIG1, STN1, SWO1, TOR1

References:

Abraham, E.R.; Tremblay-Boyer, L.; Berkenbusch, K. (2021). Estimated captures of New Zealand fur seal, common dolphin, and turtles in New Zealand commercial fisheries, to 2017-18. New Zealand Aquatic Environment and Biodiversity Report No. 258. 94 p.

Dunn, M.R.; Finucci, B.; Pinkerton, M.H.; Sutton, P. (2022). Review of commercial fishing interactions with marine reptiles. NIWA Client Report 2022147WN. 78 p.

Dunn, M.R.; Finucci, B.; Pinkerton, M.H.; Sutton, P. (submitted to *Frontiers in Marine Science*). Increased captures of the Critically Endangered leatherback turtle (*Dermochelys coriacea*) around New Zealand: The contribution of warming seas and changes in fisher behaviour.

Martin, S.L.; Siders, Z.; Eguchi, T.; Langseth, B.; Yau, A.; Baker, J.; Ahrens, R.; Jones, T.T. (2020). Update to assessing the population-level impacts of North Pacific loggerhead and western Pacific leatherback turtle interactions: inclusion of the Hawaii-based deep-set and American Samoa based longline fisheries. U.S. Dept. of Commerce, NOAA Technical Memorandum NOAA-TMNMFS-PIFSC-101, 67 p. doi:10.25923/pnf2-2q77.

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

Project Code: INT2023-04

Start Date: 1 July 2023

Completion Date: 30 June 2026

Guiding Objectives: CSP Objectives B, C; National Plan of Action – Sharks; New Zealand sea lion Threat Management Plan.

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 observed captured in New Zealand fisheries (for live captures and dead specimens discarded at sea).

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 the 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 a continuation of INT2020-02 and is designed to complement the existing seabird and coral identification projects. Observers routinely collect samples of genetic material from these taxa, and these can be used to resolve uncertain identification determinations from photographs.

Research approach

Where Fisheries Observers recorded an incidental capture of a marine mammal, turtle, or protected fish generally no specimen is retained. Instead, photographic records and a genetic sample are taken. Live interactions are photographed where possible. All photographs obtained, by specimen, will be delivered to a suitable expert for that taxonomic group in electronic format on a quarterly basis. Details on the date, time, location, and fishery of capture will also be provided. Photographs will be examined to determine the following:

- Identification, to the lowest taxonomic level possible
- Sex (where possible)
- Age (where possible), and
- Provenance (origin) (where possible).

These data will be reported by taxon and fishery stratum (fishing method, fishery area and target species). When a specimen is identified, the identification features used shall be fully described.

Genetic samples of all bycaught marine mammals, turtles and protected fish are routinely collected by Fisheries Observers and where photographic analysis cannot adequately determine taxa, genetic analysis may be undertaken.

Outputs

1. A summary of results will be reported, reviewed by the CSP TWG, and published on an annual basis.
2. Information requested by CSP will be provided within a reasonable timeframe (usually 10 working days).

3. Provision of all data collected in electronic format, suitable for updating Fisheries New Zealand databases and/or other relevant databases.

Note: A three-year term is proposed

Indicative Research Cost: \$15,000 per annum

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish stocks: BAR_{1, 7}, BIG₁, BNS_{1, 2, 3, 7}, BUT_{5, 7}, BWS₁, ELE_{3, 5, 7}, EMA_{1, 3, 7}, FLA_{1, 2, 3, 7}, GMU₁, GSH_{1, 3, 4, 7, 8, 9}, GSP_{1, 7}, GUR_{1, 2, 3, 7, 8}, HAK_{1, 4, 7}, HOK₁, HPB_{1, 2, 3, 4, 7, 8}, JDO_{1, 2, 3, 7}, JMA_{1, 3, 7}, KIN_{1, 7, 8}, LEA_{1, 2, 3}, LIN_{1, 2, 3, 4, 5, 6, 7}, MAK₁, MOK_{1, 3, 5}, MOO₁, ORH_{1, 2A, 2B, 3A, 3B}, OEO_{1, 3A, 4, 6}, PAR_{1, 9}, POR₁, POS₁, RBM₁, RSN_{1, 2}, RIB_{1, 2}, RCO_{1, 3, 7}, RSK_{1, 3, 7, 8}, SBW_{6A, 6R, 6L, 6B}, SCH_{1, 2, 3, 4, 5, 7}, SCI_{1, 2, 4A, 6A, 6B}, SKI_{1, 3, 7}, SNA_{1, 2, 3, 7, 8}, SPD_{1, 3, 4, 5, 7, 8}, SPE_{1, 3, 4, 7}, SPO_{1, 3, 7, 8}, SQU_{1T, 6T}, SSK_{1, 3, 7, 8}, STA_{1, 3, 4, 5, 7}, STN₁, SWA_{1, 3, 4}, SWO₁, TAR_{1, 2, 3, 4, 5, 7, 8}, TOR₁, TRE_{1, 2, 7}, TRU_{3, 4}, WAR_{1, 2, 3, 7, 8}, WWA_{2, 3, 4, 5B, 7}, YEM_{1, 8, 9}.

NOTE: Pending the results of the camera rollout occurring in 2023/24, the stocks presently allocated may be revisited in future.

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

Project Code: INT2023-05

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objectives B and E; CSP Protected Coral Medium Term Research Plan Theme

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.

Research approach

This project will use recently tested genetic markers to examine deep-sea gorgonian corals (Anthozoa: Octocorallia: Alcyonacea) of the sea-fan family Paramuriceidae, which is known to constitute at least 15 genera within the NZ EEZ. However, there are currently only two NZ records of described species from this group (Specify niwainvert extract January 2023); the remainder constitute undescribed or unidentified species. Outputs of this project would supplement recent examinations of species-level diversity for another gorgonian family, the Primnoidae, which was previously conducted for the Chatham Rise (BCBC2020-26) and would provide a crucial framework for review and revision by international taxonomic experts (see INT2023-07 Expert identifications of protected corals). The identifications and associated distributional data would also contribute to ongoing CSP projects INT2022-03 (bycatch identification) and POP2022-04 (uncatalogued corals).

Coral paramuriceid specimens from observed trips and NIWA trawl surveys or biodiversity research voyages from FMA 4 and 6, held within the NIWA Invertebrate Collection, will be examined for morphological diversity. From these, up to 48 specimens will be selected for target bait-capture DNA sequencing of Ultra-Conserved Elements and exons ('UCEs'; Quattrini et al., 2017), which is a genomic approach capable of unambiguously distinguishing closely related species of octocorals (Untiedt et al., 2021), including gorgonians (Bilewitch, 2022). DNA sequence data will be generated for each of the 48 sequenced samples, which will be used to reconstruct the phylogenomic relationships of paramuriceids following the methods described in Bilewitch (2022). The resulting high-resolution genealogy will be used to provide an estimate of the total number of species present, including those derived from bycatch vs. non-bycatch specimens (as in Bilewitch, 2022), and a comparison of the observed diversity between the two FMAs. These results will represent the first in-depth examination of genetic diversity for this coral family in the world and will be of interest internationally as the Paramuriceidae is a common constituent of seamounts and other hard-bottom habitats in the deep-sea.

Outputs

A technical report (and associated data), detailing high-resolution species inventory for the Chatham Rise and Campbell Plateau FMA regions for the Paramuriceidae (formerly referred to as the Plexauridae [PLE], or 'plexaurid' sea-fans)

Note: A one-year term is proposed

Indicative Research Cost: \$58,000

Cost Recovery: F(CR) Item 4B (100% Industry)

Fish stocks: BAR5, HAK1, 4, HOK1, JMA3, LIN4, 6, ORH3A, 3B, OEO4, 6, SBW1, 6A, 6R, 6I, 6B, SCI3, 4A, 6A, 6B, SQU1T, 1J, 6T, SWA3, 4, WWA3, 4, 5B

References:

Bilewitch, J.P. (2022) BCBC2020-26: Octocoral bycatch diversity on the Chatham Rise - Final Report. NIWA Client Report DOC21302: 31 p.

Bilewitch, J.P., Tracey, D. (2020) Coral biodiversity in deep-water fisheries bycatch. Final Report prepared by NIWA for the Conservation Services Programme, Department of Conservation. DOC19304-INT2019-05. NIWA Client Report 2020223WN: 36 p.

Conservation Services Programme DRAFT Protected Coral Medium-Term Research Plan 2022-23. 17 p.

Funnell, G., Gordon, D., Leduc, D., Makan, T., Marshall, B.A., Mills, S., Michel, P., Read, G., Schnabel, K., Tracey, D., Wing, S. (2023) Conservation status of indigenous marine invertebrates in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 40. Department of Conservation, Wellington. 42 p

Quattrini, A.M., Faircloth, B.C., Dueñas, L.F., Bridge, T.C.L., Brugler, M.R., Calixto-Botía, I.F., DeLeo, D.M., Forêt, S., Herrera, S., Lee, S.M.Y., Miller, D.J., Prada, C., Rádis-Baptista, G., Ramírez-Portilla, C., Sánchez, J.A., Rodríguez, E., McFadden, C.S. (2017) Universal target-enrichment baits for anthozoan (Cnidaria) phylogenomics: New approaches to long-standing problems. *Molecular Ecology Resources*, 2017: 1-15. 10.1111/1755-0998.12736

Tracey, D.M., Hjørvarsdottir, F. (2020) The State of Knowledge of Deep-Sea Corals in the New Zealand Region. NIWA Science and Technology Series: 140 p.

Tracey, D.M., Baird, S.J., Sanders, B., Smith, M.H. (2011) Distribution of protected corals in relation to fishing effort and assessment of accuracy of observer identification. NIWA Client Report WLG2011-33: 70 p.

Untiedt, C.B., Quattrini, A.M., McFadden, C.S., Alderslade, P.A., Pante, E., BurrIDGE, C.P. (2021) Phylogenetic relationships within *Chrysogorgia* (Alcyonacea: Octocorallia), a morphologically diverse genus of octocoral, revealed using a target enrichment approach. *Frontiers in Marine Science*, 7.10.3389/fmars.2020.599984

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

Project Code: INT2023-06

Start Date: 1 July 2023

Completion Date: 30 June 2025

Guiding Objectives: CSP Objectives D and E; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

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 parts 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.

Research approach

Molecular analyses of faecal samples collected from across the northern and southern populations of hoiho (subantarctic islands) over a five-year period (2017-2021) will establish any difference in diet, any changes in hoiho microbiomes, and the cooccurrence of disease challenges over this time frame. Relevant metadata from each of the sites will be obtained from the Department of Conservation's Yellow-Eyed Penguin Database.

Outputs

A written technical report outlining:

- the status of diet in the northern and southern populations of hoiho;
- characterising the hoiho microbiome, and identifying viral illnesses present at breeding sites over the time period 2017 to the present day;
- established similarities or differences in diet, microbiome, and disease between the northern and southern subpopulations of hoiho.

This information, in combination with other studies into the feeding zones and health of hoiho, will deliver a clearer picture of the impact of fishing practices, such as bottom trawling, on the species.

Note: A two-year term is proposed

Indicative Research Cost: \$50,000 per annum

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish stocks: ELE3, SCH3, 5, SPO3

References:

Mattern T, Meyer S, Ellenberg U, Houston DM, Darby JT, Young M, van Heezik Y, Seddon PJ. 2017. Quantifying climate change impacts emphasises the importance of managing regional threats in the endangered yellow-eyed penguin. *PeerJ* 5:e3272.

Seddon PJ, van Heezik Y, Ellenberg U. 2013. Yellow-eyed penguin (*Megadyptes antipodes*), p 360. In Borboroglu PG, Boersma PD (ed), *Penguins: natural history and conservation*. University of Washington Press, Seattle, WA.

Young MJ, Dutoit L, Robertson F, van Heezik Y. 2020. Species in the faeces: DNA metabarcoding as a method to determine the diet of the endangered yellow-eyed penguin. *Wildl Res* 47(6): 509-522.

West AG, Waite DW, Deines P, Bourne DG, Digby A, McKenzie VJ, Taylor MW. 2019. The microbiome in threatened species conservation. *Biol Conserv* 229:85-98

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2.13 INT2023-07 Expert identifications of protected corals

Project Code: INT2023-07

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objectives B and E; CSP Protected Coral Medium Term Research Plan (Theme 1)

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.

Research approach

This project seeks funds to extend and add value to the outputs of the POP2022-04 'Cataloguing decades of undocumented protected coral specimens' CSP project, by bringing international taxonomic experts to New Zealand to confirm and/or revise identification of protected coral specimens in the NIC in Wellington. The project relates to protected deep-sea and shallow-water coral species in the orders Alcyonacea (specifically the gorgonian octocoral groups), and Scleractinia (stony corals), and the intention is to invite three experts to New Zealand in 2023/24 to confirm protected coral identifications to species level for stony corals and paramuriceid/plexaurid/acanthogorgiid octocorals. The need for identifications across these taxonomic groups highlights a real gap in knowledge in our region. All provide ecosystem services in the deep sea and constitute frequent components of trawl bycatch (e.g., see Mills et al. 2022).

Experts will be invited to the NIC for the identifications required and for the published description of our region's fauna (e.g., as previously by Cairns (2012; 2016; 2021) for primnoid sea fans; Opresko et al. (2014; 2022) for black corals). To make the most of the visiting experts, this project will have the expert include bycaught coral specimens collected by Fisheries Observers under CSP project INT2019-04 'Identification storage, and genetics of cold-water coral bycatch specimens' in addition to samples from research voyages.

Outputs

A technical report with a list of verified coral taxa and their geographic locations. Experts to work on New Zealand region Memoirs of their protected coral group.

Note: A one-year term is proposed

Indicative Research Cost: \$30,000

Cost Recovery: F(CR) Item 4B (100% Industry)

Fish stocks: BAR1, 5, BYX1, 2, HAK1, 4, 7, HOK1, JMA3, 8, LIN1, 5, 6, ORH1, 2A, 2B, 3A, 3B, 7A, 7B, OEO1, 3A, 4, 6, SBW6A, 6R, 6I, 6B, SCI4A, SQU1T, 6T, SWA3, 4, WWA5B

References:

Cairns S.D. (2012). The Marine Fauna of New Zealand: New Zealand Primnoidae (Anthozoa: Alcyonacea). Part 1. Genera *Narella*, *Narelloides*, *Metanarella*, *Calyptraphora*, and *Helicoprinnoida*. NIWA Biodiversity Memoir 126: 71 p.

Cairns S.D. (2016). The Marine Fauna of New Zealand: Primnoid octocorals (Anthozoa, Alcyonacea) – Part 2. *Primnoella*, *Callozostron*, *Metafannyella*, *Callogorgia*, *Fanellia* and other genera. NIWA Biodiversity Memoir 129. 136 p.

Cairns S.D. (2021). The Marine Fauna of New Zealand. Primnoid octocorals (Anthozoa, Alcyonacea) – Part 3. *Thouarella*, and additional records of other primnoid species. NIWA Biodiversity Memoir 133: 72 p.

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Mills, S.; Macpherson, D.; Connell, A.; Tracey, D. (2022). INT2019-04 Identification and storage of cold-water coral bycatch specimens 1 July 2021 – 31 December 2021. Milestone 7. Six monthly progress update prepared by NIWA for the Conservation Services Programme, Department of Conservation. DOC20303-INT2019-04. 23 p.

Opresko, D.; Tracey, D.; Mackay, E. (2014). Antipatharia (black corals) for the New Zealand region. A field guide of commonly sampled New Zealand black corals including illustrations highlighting technical terms and black coral morphology. NIWA Client Report for the New Zealand Aquatic Environment and Biodiversity Report No. 131. 20 p.

Opresko, D.M.; Stewart, R.; Voza, T.; Tracey, D.; Brugler, M.R. (2022). New genus and species of black coral from the SW Pacific and Antarctica (Cnidaria: Anthozoa: Antipatharia: Schizopathidae) *Zootaxa* 5169 (1): 031–048.

Tracey, D., Macpherson, D., Stewart, R., Bilewitch, J., Mills, S., Stevens, D., Wood, B., Mackay E., Chin, C., Maggs, J. (2021b). Updated coral guide and inshore invertebrate guide coral content. NIWA Fisheries funded project FIFI2202. 19 p.

2.14 INT2023-08 Sub-antarctic albatross diet: composition of natural prey versus fisheries bait/waste

Project Code: INT2023-08

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objectives B and E; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

Project Objectives:

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 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.

Research approach

This is a one-year laboratory and desktop study to analyse pre-collected albatross scat/stomach samples and conduct a literature review.

The DNA metabarcoding technique used in analyses will follow methodology developed to investigate king shag diet in previous CSP project BCBC2019-05. Results will be matched to GenBank; the genetic sequence database and prey identified to species level where possible.

A data extract will be requested from the FNZ Research Data Management team to identify bait and discard species recorded in the Centralised Observer Database for SLL fisheries and these will be separated out from the GenBank results to calculate the proportion of species considered naturally foraged and scavenged.

Outputs

1. A technical report identifying levels of fisheries and naturally foraged prey species for selected albatross, discussed in the context of a literature review incorporating previous research in this area, and providing future recommendations on considerations for improved risk assessment and mitigation measures.
2. All data will be provided to DOC in electronic format.

Note: A one-year term is proposed

Indicative Research Cost: \$40,000

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish stocks: BAR_{1, 4, 5, 7}, BIG₁, GUR_{1, 7}, HAK_{1, 7}, HOK₁, HPB_{3, 4, 7, 8}, JMA_{3, 7}, LIN_{1, 3, 4, 5, 6, 7}, RIB_{2, 3, 4, 5, 7}, RCO₃, SBW_{6A, 6B, 6I, 6R}, SCH_{3, 4, 8}, SCI_{1, 2, 3, 6A}, SQU_{1J, 1T, 6T}, STN₁, SWA_{1, 3, 4}, SWO₁, TAR_{1, 2, 3, 7}, TOR₁, WAR₃, WWA_{5B}

2.15 INT2023-09 Understanding the extent and usage of coral rubble reporting codes by Fisheries Observers

Project Code: INT2023-09

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objective B; CSP Coral Medium Term Research Plan Theme 1

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.

Research approach

The coral rubble reporting codes CBB (coral rubble alive or dead) and CBD (coral rubble dead) account for over half of reported coral bycatch greenweight. However, ascertaining life status from live corals and images is very difficult. This project will examine observer images and quantify the likely proportion of genuine rubble; including how much of 'live or dead' fits each category, if more specific codes could have been used, if images are taken and match reports, and mapping areas/taxa/fisheries for which this code is the most commonly used.

The first step in this project is to determine what the current understanding of definitions of coral rubble is and when coral rubble codes are being applied by examining observer material (images, reports, and instructions), including archival unlabelled images, and if applicable, fisher reports of bycatch using rubble codes. The proportion of correct reporting will be determined, and to better understand the distribution of incidents of coral rubble bycatch, rubble reports will be analysed by year, target fishery, area, fishing gear, and/or other relevant metrics available in the Centralised Observer Database. Results from these analyses will help inform revision of observer training material and determine steps for routine checks of reported coral rubble.

Outputs

A technical report, based upon observer images, that will quantify the likely proportion of genuine rubble; including how much of 'live or dead' fits each category CBB (coral rubble alive or dead) and CBD (coral rubble dead), if more specific codes could have been used, if images are taken and match reports, and mapping areas/taxa/fisheries for which this code is the most often used.

Note: A one-year term is proposed

Indicative Research Cost: \$10,000

Cost Recovery: F(CR) Item 4B (100% Industry)

Fish stocks: BAR1, 5, BYX1, 2, HAK1, 4, 7, HOK1, JMA3, 8, LIN1, 5, 6, ORH1, 2A, 2B, 3A, 3B, 7A, 7B, OEO1, 3A, 4, 6, SBW6A, 6R, 6I, 6B, SCI4A, SQU1T, 6T, SWA3, 4, WWA5B

2.16 INT2023-10 Impact of fisheries extractions on pelagic foraging seabird populations in the wider Hauraki Gulf area

Project Code: INT2023-10

Start Date: 1 July 2023

Completion Date: 30 June 2026

Guiding Objectives: CSP Objective D; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

Project Objective:

1. Improve understanding of food-web dynamics and the potential impact of fisheries extractions on foraging success through modelling of seabird feeding associations and biomass availability in fish schools.
2. Monitor fluttering shearwaters and white-fronted tern populations based on these species high-level foraging association and dependence on fish schools and low population sizes within the Hauraki Gulf region.
3. Assess changes in food availability in fish schools, including inter-annual variation, through DNA analysis of scat samples from fluttering shearwaters and white-fronted terns and identify changes in plankton productivity.

Rationale

Seabird populations in the Hauraki Gulf (e.g. gulls, terns, gannets, fluttering shearwaters, prions, Buller's shearwaters) are either at risk, or have seen population declines in recent years. Fish schools provide a valuable food source for seabird populations by bigger fish in the school (e.g. kahawai, trevally) driving smaller prey species (plankton, krill, small fish) to the surface where they are available to seabirds. These schools of large fish are also targeted by commercial fishers. While fisheries outtake of small pelagic fish species (of the size suitable for seabird prey) is considered minimal in the Hauraki Gulf region it is the impact on the food web of removing larger fish that is in question. Fisheries extractions of QMS fish species like kahawai and trevally may have an indirect negative impact on seabird feeding if less aggregations of big fish result in less biomass of plankton, krill and smaller fish being driven to the surface for the birds to feed on. It is necessary to better understand this relationship and the impact on the wider food web, and how it may be changing the feeding ecology of seabirds and subsequently impacting seabird populations. In order to achieve this, seabird populations will need to be monitored to look for temporal trends, model the impact of fewer/smaller fish schools on food availability to seabirds, and to look at temporal variation in what species are available to feed on from fish school workups, particularly changes in biomass and availability of energy rich plankton. This work will build on previous CSP research including INT2016-04, POP2017-06, POP2019-02 & BCBC2020-08 and will build on modelling by Pinkerton et al (2023) in their report entitled 'The role of low- and mid-trophic level fish in the Hauraki Gulf ecosystem'. (New Zealand Aquatic Environment and Biodiversity Report No. 301).

Research approach

Fluttering shearwater and white-fronted tern populations will be monitored during breeding season using nest surveys at established study sites and aerial photography (drone). The results will be considered in the context of fisheries extractions in the region during breeding season. This will also consider findings from DNA analysis of prey species found in scat and the modelling of impacts on populations with reduced biomass availability of prey species (plankton, krill etc.) for adults to feed chicks during the breeding season due to fisheries extractions and environmental variables (e.g., sea temperature and primary productivity).

Outputs

1. A technical report that describes the potential impact of fisheries extractions on seabird populations in the Hauraki Gulf region that will inform fisheries management.
2. All data will be provided to DOC in an electronic format.

Note: A three-year term is proposed

Indicative Research Cost: \$30,000

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish stocks: EMA1, GMU1, JMA1, KAH1, PIL1, SNA1, STN1, SWO1, TRE1

DRAFT

2.17 INT2023-11 Understanding coral bycatch - assessing large catches

Project Code: INT2023-11

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objective B; CSP Protected Coral Medium Term Research Plan (Theme 1)

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., 500kg - >1tonne/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.

Research approach

This project would look at historical coral bycatch records, survey subject matter experts, examine COD vs. trip diaries, and examine imagery, to see if large catches (500kg - >1tonne/event or trip) are possible or likely, as we often see such high reports in the bycatch records. Comparisons would be made between maximum research survey coral catches by taxa, and maximum observed and corroborated catches by taxa on commercial vessels.

These initial findings will be used to establish data grooming protocols and thresholds that trigger data checks by taxa/morphological groups. A subsequent second-phase project could use modelling approaches to validate historical reporting and to map areas/fisheries where high bycatch is possible/ likely (e.g., by overlapping results with trawl footprint data and hotspots abundance data in heavily fished and rarely fished areas).

Outputs

1. A technical report, based upon recent and historical coral bycatch records, surveys of subject matter experts, examination of COD vs. trip diaries and imagery, to see if large catches are feasible and likely.
2. Comparisons would be made between maximum research survey coral catches by taxa, and maximum observed and corroborated catches by taxa on commercial vessels - and mapped accordingly.
3. Drafting of data grooming protocols and thresholds by taxa/morphological groups that could underlie routine flagging and validation of Fisheries Observer (and potentially fisher) reported coral bycatch data.

Note: A one-year term is proposed

Indicative Research Cost: \$40,000

Cost Recovery: F(CR) Item 4B (100% Industry)

Fish stocks: BAR1, 5, BYX1, 2, HAK1, 4, 7, HOK1, JMA3, 8, LIN1, 5, 6, ORH1, 2A, 2B, 3A, 3B, 7A, 7B, OEO1, 3A, 4, 6, SBW6A, 6R, 6I, 6B, SCI4A, SQU1T, 6T, SWA3, 4, WWA5B

3. Population Projects

NOTE: This multi-year project was consulted on in 2021/22 and is included here for completeness, in addition to changes in budget for the remaining year. Due to unforeseen operational costs full delivery of this project will require an increase in budget to \$70,000 for year 3.

3.1 POP2021-04 Flesh-footed shearwater population monitoring

Project code: POP2021-04

Start Date: 1 July 2021

Completion Date: 30 June 2024

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

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 Titi 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. Titi 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.

Research Approach

Capturing and marking of adults and chicks will continue at Lady Alice and Ohinau Islands. To capitalise on this huge banding effort since 2016 (including thousands of chicks), the opportunity now arises to collect detailed information about the age of first return and first breeding in this species, plus juvenile survival rates from fledgling to first return. Over the next three years a large sample of banded birds will be recaptured at study burrows, newly dug burrows in study plots, and on the surface, allowing for demographic studies on survival rates in two regions.

The small colony on Titi Island in the Marlborough Sounds is the southernmost population in New Zealand of flesh-footed shearwaters. A resurvey and estimate of population size at this colony will provide information about whether population trends observed on northern colonies are matched by those at this outlier site.

Outputs

1. A technical report providing methods used and results of the flesh-footed shearwater population and demography assessments.
2. Data collected during the project to be made available in electronic format.

Note: A three-year term is proposed

Indicative Research Cost: \$60,000 year 1 and 2, \$70,000 year 3 as per consultation in CSP Annual Plan 2023/24.

Cost Recovery: F(CR) Item 3 (50% Industry 50% Crown)

Fish Stocks: BIG1, BNS1, GUR8, JDO1, SNA1, STN1, TAR1, 2, 8, TRE1, SWO1

DRAFT

NOTE: This multi-year project was consulted on in 2022/23 and is included here for completeness, in addition to changes in budget for the remainder of the project. Due to unforeseen operational costs full delivery of this project will require an increase in budget to \$100,000 per annum. If budget is increased the objective of at-sea monitoring can be expanded to include collecting data to inform the estimate of total population size.

3.2 POP2022-01 Black petrel population monitoring

Project code: POP2022-01

Start Date: 1 July 2022

Completion Date: 30 June 2025

Guiding Objectives: CSP Objectives B and E; CSP Seabird plan; National Plan of Action – Seabirds.

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 light-weight tracking tags allow for the tracking of juvenile dispersal and migration, a poorly understood cohort.

Research Approach

The capture and banding of breeding and non-breeding birds will continue at the main study sites on Aotea/Great Barrier Island. This work will be focussed on the incubation period to band and recapture adults (for estimates of annual breeding probability, adult survival, juvenile survival, and recruitment) and the fledgling period to band surviving chicks (to estimate breeding success).

Live capture of black petrels at-sea off northern New Zealand will also continue to increase sample sizes of recaptures of banded birds attracted to the research vessel. At-sea capture-recapture work aims to use ratios of banded to un-banded birds for independent modelling of the current population size of this species away from the main study colony. In addition, the bands of captured birds will be matched against banding histories from the study colony to assess survival rates for returning immatures that may have dispersed out of the study colony. To

achieve these two objectives, large numbers (i.e., hundreds of birds) will need to be safely live-captured at sea and checked for metal bands and any unmarked birds will be banded. As such, the at-sea capture-recapture work of POP2021-01 will continue over the next three years.

Depending on availability of resources and products, new lightweight solar-powered tags will be used to track age classes of black petrels where we have limited information on their movements. In particular tracking tags provide an opportunity to improve our understanding of the at-sea movements of juvenile black petrels. Improving insights into the distribution of this poorly understood cohort of birds is crucial. This research will be done in one of the three study seasons.

Outputs

1. A technical report providing methods used and results of the black petrel demographic research, and at-sea capture-recapture of black petrels.
2. Data collected during the project to be made available in electronic format.

Note: A three-year term is proposed

Indicative Research Cost: \$70,000 year 1, \$100,000 year 2 and 3 as per consultation in CSP Annual Plan 2023/24.

Cost Recovery: F(CR) Item 3 (50% Industry 50% Crown)

Fish Stocks: BIG1, BNS1, HOK1, HPB1, SNA1, STN1, SWO1, TAR1, 2.

NOTE: This multi-year project was consulted on in 2022/23 and is included here for completeness.

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

Project code: POP2022-02

Start Date: 1 July 2022

Completion Date: 30 June 2024

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

Project Objective:

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 light-weight tags and different attachment methods that allow birds to be monitored across multiple years.

Research Approach

We will investigate the options of using either a leg-loop harness attachment as used on wading birds or a tail mounted tag. There is a range of solar-powered light weight satellite tags available from major suppliers that are suitable to follow a cohort of FFSW chicks across at least one full year. If successful, we will find out if the juvenile birds go to the same areas as adults in the North Pacific and where they stay at sea in their first returning summer before they begin to visit colonies 3-4 years after fledging. We expect to deploy between 10 and 20 tags depending on which tag type is used and their current cost. The analysis of the data would be completed in a separate year once all these tags stop working.

Tags will be deployed on FFSW chicks on Ohinau Island just prior to fledging. This site is monitored under POP2021-04 and 10-20 high quality chicks will be selected for the tracking study.

Outputs

1. A technical report summarising the methods used to deploy tags and the initial results of the tracking study (first month).
2. A summary of these results will be reported to and reviewed by the CSP Technical Working Group and made available online.
3. Any recommendations on improvements for use of tracking tags on this species.

Note: A two-year term is proposed

Indicative Research Cost: \$30,000 per annum

Cost Recovery: F(CR) Item 3 (50% Industry 50% Crown)

Fish Stocks: BIG1, BNS1, GUR8, JDO1, SNA1, STN1, SWO1, TAR1, 2, 8, TRE1

DRAFT

NOTE: This multi-year project was consulted on in 2022/23 and is included here for completeness.

3.4 POP2022-03 Deep-sea protected coral reproduction study

Project code: POP2022-03

Start Date: 1 July 2022

Completion Date: 30 June 2024

Guiding Objectives: CSP Objective E; CSP Coral Plan.

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.

Research Approach

The study will examine physical specimens of preserved corals to analyse morphometrics and carry out histological analyses. The study will build upon the desktop study undertaken in BCBC2020-01 that identified candidate taxa for further analysis; the stony corals *Desmophyllum dianthus*, *Goniocorella dumosa* and *Enallopsammia rostrata*, and the octocorals *Paragorgia arborea* and *Primnoa notialis*. These species have also been identified as high and medium risk in the pilot coral risk assessment and sufficient samples are already available. Additional taxa will be included to represent the four protected coral groups, and to align with taxa commonly (or intended to be) included in coral fisheries risk assessments and species distribution models.

Outputs

1. Annual progress reports and presentations to the CSP Technical Working Group.
2. A written summary of results will be provided, along with a full technical report. This will also be presented to and reviewed by the CSP Technical Working Group and made available online.
3. Data to be provided in an electronic format.
4. Recommendations to be provided on how to apply the data to concurrent and future coral research, in particular suggested productivity parameters for risk assessment approaches, and how data might inform conservation management of protected corals.

Note: A two-year term is proposed

Indicative Research Cost: \$40,000 per annum

Cost Recovery: F(CR) Item 4B (100% Industry)

Fish Stocks: BAR_{1, 5}, BYX_{1, 2}, HAK₁, HOK₁, JMA_{3, 8}, LIN_{1, 5, 6}, ORH_{1, 2A, 2B, 3A, 3B, 7A, 7B},
OEO_{4, 6}, SBW_{6A, 6R, 6I, 6B}, SCI_{4A}, SQU_{1T, 6T}, SWA_{3, 4}, WWA_{5B}

DRAFT

NOTE: This multi-year project was consulted on in 2022/23 and is included here for completeness.

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

Project code: POP2022-08

Start Date: 1 July 2022

Completion Date: 30 June 2025

Guiding Objectives: CSP Objectives B and E; CSP Seabird plan; National Plan of Action – Seabirds.

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.

Research Approach

The project will collect data to improve estimates of key demographic parameters of Gibson's albatross via continued mark-recapture monitoring. This will follow established methods (Walker & Elliott 1999) to estimate survival, productivity, and recruitment, and estimate the size and trend of the population. This suite of data allows more precise assessment of population trends than from simple nest counts. Drone-based aerial survey methods will be used to conduct wider population counts beyond the study plots. GLS and satellite tags will be used to improve our knowledge of at-sea distribution and overlap with fisheries posing bycatch risk.

The research component for white-capped albatross will include surveys of the Disappointment Island study colony to help interpret past aerial photography data sets, deploy trail cameras to monitor breeding activity and timing of nest failures, collect band recovery data from study colony birds, continue to mark a sample of breeding birds to build up robust datasets for adult survival analysis and deploy and collect GLS tags from a sample of birds to look at the extent of movements of birds in relation to annual variability in foraging conditions. Opportunities to investigate the use of drones to estimate total population size more accurately may also be progressed as feasible.

This project will also provide recommendations for a long-term monitoring strategy that can most efficiently and effectively provide the data required to understand the drivers behind population change and monitor the outcome of fisheries bycatch reduction management.

Outputs

1. Annual technical report(s) on the work undertaken and results found, including update estimates of key demographic parameters and population estimates.
2. Annual summary of results will be presented to, and reviewed by, the CSP Technical Working Group, and made available online.
3. Recommendations for an efficient and effective long-term monitoring strategy.
4. Data collected during the project to be made available annually in electronic format.

Note: A three-year term is proposed

Indicative Research Cost: \$160,000 per annum

Cost Recovery: F(CR) Item 3 (50% Industry 50% Crown)

Fish Stocks: BAR_{1, 5}, BIG₁, GUR_{1, 7}, HAK₁, HOK₁, HPB_{4, 7, 8}, JMA_{3, 7}, LIN_{1, 4, 5, 6, 7}, RIB_{2, 3, 4, 5, 7}, SCH_{3, 8}, SCI_{3, 6A}, SQU_{1J, 1T, 6T}, STN₁, SWA_{1, 3, 4}, SWO₁, TAR_{1,2, 3, 7}, TOR₁, WAR₃, WWA_{5B}

DRAFT

NOTE: This multi-year project was consulted on in 2022/23 and is included here for completeness.

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

Project code: POP2022-10

Start Date: 1 July 2022

Completion Date: 30 June 2025

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

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 trialed 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.

Research Approach

The monitoring of key Antipodean albatross demographic parameters (adult survival, juvenile survival, recruitment, breeding probability, and breeding success) will take place during the austral summer. As this is a bi-annual breeder whose chicks take close to a year to fledge, both returning adults starting to breed, and chicks close to fledging can be monitored during the same trip allowing for a full assessment of all key vital rates. Monitoring will take place using protocols standardised over the last 20 years. However, an independent population estimate is out of date and a major data gap. Methods developed during 2021/22 will be employed to provide this key demographic parameter. Both streams of Antipodean albatross work involve close handling of birds and as such, feather sampling for stable isotope analyses and stress analyses (i.e., CORT) will be a simple addition to this work plan. The diet and stress analyses across multiple years and cohorts will provide much needed insights into the potential effects climate change has on this

rapidly declining species. This project will also provide recommendations for a long-term monitoring strategy that can most efficiently and effectively provide the data required to understand the drivers behind population change and monitor the outcome of fisheries bycatch reduction management.

White-chinned petrels breed at a similar time as Antipodean albatrosses and as such this species can be monitored at the same time. Key vital rates for this species are needed and as such a capture-mark-recapture study will be set up to facilitate the estimation of adult survival, juvenile survival, recruitment, and breeding probability). Additionally, while population estimates exist for both Auckland Islands (POP2017-04) and Campbell Island (BCBC2019-03), population estimates for Antipodes Island, another stronghold for the species, are lacking. As such, a population estimate employing methods developed on Auckland and Campbell Island will be conducted. Combined, these two work streams will provide updated parameters for one of the most bycaught species in New Zealand.

Outputs

1. Annual technical report(s) on the work undertaken and results found, including update estimates of key demographic parameters and population estimates.
2. Annual summary of results will be presented to, and reviewed by, the CSP Technical Working Group, and made available online.
3. Recommendations for an efficient and effective long-term monitoring strategy.
4. Data collected during the project to annually be made available in electronic format.

Note: A three-year term is proposed

Indicative Research Cost: \$160,000 per annum

Cost Recovery: F(CR) Item 3 (50% Industry 50% Crown)

Fish Stocks: BAR1, 5, 7, BIG1, HAK1, 7, HOK1, HPB3, 4, 7, JMA3, 7, LIN3, 4, 5, 6, 7, RCO3, SBW6A, 6B, 6I, 6R, SCH3, 4, SCI1, 2, 3, 6A, STN1, SWA1, 3, 4, SWO1, SQU1J, 1T, 6T, TOR1, WAR3, WWA5B

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

Project code: POP2023-01

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objectives B and E; CSP Sea Turtle Medium Term Research Plan

Project Objectives:

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.

Research Approach

The project will design and trial a statistically robust aerial line transect survey covering part or all the area off eastern Bay of Plenty and East Cape where interactions with surface longliners are most frequent. It is expected the methodology will involve the use of overhead fixed wing aircraft, onboard Fisheries Observers, and digital video technology to record the transects.

Outputs

1. A technical report describing the proposed survey methodology, capture of relevant environmental variables, statistical analyses and data storage, reviewed by the CSP Technical Working Group.
2. A final report describing the survey results and providing recommendations on potential improvements to the methodology, long-term data storage needs and other potential uses of the data.
3. Provision of all data and video files collected in electronic format.

Note: A one-year term is proposed

Indicative Research Cost: \$200,000

Cost Recovery: F(CR) Item 3 (50% Industry 50% Crown)

Fish Stocks: BIG1, STN1, SWO1, TOR1

DRAFT

3.8 POP2023-02 Southern Buller's population study

Project code: POP2023-02

Start Date: 1 July 2023

Completion Date: 30 June 2026

Guiding Objectives: CSP Objective E; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

Project Objectives:

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.

Research Approach

This three-year project is split across two field locations: the Snares and Solander Islands. At the Snares, work will continue with previously established mark-recapture monitoring methodology to further improve estimates of key demographic parameters. Particularly, estimates of annual survival of birds banded as breeders, which have showed continued decline in the most recent data assessment from CSP project POP2019-04 (2022). TDR's and GLS tags will also be fitted to breeding birds at the Snares to investigate diving behaviour and distribution patterns. The Solander field work will also entail fitting GPS tags to assess at-sea distribution patterns and work will also include an aerial and ground based census to update population estimates.

Outputs

1. Annual technical report(s) on the work undertaken and results found, including updated estimates of key demographic parameters, population size, at-sea distribution, and diving behaviour.
2. All data will be provided to DOC in electronic format.

Note: A three-year term is proposed

Indicative Research Cost: \$150,000 per annum

Cost Recovery: F(CR) Item 3 (50% Industry 50% Crown)

Fish Stocks: BAR1, 4, 5, BIG1, HOK1, LIN5, 7, SCI3, 6A, SQU1T, 6T, STN1, SWA4, WWA5B

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

Project code: POP2023-03

Start Date: 1 July 2023

Completion Date: 30 June 2025

Guiding Objectives: CSP Objectives C, D and E; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

Project Objectives:

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).

Research Approach

This two-year project will be split across two field seasons. In the first year, a distribution survey across Campbell Island will be performed, checking all previously known and unknown landing sites. In the second year, counts of the larger identified breeding areas will be undertaken to generate a population estimate. Tracking (GPS-dive loggers, satellite transmitters) of hoiho will occur in both years. Population data collected under this project are critical for assessing the species wide risk from bycatch in setnets and can inform species wide multi-threat risk assessments. Furthermore, foraging distribution data for the southern population are important as they can inform assessments of any direct or indirect effects of trawling on hoiho.

Outputs

A technical report (and associated data layers) detailing:

1. A population estimate for Campbell Island hoiho including methodology; and
2. The spatio-temporal distribution, activity and dive patterns of Campbell Island hoiho, and assessing potential overlap of hoiho foraging with fishing activities.

Note: A two-year term is proposed

Indicative Research Cost: \$100,000 per annum

Cost Recovery: F(CR) Item 3 (50% Industry 50% Crown)

Fish Stocks: BAR_{1, 5, 7}, BIG₁, HOK₁, HPB_{3, 5, 7}, LIN_{3, 4, 5, 6, 7}, RCO_{3, 7}, SCI_{2, 3, 4A}, SQU_{1J, 1T, 6T}, SWO₁, TAR_{1, 2, 3, 7W}

DRAFT

3.10 POP2023-04 Campbell Island seabird research

Project code: POP2023-04

Start Date: 1 July 2023

Completion Date: 30 June 2025

Guiding Objectives: CSP Objectives C and E; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

Project Objectives:

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 and Light-mantled Sooty Albatross nests located opportunistically during surveys of other priority species.

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 Campbell Island, research on Southern Royal Albatross has been combined with research on other priority species, such as Grey-headed Albatross, into one Campbell Island seabird research project. 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, Light-Mantled Sooty Albatross, Antipodean Albatross, Campbell Albatross, and White-chinned Petrels), but this a lower priority than the research on the species mentioned above and dependent on logistics.

Research Approach

To confirm the potential severe population decline of Southern Royal Albatross, nest counts will be conducted at the two traditional study areas as well as at three traditional index areas. Marked individuals will be resighted and new individuals will be marked in the Col study area. Here, 12 remote cameras have been placed in 2023 (POP2023-11) to monitor productivity, and these efforts will be continued through this project as well. Finally, GLS tags were also deployed on breeding Southern Royal Albatrosses in 2023 and these efforts will be repeated to ensure that

both breeding cohorts of this bi-annual species are tracked. If provided through other means, satellite transmitters will also be deployed on Southern Royal Albatrosses. Combined, these research avenues will provide the data required to understand the drivers behind population trends. This project will also provide recommendations for a long-term strategy that can most efficiently and effectively assess population change and monitor the outcome of fisheries bycatch reduction management.

Grey-headed albatross breed at a similar time as Southern Royal Albatross and thus this species can be monitored at a similar time, particularly if colonies are visited early in the Austral summer. Specifically, nest counts using traditional photo-points will provide updated insights into population size and trends, resights of marked individuals will extend the existing demographic dataset, and installation of remote cameras will allow for monitoring of breeding success (which has not been monitored for almost 30 years). Similarly, chicks of Northern Giant Petrels and nests of Light-mantled Sooty Albatross will be counted and mapped where observed during fieldwork on the two albatross species. Finally, key information (e.g., nest locations and/or counts) of other species, including Antipodean Albatross, Campbell Island Albatross, and White-chinned Petrel, should also be recorded while conducting monitoring of the focal species. Combined, this project will provide updated parameters for a range of seabird species vulnerable to bycatch in a highly-efficient way.

Outputs

1. Annual technical report(s) on the work undertaken and results found, including updated estimates of key demographic parameters and population estimates.
2. Annual summary of results will be presented to, and reviewed by, the CSP Technical Working Group, and made available online.
3. Recommendations for an efficient and effective long-term monitoring strategy.
4. Data collected during the project to annually be made available in electronic format.

Note: A two-year term is proposed

Indicative Research Cost: \$90,000 per annum

Cost Recovery: F(CR) Item 3 (50% Industry 50% Crown)

Fish Stocks: BAR1, 5, 7, BIG1, HOK1, HPB3, 5, 7, LIN3, 4, 5, 6, 7, RCO3, 7, SCI2, 3, 4A, SQU1J, 1T, 6T, SWO1, TAR1, 2, 3, 7W

3.11 POP2023-05 Auckland Islands New Zealand sea lions

Project code: POP2023-05

Start Date: 1 July 2023

Completion Date: 30 June 2026

Guiding Objectives: CSP Objective E; New Zealand sea lion Threat Management Plan.

Project Objectives:

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 (Chilvers et al. 2005, Johnston & Childerhouse 2022). 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, 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 (Bowen 2012).

Research Approach

Auckland Islands New Zealand sea lion pup production has historically been estimated using a range of methods including aerial and ground-based direct counts and mark-recapture (Baker et al. 2012, Chilvers 2012; Childerhouse 2013). This project will undertake ground-based pup counts at Enderby Island, Dundas Island and Figure of Eight Island. Researchers will mark a subset of pups following established protocols and collect high quality resight data from previously marked animals (Chilvers 2012; Childerhouse 2012). It is expected this work will take approximately five weeks.

In the interest of cost-savings, this project may be undertaken in conjunction with wider NZ sea lion Threat Management Plan research and management actions on the Auckland Islands.

Outputs

1. A technical report detailing methods used and results of the New Zealand sea lion pup production estimates.
2. Data collected during the project to be error-checked, formatted, and uploaded to the New Zealand sea lion demographic database.

Note: A three-year term is proposed

Indicative Research Cost: \$150,000

Cost Recovery: F(CR) Item 2 (90% Industry 10% Crown)

Fish Stocks: SQU6T, SCI6A

References:

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Johnston O, Childerhouse S. 2022. INT2020-02: Identification of marine mammals captured in New Zealand fisheries 2020-21. Report prepared for the Conservation Services Programme, Department of Conservation, Wellington, New Zealand. Cawthron Report No. 3772. 18 p.

Roberts J, Fu D, Doonan I & Francis C (2014) NZ sea lion: demographic assessment of the causes of decline at the Auckland Islands. Demographic model options: demographic assessment. Report prepared by NIWA for the Conservation Services Programme, Department of Conservation, Wellington, New Zealand. 142p.

4. Mitigation Projects

NOTE: This multi-year project was consulted on in 2021/22 and is included here for completeness.

4.1 MIT2021-01 Protected Species Liaison Project

Project Code: MIT2021-01

Start Date: 1 July 2021

Completion Date: 30 June 2024

Guiding Objectives: CSP Objective A; CSP Seabird plan; National Plan of Action – Seabirds, National Plan of Action – Sharks.

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 non-regulatory measures, to avoid interactions. To measure success of mitigation and identify areas where further development is needed across each fleet, there needs to be consistency in the mitigation measures used while still allowing for innovation. Through the 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.

Research Approach

Within the next three years the capacity of the programme is expected to grow substantially. The role of the Liaison Officers will largely remain the same, supporting and educating fishers in best practice mitigation and providing a vital interface between skippers, government, and researchers. The growth over the next three years will consist of additional Liaison Officers to expand into additional fisheries and areas, increased contact with high-risk vessels and fleets, development, and delivery of a training programme for crew on protected species and mitigation and the hiring of a full-time Liaison Coordinator to ensure the operational oversight of the programme.

Improvements in the next phase of the project are needed to measure the success of the Protected Species Liaison Programme and overcome constraints in reporting capability. This will be addressed through database development and standardised procedures. There will also be

increased engagement with quota holders to support the uptake of PSRMPs and Mitigation Standards.

Outputs

1. Database including PSRMPs installed and updated, vessels visited, trigger responses, mitigation materials and training provided.
2. Creation of an inter-agency Advisory Group and internal Project Executives Group to work through challenges within the programme and report progress.
3. Development of management protocols and responses to triggers.
4. Reports to relevant advisory groups detailing progress and any developments which have come from the fleet.
5. Annual written reporting will be provided as part of the NPOA-Seabirds - Annual Research Report.

Note: A three-year term is proposed

Indicative Research Cost: \$250,000 per annum

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish stocks:

Objective/Species	Indicative Cost	Fish Stocks
1. Surface Longline	\$50,000	ALB1, BIG1, STN1, SWO1
2. Bottom Longline	\$50,000	BNS1, HPB1, SNA1
3. Inshore Trawl	\$50,000	BAR1, 7, FLA1, GUR1, JDO1, LIN1, 2, RCO3, SNA1, 2, TAR1, 2, 3, TRE1, 7
4. Setnet	\$50,000	SCH3, 5, SPO3, ELE3, 5, MOK3, SPD5
5. Purse seine	\$50,000	SKJ1, JMA1, EMA1, PIL1

NOTE: This multi-year project was consulted on in 2022/23 and is included here for completeness.

4.2 MIT2022-01 Longline hauling mitigation devices

Project code: MIT2022-01

Start Date: 1 July 2022

Completion Date: 30 June 2024

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

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.

Research Approach

CSP project MIT2018-02 (Hauling mitigation for small longline vessels) developed two simple devices and conducted limited trialling which showed the devices to be effective at deterring birds from the hauling station where baited hooks can become available to seabirds. This project will seek to promote uptake of the devices developed and collect further data on bird activity to supplement previous findings.

Small longline vessel operators will be sought who are willing to participate in the project, and their preferred design of haul mitigation device will be supplied for deployment. To assess the effectiveness and practicality of the device, a data collection protocol will be developed. This is likely to involve at-sea data collection, reporting by crew, and through camera deployments where appropriate. It is envisaged that the protocols will be based on those developed by CSP project MIT2018-02, adapted as required to utilise a range of data inputs most effectively for the longer-term deployments during this project.

The project will include an initial workshop with industry representatives and other stakeholders to refine and target the approach taken.

The project will also include recommendations for any further refinement to improve the effectiveness and operationally practicality of the devices.

Outputs

1. A technical report on the work undertaken and results found.
2. A summary of results will be presented for review by the CSP Technical Working Group and made available online.
3. Recommendations on further refinements to improve effectiveness of haul mitigation devices and/or steps to further achieve wider uptake of these devices in longline fisheries.
4. Data collected during the project to be made available in electronic format.

Note: A two-year term is proposed

Indicative Research Cost: \$70,000 per annum

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish Stocks: BIG1, BNS1, 2, 3, 7, 8, HPB1, LIN1, 2, SNA1, STN1, SWO1

DRAFT

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

Project code: MIT2023-01

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objectives A, B and C; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

Project Objectives:

1. Review the effect of hook size and bait type on seabird and turtle bycatch rates across different target fisheries using existing information sources.
2. Review current best practice international literature on the impact of hook size on bycatch.
3. Interview surface longline operators in all fisheries to identify preferred hook size and bait type as turtle/seabird deterrents to better inform protected species risk management plans.

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.

Research Approach

This one-year project involves a desktop study to investigate existing bycatch data on hook type, size, and bait specific to longline fisheries for all bycatch seabird and turtle species, conduct a literature review, and a hold a half-day online workshop to speak with fishers on their experiences with hook and bait types to reduce bycatch.

Outputs

A technical report that details the impact of hook size and bait type on seabird/turtle bycatch rates to provide improved messaging on recommendations for mitigation use for reducing bycatch, and to inform any future review of fisheries regulations/circulars. The report will also detail international best practice and present results from the workshop with fishers.

Note: A one-year term is proposed

Indicative Research Cost: \$50,000

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish Stocks: BIG1, BNS1, 2, 3, 7, 8, GUR1, 7, 8, HPB1, LIN1, 2, SCH3, 5, SNA1, STN1, SWO1, TAR1, 2, 3, TOR1

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

Project code: MIT2023-02

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objectives A and B; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan; CSP Sea Turtle Medium Term Research Plan

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.

Research Approach

This project will build on initial work undertaken by DOC using existing TDR data to characterise the depth profile of hooks during the entire fishing period. This will include the collection of further fishing gear depth profiles using time-depth recorders over the entire soak period and quantifying possible explanatory variables such as line weighting and float configurations. The project will also assess bycatch records to describe capture time, to the extent possible, and review any relevant international research. The project will quantify the evidence on the effectiveness of existing practices (e.g., line weighting) to mitigate the availability of hooks during the soak and will recommend any other mitigation options for possible future use or testing.

Outputs

A technical report that details the research trials undertaken, results, and further recommendations to improve bycatch mitigation during pelagic soak periods.

Note: A one-year term is proposed

Indicative Research Cost: \$90,000

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish Stocks: BIG1, STN1, SWO1, TOR1

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 code: MIT2023-03

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objectives A and E; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

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. Analyse the effectiveness 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.

Research Approach

In this one-year project we propose to study the habitat utilisation (GPS-dive loggers) and diet of hoiho (bird-borne cameras/molecular diet analysis) breeding at Little Glory Bay and Steep Head 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) and whether this can explain differences the major differences in breeding success and the survival of chicks from the two colonies in this area. Importantly, this project will provide an opportunity to analyse the effectiveness of recently established voluntary set net closures adjacent to the Neck area.

Advice and support would need to be sought and obtained from Rakiura Māori Lands Trust (as the landowner and mana whenua) prior to embarking on this project.

Outputs

A technical report and associated data layers:

- describing the spatio-temporal distribution of hoiho from the Neck, Rakiura in relation to setnet fisheries with an assessment of potential direct or indirect effects on hoiho foraging; and
- evaluating the potential effectiveness of the voluntary setnet exclusion zone adjacent to the Neck, Rakiura and information needed to review it if needed.

Note: A one-year term is proposed

Indicative Research Cost: \$40,000

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish Stocks: ELE3, SCH3, 5, SPO3

DRAFT

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

Project code: MIT2023-04

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objective A; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

Project Objective:

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.

Research Approach

This project will assess the effectiveness of brightly coloured synthetic warps as a seabird bycatch mitigation practice by collecting at-sea data. It is envisaged that a bycatch proxy measure, such as number and behaviour of birds in the vicinity of the warp will be used. This provides for a more data-rich evidence base compared to monitoring bycatch which is a relatively rare event in comparison. To maximise cost saving synergies this project will be implemented alongside the at-sea testing component of MIT2022-07 (postponed to 2023/24). This will also mean that data can be collected alongside the testing of other warp strike mitigation devices thus allowing an assessment of comparative effectiveness.

Outputs

A technical report that details the research undertaken, results, and any further recommendations to improve the effectiveness of warp-strike mitigation.

Note: A one-year term is proposed

Indicative Research Cost: \$60,000

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish Stocks: BAR1, 7, FLA1, GUR1, JDO1, LIN1, 2, RCO3, SNA1, 2, TAR1, 2, 3, TRE1

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

Project code: MIT2023-05

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objective B; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

Project Objective:

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.

Research Approach

This project will build on existing CSP Liaison Programme capacity and will provide further gear and support that goes beyond the current scope and scale of the Liaison Programme project. Operators will be identified through the assessment of Protected Species Risk Management Plans against Mitigation Standards. Vessel-specific bycatch mitigation solutions will be developed through ongoing work with vessel operators and by utilising knowledge from Liaison Officers, in addition to the social research report on drivers for fisher uptake of seabird bycatch mitigation in the surface longline fishery (BCBC2020-11d).

Depending on the bycatch mitigation solutions identified, the provision of gear could potentially include hook-shielding devices (previously ordered under MIT2020-01), novel line weighting options, refinement of tori lines and/or hauling mitigation. Support to operators will include coordination of bycatch mitigation materials and assistance in their implementation. Support could also include testing of bycatch mitigation if operators need to refine at-sea suitability.

Outputs

1. A technical report that details areas of improved alignment to Mitigation Standards over the duration of this project. This report will also include a summary of any barriers that could not be overcome and provide recommendations on whether the Liaison Programme project should increase in scope and scale to further accommodate and sustain this increased mitigation support in the surface longline fleet.

Note: A one-year term is proposed

Indicative Research Cost: \$70,000

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish Stocks: BIG1, STN1, SWO1, TOR1

DRAFT

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

Project code: MIT2023-06

Start Date: 1 July 2023

Completion Date: 30 June 2025

Guiding Objectives: CSP Objectives A; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

Project Objective:

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.

Research Approach

This project will build on the previous research undertaken to develop these devices and will focus on further development to achieve a design that can readily be adopted commercially across relevant fleets. Specifically, the project will:

- continue trials of the underwater setter, during commercial fishing operations, focussing on comparing the use of tougher baits through the setter and gear set with more typical 50:50 squid and pilchard mixes and/or straight pilchard; and
- continue trials of the line depressor focussing on building a second prototype, setting baited hooks at depth, deploying intermediate floats, and making turns. Working camera mounts into the second prototype may provide for assessment of bait loss via video footage review.

A workshop will be held with key fishing industry participants including the device developers and skippers, as well as seabird bycatch mitigation practitioners to prioritise development actions and identify cost effective options to assess mitigation effectiveness and practicality at-sea. It is envisaged that the project will support the longer-term use of the device(s) under commercial fishing operations through technical assistance and data collection.

Outputs

1. A workshop report describing prioritised development actions and at-sea testing options.
2. One or more underwater line setting device(s) further developed to be a practical option for use on a range of fishing vessels.

3. Annual research reports describing progress against the planned development and testing.

Note: A two-year term is proposed

Indicative Research Cost: \$75,000 per annum

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish Stocks: BNS_{1, 2}, HPB_{1, 2}, LIN_{1, 2}, SNA₁

Reference:

Goad, D., Kiddie, B., Hollands, N., Clow, A., Angel, J. 2022. Development of bottom longline underwater setting devices. BCBC2020-11b final report prepared by Vita Maris for Department of Conservation, Wellington. 30 p.

DRAFT

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

Project code: MIT2023-07

Start Date: 1 July 2023

Completion Date: 30 June 2024

Guiding Objectives: CSP Objective B; National Plan of Action – Seabirds; CSP Seabirds Medium Term Research Plan

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 the 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.

Research Approach

The project will consider testing any relevant novel options identified during the social science research underway in the fishery as part of CSP project MIT2022-02. It will also consider the potential use of Hookpods in relevant bottom longline target fisheries. A workshop with key industry participants, mitigation practitioners and liaison officers will be convened to identify and further novel options and provide advice on priority option(s) to test. The workshop will also identify cost effective options to assess mitigation effectiveness and practicality at-sea, which will then be implemented accordingly. The chosen device(s) will be tested for the mitigation effectiveness, practicality, and any effect on fish catch.

Outputs

1. A workshop report describing prioritised development actions and at-sea testing options.
2. A technical report that details the research trials undertaken, results, and any further recommendations to improve seabird bycatch mitigation options in floated demersal longline gear.

Note: A one-year term is proposed

Indicative Research Cost: \$120,000

Cost Recovery: F(CR) Item 4 (100% Industry)

Fish Stocks: BNS1, 2, 3, 7, 8, LIN1, 2, 3, 5, 7

Appendix: Cost Recovery Tables

A: CSP 2023/24 Project Costs

Code	Project	Research	Admin	Total	CR Item	Industry %	Industry	Crown
Interaction Projects								
INT2021-04	Collection and curation of tissues samples from protected fishes and turtles	\$22,000	\$1,042	\$23,042	4	100	\$23,042	\$0
INT2022-02	Identification of seabirds captured in New Zealand fisheries	\$80,000	\$3,789	\$83,789	4	100	\$83,789	\$0
INT2022-03	Identification, storage and genetics of cold-water coral bycatch specimens	\$80,000	\$3,789	\$83,789	4B	100	\$83,789	\$0
INT2022-04	Risk Assessment for Protected Corals	\$75,000	\$3,552	\$78,552	4B	100	\$78,552	\$0
INT2022-05	Determining the resilience of Fiordland corals to fisheries impacts	\$30,000	\$1,421	\$31,421	-	-	\$0	\$31,421
INT2023-02	Species identification of camera-detected protected species captures in New Zealand fisheries	\$60,000	\$2,842	\$62,842	4	100	\$62,842	\$0
INT2023-03	Characterising surface longline fishing fleet behaviour for sea turtle bycatch	\$50,000	\$2,368	\$52,368	4	100	\$52,368	\$0
INT2023-04	Identification of marine mammals, turtles and protected fish captured in New Zealand fisheries	\$15,000	\$710	\$15,710	4	100	\$15,710	\$0
INT2023-05	High-resolution estimation of species diversity for a protected coral family commonly occurring as trawl bycatch	\$58,000	\$2,747	\$60,747	4B	100	\$60,747	\$0
INT2023-06	Investigating the impact of fisheries on endangered hoiho diet, microbiome, and disease susceptibility	\$50,000	\$2,368	\$52,368	4	100	\$52,368	\$0
INT2023-07	Expert identifications of protected corals	\$30,000	\$1,421	\$31,421	4	100	\$31,421	\$0
INT2023-08	Sub-antarctic albatross diet: composition of natural prey versus fisheries bait/waste	\$40,000	\$1,894	\$41,894	4	100	\$41,894	\$0
INT2023-09	Understanding the extent and usage of coral rubble reporting codes by fisheries observers	\$10,000	\$474	\$10,474	4B	100	\$10,474	\$0
INT2023-10	Impact of fisheries extractions on pelagic foraging seabird populations in the wider Hauraki Gulf area	\$30,000	\$1,421	\$31,421	4	100	\$31,421	\$0
INT2023-11	Understanding coral bycatch - assessing large catches	\$40,000	\$1,894	\$41,894	4B	100	\$41,894	\$0
Population Projects								
POP2021-04	Flesh-footed shearwater population monitoring	\$70,000	\$3,315	\$73,315	3	50	\$36,658	\$36,658
POP2022-01	Black Petrel population monitoring	\$100,000	\$4,736	\$104,736	3	50	\$52,368	\$52,368
POP2022-02	Flesh-footed shearwater additional proposed research	\$30,000	\$1,421	\$31,421	3	50	\$15,710	\$15,710
POP2022-03	Deep sea protected coral reproduction study	\$40,000	\$1,894	\$41,894	4B	100	\$41,894	\$0
POP2022-08	Auckland Island seabird research: Gibson's and white-capped albatross	\$160,000	\$7,577	\$167,577	3	50	\$83,789	\$83,789
POP2022-10	Antipodean island seabird research: Antipodean albatross and white chinned petrel	\$160,000	\$7,577	\$167,577	3	50	\$83,789	\$83,789

POP2023-01	Aerial survey of leatherback turtles off Northeast North Island	\$200,000	\$9,472	\$209,472	3	50	\$104,736	\$104,736
POP2023-02	Southern Buller's population study	\$150,000	\$7,104	\$157,104	3	50	\$78,552	\$78,552
POP2023-03	Updated population estimate and marine habitat utilisation of yellow-eyed penguins/hoiho breeding on Campbell Island	\$100,000	\$4,736	\$104,736	3	50	\$52,368	\$52,368
POP2023-04	Campbell Island seabird research	\$90,000	\$4,262	\$94,262	3	50	\$47,131	\$47,131
POP2023-05	Auckland Islands New Zealand sea lions	\$150,000	\$7,104	\$157,104	2	90	\$141,393	\$15,710
Mitigation Projects								
MIT2021-01	Protected species liaison project	\$250,000	\$11,840	\$261,840	4	100	\$261,840	\$0
MIT2022-01	Longline hauling mitigation devices	\$70,000	\$3,315	\$73,315	4	100	\$73,315	\$0
MIT2023-01	Understanding the relationship between fish hook size and bait type with seabird and turtle captures	\$50,000	\$2,368	\$52,368	4	100	\$52,368	\$0
MIT2023-02	Understanding and mitigating seabird and turtle bycatch during the pelagic longline soak period	\$90,000	\$4,262	\$94,262	4	100	\$94,262	\$0
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	\$40,000	\$1,894	\$41,894	4	100	\$41,894	\$0
MIT2023-04	Synthetic trawl warps to mitigate seabird warp strikes	\$60,000	\$2,842	\$62,842	4	100	\$62,842	\$0
MIT2023-05	Enabling uptake of best practice seabird bycatch mitigation in the surface longline fishery	\$70,000	\$3,315	\$73,315	4	100	\$73,315	\$0
MIT2023-06	Underwater line setting devices for bottom longline vessels	\$75,000	\$3,552	\$78,552	4	100	\$78,552	\$0
MIT2023-07	Novel seabird bycatch mitigation for floated demersal longline fisheries	\$120,000	\$5,683	\$125,683	4	100	\$125,683	\$0
TOTAL		\$2,745,000	\$240,000⁴	\$2,875,000			\$2,272,769	\$602,231

⁴ Includes \$110,000 of admin costs for the Observing commercial fisheries programme