

**Conservation Services Programme
DRAFT
Annual Research Summary
2021-22**

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1. Introduction

1.1 Purpose

This report outlines the research carried out through the Conservation Services Programme Annual Plan 2021/22 and provides updates on multi-year projects started in previous years.

The Conservation Services Programme is one component of the Department of Conservation (DOC)'s wider bycatch programme and describes those services delivered as 'conservation services'. DOC has recently established a more extensive fisheries bycatch programme as a result of the availability of additional funding through the Biodiversity Budget 2018¹.

Other DOC bycatch related projects are summarised within the appendix of this report. These projects are not levied from the commercial fishing industry and therefore do not follow the same consultation and review process as research that is undertaken through the Conservation Services Programme.

1.2 Background

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

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

1.3. CSP Vision and Objectives

The Conservation Services Programme (CSP) vision is that:

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

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

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

¹Available to download from: <https://www.doc.govt.nz/news/budget-2018/docs-budget-2018-explained/>

Detailed objectives for CSP are provided in the Conservation Services Programme Strategic Statement².

1.4 Development of the Annual Plan

The Conservation Services Programme Annual Plan 2021/22³ described the conservation services to be delivered as the Conservation Services Programme, and subject to cost recovery from the commercial fishing industry. As such, this Annual Plan formed the basis for levying the commercial fishing industry under the Fisheries Act 1996. For further background information on CSP, including extracts of relevant legislation, refer to the Conservation Services Programme Strategic Statement.

In the development of this Annual Plan a series of discussions were held with Fisheries New Zealand (FNZ) staff to harmonise the CSP and FNZ research programmes for 2021/22 and to ensure there was no duplication. A formal consultation process was also used as described below.

1.5 Consultation process

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

The collaborative processes used to develop the 2021/22 Annual Plan are as follows:

- Inshore observer coverage is based on a continuation of delivering objectives identified by a process conducted in preparation for the CSP Annual Plan 2021/22. This process was developed jointly by the CSP team at DOC and the Inshore Fisheries team at FNZ.
- Deepwater and Highly Migratory Species (HMS) observer coverage was developed jointly by the CSP team at DOC and the deepwater and HMS fisheries team at FNZ.

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

18 December 2020	Updated medium term research plans, initial list of research proposals and CSP RAG prioritisation framework circulated to CSP RAG.
8 March 2021	CSP RAG meeting to discuss and prioritise initial research proposals.
22 March 2021	Additional feedback received from CSP RAG on research proposals and their prioritisation.
21 April 2021	Draft CSP Annual Plan 2021/22 released for public consultation.
25 May 2021	Public consultation period closed.
1 July 2021	Summary of public submissions and response to comments completed.
9 July 2021	Director-General of Conservation conveyed the Conservation Services Programme Annual Plan 2021/22, amended in accordance with public submissions, to the Minister of Conservation for agreement.

² Available to download from: <https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/resources/rag-resources/csp-strategic-statement-2020.pdf>

³ Available to download from: <https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/plans-and-submissions/202122/final-csp-annual-plan-2021-22.pdf>

1.6 Report structure

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

Conservation Services Programme activities in 2021/22 were divided into three main areas:

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

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2. Interaction Projects

2.1 INT2021-01 Observing commercial fisheries

Overall objective

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

Specific objectives

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

Rationale

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

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

Project status

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

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$2,333,951. Services were provided by Fisheries New Zealand Observer Services.

2.2 INT2019-02 Identification of seabirds captured in New Zealand fisheries

Overall 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 DNA analysis, 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).
5. 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. Observers on commercial vessels are not always able to identify seabirds at sea with high precision and the assessment of the age-class, sex and provenance of captured individuals requires necropsy in most cases. Historically all dead seabird specimens collected by observers have been returned for necropsy where possible. However, in many cases, the taxon can be confirmed through expert examination of photographs taken by observers, and this can be achieved at a lower cost than returning carcasses and performing necropsy. To maximise cost efficiencies a new protocol has been developed to determine which specimens are returned for full necropsy. This protocol aims to strike a balance between returning birds for full necropsy (for rarer species and in less observed fisheries) and photographing birds for determination of taxon (for commonly caught species in well observed fisheries). A new addition to this protocol is the collection of feather samples from bycaught seabirds to allow genetic determination of identification for difficult species groups.

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

Information gained through this project will link to Fisheries NZ databases, seabird bycatch estimates, and will inform ongoing risk assessment, research and modelling of the effects of fisheries bycatch on seabird populations. Further, the mode of capture and associated information will enable robust

analyses to be made of the factors contributing to seabird capture events and inform the development of appropriate mitigation strategies.

Project status

This is a multi-year project that is due for completion in May 2023. The reporting for 2020-21 is completed, and reporting for 2021-22 is in progress.

Project logistics summary statement

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

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

Specific objectives

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

Rationale

The 2010 amendment of Schedule 7A of the Wildlife Act 1953 protects all hard corals, including: black corals (all species in the order Antipatharia); gorgonian corals (all species in the order Alcyonacea (previously known as Order Gorgonacea)); stony corals (all species in the order Scleractinia); and hydrocorals (all species in the family Stylasteridae). Identifying coral bycatch that cannot be 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, benthic risk assessments and management of benthic marine protected species.

This project will improve the ability of observers to identify protected corals and so improve the quality of data collected. Observer briefings can continue and be formalised, and observers can be informed about how the research data are used. This will improve their skills at identifying and collecting samples and bycatch data. Specialists can then confirm identifications to help understand distributions at a more detailed taxonomic level. This work will also feed into planned coral connectivity research, which will enable more robust assessment of areas at risk from fisheries impacts.

Project status

This is a multi-year project that is due for completion in May 2023. The reporting for 2021-22 is in progress.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$60,000 per annum over three years.

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

Overall objective

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

Rationale

The accurate determination of the taxon of marine mammals, turtles and protected fish captured in New Zealand fisheries is vital for examining the potential threat to population viability posed by incidental fisheries captures. Observers on commercial vessels are not always able to identify marine mammals, turtles and protected fish at sea with high precision, and 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 designed to complement the existing seabird and coral identification projects. Observers routinely collect samples of genetic material from these taxa, these can be used to resolve uncertain identification determinations from photographs.

Project status

This is a multi-year project that is due for completion in December 2023. The reporting for 2021-22 is in progress.

Project logistics summary statement

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

2.5 INT2021-02 Characterisation of protected coral interactions

Specific objectives

1. To improve our understanding of the current extent and variation of protected coral bycatch across multiple fisheries and fishing methods.
2. To improve our understanding of the risks of fishing to protected coral groups and how those risks vary temporally and spatially.
3. To inform focus areas / fisheries for mitigation efforts.
4. To inform development of a risk assessment.

Rationale

This project seeks to collate available protected coral bycatch records to update and improve our understanding of where various coral groups and taxa are caught, and which fisheries, fishing methods and areas pose the highest risk to corals.

Project status

Delayed. Delivery expected early 2023.

Project logistics summary statement

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

2.6 INT2021-03 Review of commercial fishing interactions with marine reptiles

Specific objectives

1. Characterise commercial fishery interactions with marine reptiles, particularly sea turtles, within New Zealand fishery waters.
2. Report on total numbers of captures and fate of bycaught marine reptiles by species, fishery, and year.
3. Identify species most at risk from commercial fishing and fisheries with the highest observed or reported catches of marine reptiles.

Rationale

Five species of sea turtle and three species of sea snake are recorded from New Zealand waters. All are protected under the Wildlife Act 1953. All Pacific populations of sea turtles are considered threatened or endangered. Leatherback and green turtles are the marine reptiles most frequently reported as bycatch in commercial fisheries, reflecting the higher frequency and duration of their occurrence in New Zealand waters. Satellite tagging has shown that adult leatherback turtles migrate directly from breeding beaches in the tropical southwest Pacific to offshore areas of high planktonic productivity off northern New Zealand and may remain in or close to New Zealand waters for more than a year. In contrast, juvenile green turtles recruit to coastal habitats, harbours, and rocky reefs in Northland from the pelagic phase and potentially remain in New Zealand waters for up to five or six years before migrating to adult habitats in tropical regions. The last review of bycatch of marine reptiles was conducted in 2016 and covered the period 2008 to 2015. This report found that in some years turtle bycatch in surface longlines fisheries exceeded the minimal marine turtle interaction rate recommended by the Western and Central Pacific Fisheries Commission.

Project status

Complete.

Summary of the methods and key findings

Between 2007–08 and 2020–21, there were a total of 273 reported captures of turtles, an average of 19.5 per year, and one capture of a sea snake. Of these, 49 were recorded by Ministry observers. In commercial fishing returns, five species of turtles were reported, with leatherback being the most frequently captured ($n = 217$; 79.5%), following by green turtles ($n = 25$; 9.2%). In the observed records, 37 (76%) were leatherback turtles. Most captures, across all species, were made in the surface longline fisheries targeting bigeye tuna or swordfish in FMA 1 (northeast North Island), where such fishing effort was also greatest, largely between January and April. The single sea snake, a banded sea krait, was caught during bottom longline fishing targeting tarakihi. The turtle captures varied between 2–34 per year until 2020–21, when they increased to 58.

For the main turtle capture area and season, FMA 1 and January to April inclusive, between 2007–08 and 2020–21, most of the reported turtle captures (86.6%) were made by vessels which did not have an observer aboard. Of the 53 vessels in the selected fishery, 10 (18.9%) had reported turtle bycatch, and just five of the 10 reported 90.7% of the turtle captures, with one vessel alone reporting 38.7% of all captures. This vessel was only observed in 2020, when it accounted for 33.0% of the observed events, and 2021, when it accounted for 47.3% of the observed events. That observers were on this

vessel in 2021, and the times and places that it fished, may partially explain why the observer turtle capture total was so much higher in 2020–21.

Evaluation of the environmental variables and the captures of leatherback turtles suggested the primary influence on turtle capture was likely to be water temperature, followed by frontal zones, ocean currents, and water clarity, with primary productivity having relatively little influence. Leatherback turtle captures were predicted to be most likely when sea surface temperatures were between about 14–22°C, when subsurface temperature at 200m was relatively warm, in the first two-thirds of the calendar year, when the mixed layer depth was relatively shallow, when time varying eastward currents were either negative or relatively strong, at latitudes south of about 42°S (i.e., west coast South Island), and when vessels were targeting swordfish.

Recommendations

Overseas recommendations propose that an achievable turtle capture rate (all species combined) should be less than 0.019 turtles per 1000 hooks for surface longline fisheries. Averaged between 2008 and 2021, leatherback turtle capture rates alone were at least 0.019 turtles per 1000 hooks in FMA1 between January and April.

A previous iteration of this work provided recommendations to better monitor marine reptile captures in New Zealand and to date, little progress has been made on any of these. It is highly recommended that these proposals are adopted, including the implementation and monitoring of a minimal sea turtle interaction rate; guidelines to reduce sea turtle mortality; revision of observer coverage allocation; improved data quality and reporting; and improved population information and research.

Additional recommendations made here include the implementation of set capture limits (absolute captures) rather than catch rate limit, further collection of biological information, improved estimation of capture rates through communication with skippers, and further investigation of alternative data sources.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$33,000 over one year.

Review milestones

- Draft final report made available on the CSP webpage in June 2022
- Presentation of findings to the CSP Technical Working Group on 21 June 2022
- Final report made available on the CSP webpage in July 2022

Citation

Dunn, M.R.; Finucci, B.; Pinkerton, M.H.; Sutton, P. 2022. Review of commercial fishing interactions with marine reptiles. INT2021-03 final report by NIWA for Department of Conservation. 78 p.

Weblink

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202122-annual-plan/int2021-03-review-of-commercial-fishing-interactions-with-marine-reptiles-final-report.pdf>

2.7 INT2021-04 Collection and curation of tissues samples from protected fishes and turtles

Specific objectives

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

Rationale

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

Project status

In progress.

Summary of the methods and key findings

The Protected Species Tissue Archive (Fishes and Turtles) is currently held at Tāmaki Paenga Hira Auckland War Memorial Museum in collaboration with the Department of Conservation. This Tissue Archive is an expansion of project INT2018-04 (Improving the collection of data and samples from bycatch basking sharks; Francis 2019, Finucci et al. 2021), through archiving and providing access to samples from protected fishes and turtles. Ninety-five sample vials are currently held from 55 individuals. Samples from only one individual turtle were received through the MPI observer program, the remaining samples were received from Department of Conservation staff and NIWA. Forty new sampling kits were produced and a further 50 sampling kits previously held by the MPI observer program were improved and restocked. Development of Traditional Knowledge and Bicultural Notices is ongoing.

Only one sample was received in the current year from the fisheries observer program. This represents a missed opportunity to collect samples that would allow ongoing genetic monitoring of protected species populations.

Recommendations

- Expansion of the archive to include other protected species.
- Expansion of the storage of tissue collections from -20°C ethanol preserved to include -80°C storage of tissues (both fresh and ethanol preserved).
- Where possible deposit voucher specimens in museum collections to allow for samples in the tissue archive to be connected to a physical specimen that can be examined into the future.
- Examination of ways to facilitate the collection of tissue samples from protected species bycatch.

Project logistics summary statement

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

Review milestones

- Establishment report made available on the CSP webpage in December 2022.

Citation

Bray, R. 2022. Establishment Report – collection and curation of tissue samples from protected fishes and turtles. INT2021-04 establishment report prepared by Auckland War Memorial Museum for Department of Conservation. 19 p.

Weblink

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202122-annual-plan/int2021-04-collection-and-curation-of-tissues-samples-from-protected-fishes-and-turtles-establishment-report.pdf>

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3. Population Projects

3.1 POP2018-03 New Zealand Sea Lion: Auckland Islands pup count

Specific objectives

1. To estimate New Zealand sea lion pup production at Enderby, Figure of eight and Dundas Islands.
2. To update the New Zealand sea lion database.

Rationale

New Zealand sea lions are classified as Nationally Vulnerable (Baker et al. 2019) and are incidentally killed each year in 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 (Chilvers et al. 2005), and a Quantitative Risk Assessment of threats to the species found that the two most significant threats to the recovery of the species were *Klebsiella pneumoniae* mortality and commercial trawl-related mortality (Roberts & Doonan 2016).

Approximately 70% of New Zealand sea lions breed at the Auckland Islands, where population data has been collected since the mid-1990s, including annual estimates of pup production and re-sighting 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). CSP project POP2012-02 analysed population data to determine the key demographic factors driving the observed population decline of New Zealand sea lions at the Auckland Islands. This analysis 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 Auckland Islands population (Roberts et al. 2014). A literature review to identify potential indirect effects of commercial fishing on the Auckland Islands population as part of CSP project POP2010-01 highlighted several key information gaps that prevent a full understanding of any such effects, including time series data of population dynamics (Bowen 2012).

In response to the continued decline at the Auckland Islands, the Ministers of Conservation and Primary Industries published a Threat Management Plan (TMP) for New Zealand sea lions in 2017. POP2018-03 is designed to collect NZ sea lion pup count information required to manage the impact of commercial fishing on the Auckland Islands population. It is envisaged that other research and management actions, will be progressed as part of the TMP, and may be delivered alongside the CSP research programme to provide logistical synergies.

Project status

Complete.

Summary of the methods and key findings

Five days of fieldwork were completed on the Auckland Islands, from 6 to 10 January 2022, which allowed for mark-recapture estimates and direct counts of sea lion pups on Enderby, Dundas, and Figure of Eight Islands. However, the timing of the research was c. 10 days earlier than standardised counts due to vessel availability, and, therefore, not all pups had been born when counts occurred. Additional tasks, including incidental tag resightings and assessment of alternative materials for mark-recapture marking of pups were undertaken.

Total pup production for the Auckland Islands was estimated at 1686 ± 51.4 pups (mean \pm 1SE), which includes an adjustment to account for the early date of the counts, and 43 pups found dead at the time of counts. This figure is approximately 1.9% higher than the sum of mean direct counts and mark-recapture estimates without adjustment (minimum estimate = 1617 ± 49.4 pups). Both the adjusted and minimum estimates were higher than the minimum target of 1575 pups set in the New Zealand sea lion Threat Management Plan (DOC and MPI 2017), and both are considered to be underestimates of this year's pup production, due to the lack of cumulative dead pup count data from Enderby and the use of direct count methods (rather than mark-recapture) on Dundas Island. Based on these estimates, Auckland Islands pup production has remained stable since 2009.

Due to logistical and funding limitations, the last three seasons have not delivered the quality data necessary to support a robust analysis of pup and female survival, including pup morphometrics, flipper tagging and transponder insertion, and structured daily resighting effort for tagged animals. While the five-year TMP objective to 'halt the decline' of the New Zealand sea lion has been achieved, without continued mark-resight surveys there will be significant data deficiency which will limit our ability to analyse demographic trends and effectiveness of interventions to grow the population.

Recommendations

It is imperative that a full season of subantarctic fieldwork be conducted in 2022/23 so that New Zealand sea lion population and demographic research, as well as research on interventions to improve survival of pups, can be implemented and assessed.

Project logistics summary statement

This project was 90% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$100,000 per annum over four years.

Review milestones

- Final results for 2021/22 presented at the CSP TWG meeting on 19 May 2022
- Final report for 2021/22 published on the CSP website in September 2022

Citation

Young MJ and Manno K (2022). Auckland Islands 2021/22 New Zealand sea lion field research report: Conservation Services Programme pup count. Department of Conservation, Dunedin. 35 pp.

Weblink

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pre-2019-annual-plans/pop2018-03-nz-sealion-auckland-islands-pup-count-final-report.pdf>

3.2 POP2019-04 Southern Buller's albatross: Snares Islands/Tini Heke population project

Specific objective

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

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 proposal delivers priority research components of the CSP seabird plan involving the estimation of key demographic parameters of Southern Buller's albatross at the Snares. An established study site for Southern Buller's albatross, with substantial historic mark-resight effort, exists at the Snares (Sagar 2014), one of the most accessible subantarctic island groups. Information involving demographic parameters have been collected at the three study sites annually since 1992.

Project status

This is a multi-year project that is due for completion in March 2023. Year one and year two are complete.

Summary of the methods and key findings

Demographic studies at the three study colonies on North East Island have been undertaken annually from 1992 to 2022, with the exception of 2018 and 2021, and so this report incorporates some of these data in the current analysis. Estimates of the numbers of breeding pairs, made by recording the contents (chick, egg or egg fragments) of each nest mound, increased in two of the three colonies to over the numbers recorded during 2020 to be at all-time highs for the 30-year duration of the study. With the assumption that the combined total number of breeding pairs in the three study colonies was representative of North East Island as a whole, and notwithstanding the maximal counts in two of the study colonies recorded in 2022, then the breeding population probably peaked around 2005–2006 and has since undergone marked annual variations.

A total of 379 birds were recaptured that had been banded previously in the study colonies as breeding adults of unknown age. A further 137 breeding birds were banded in the study colonies – these are presumed to be first-time breeders – during the latest 2022 survey. Estimates of annual survival of birds banded as breeders continued to decline, with estimates close to 0.9, or lower, in recent years. During the period 1992–2004 all chicks that survived to near-fledging in the study colonies were banded and their survival to return to the study colonies in subsequent years has been monitored. In 2022, 139 of these birds were recaptured, with birds from cohorts banded from 1996 to 2004 being recaptured for the first time. This demonstrates the long-term monitoring required to obtain reliable estimates of survival of such known-age birds. Of these recaptured 139 known-age birds, 11 were found breeding for the first time, and so were recorded as being recruited to the breeding population. In addition, three birds that had been banded as near-fledging in the study colonies during September 2013 and September 2014 were also recaptured for the first time.

In 2020, 50 Global Location Sensing (GLS) tags were attached to the metal leg bands of breeding birds in the Mollymawk Bay study colony; of these, 31 were retrieved, and a further 7 recorded as being lost, during the 2022 field season.

Twelve trail cameras were deployed at breeding colonies during the 2022 fieldwork: 11 set to record one photograph every hour during daylight, and one set to record 30 seconds of moving images daily, until they are retrieved in April 2023.

Recommendations

- Continue acquiring recapture data for breeding birds at the three study colonies to confirm that adult survival is at levels that would, over the long-term, result in a declining population trajectory, and to reduce the uncertainty around recent estimates of adult survival resulting from no recapture data for two years when the population was not visited.
- A more comprehensive re-modelling approach could be applied to the entire data set to estimate parameters other than adult survival. A re-run of the modelling undertaken by Francis & Sagar (2012) would additionally be beneficial for future iterations of the spatially explicit fisheries risk assessment.

Project logistics summary statement

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

Review milestones

- Draft final report made available on the CSP webpage in May 2022
- Final report made available on the CSP webpage in June 2022

Citation

Thompson, D.; Sagar, P. 2022. Population studies of southern Buller's albatross on The Snares. Report for POP2019-04 for the Department of Conservation. Wellington, NIWA. 20 pp.

Weblink

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/201920-annual-plan/pop2019-04-southern-bullers-albatross-on-the-snares.pdf>

3.3 POP2021-01 Black Petrel research

Specific objectives

1. To monitor 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. Undertake at-sea capture of black petrels to determine proportions of banded birds and identify if current low juvenile survival rates are affected by any non-philopatric behaviour at the study colony.

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 project extends on demographic work funded by commercial fisheries levies and DOC/MPI since 1996. Black petrels are the species at highest risk from commercial fisheries in northern New Zealand. Continuing research on this species is necessary to gather current rates of adult mortality, breeding success, juvenile survival and recruitment until suitable mitigation methods significantly reduce the capture risk to this species.

Project status

Complete.

Summary of the methods and key findings

Land component

During the 2021/2022 breeding season 478 tākoketai/black petrel study burrows were intensively monitored within the Mt Hobson/Hirakimata study area on Aotea/Great Barrier Island.

There were 326 (68.2%) burrows occupied by breeding pairs, 92 (19.2%) occupied by non-breeding birds, and 60 (12.6%) were unoccupied. Overall, 239 chicks were produced from the study burrows representing a fledgling success rate of 73.3%.

Nine census grids were monitored within the study area and accounted for 196 of the inspected study burrows. Of these, 148 were occupied by breeding pairs (75.5%) and 102 chicks were produced representing a fledging success rate of 68.9%.

A total of 745 adults and 254 fledgling chicks were captured during the 2021/2022 field season with 107 adults banded this season (including 69 from study burrows). Of the 254 fledgling chicks banded during the 2021/2022 field season, 227 were banded in study burrows; 12 had already fledged prior to the banding visit in May 2022.

There have been a total of 386 returned chicks recaptured at the colony since they were banded prior to fledging. Of these, 124 returned chicks were identified during the 2021/2022 breeding season; 23 of which had been caught for the first time at the colony. The majority of returned chicks were from the 2013/2014 breeding season, followed by the 2010/2011 cohort). Not all cohorts were represented as no returned chicks from the 1995/1996 and 1996/1997 cohorts were recaptured this season. Understanding the factors affecting return rates of chicks within the 35-ha study site is vital. It is important to determine whether it is related to low juvenile survival and/or recruitment or if it is simply due to a lack of detection. Understanding juvenile survival and recruitment is necessary for accurate population estimates and risk assessment modelling. Therefore, it is recommended that effort to obtain this data is completed with urgency.

Preliminary monitoring of pig and other predator occurrence and impact on black petrels on Cooper's Castle was undertaken this season. Sixteen black petrel burrows were identified within the boundaries of this study area; three were breeding and one was being visited by non-breeding birds. All other burrows were empty. Trail cameras were placed along pig pathways, walking tracks and outside active black petrel burrows. Footage confirmed feral pig, rat, and feral cat presence. While no interactions with black petrels were caught on camera, there was one cat predation and one rat predation at the study colony this season. Introduced species still pose a threat to the black petrel population and it is imperative pest control measures continue.

At-sea captures

In January 2022 WMIL staff were only able to undertake a one-day catching trip out in the waters north-east of the Marotere (Chicken) Islands group, and north of the Mokohinau Islands group. Poor weather prevented a longer trip. A total of 17 black petrels were caught from the back of the boat using a hand cast net and were all un-banded birds. Additional species caught were 18 toanui/flesh-footed shearwater (*Ardenna carneipes*) (Threat Status - At Risk: Relict).

In March 2022 WMIL staff were able to undertake a longer three-day catching trip, targeting the same areas, but particularly north of the Mokohinau Islands group. A total of 130 black petrels were caught from the back of a boat using the same hand cast net method. This total included 5 already banded birds from WMIL study colonies on Aotea/Great Barrier Island and Te Hauturu-o-Toi/Little Barrier Island, as well as 3 banded birds from the at-sea capture work. Additional species caught and banded were 78 flesh-footed shearwater, two New Zealand storm petrel (*Fregetta maoriana*) (Threat Classification: Nationally Vulnerable) and one rako/Buller's shearwater (*Ardenna bulleri*) (Threat Classification: At Risk: Declining).

In November 2022 WMIL staff were able to undertake a two-day catching trip, targeting the same areas as previously. A total of 39 black petrels were caught using the hand cast net method. This total included 2 already banded birds from the WMIL study colony on Aotea/Great Barrier Island. Additionally, 30 flesh-footed shearwaters were also caught and banded, one of which was already banded, having been banded at a WMIL study colony on Lady Alice Island in 2017. Finally one ōi/grey-faced petrel (*Pterodroma gouldi*) (Threat Classification: Not Threatened) was also caught and banded.

Over all trips undertaken by WMIL (April 2021, January 2022, March 2022 and November 2022), a total of 383 seabirds were captured altogether (April 2021: n=67, January 2022: n=35, March 2022: n=211, November 2022: n=70). A total of 176 (January 2022: n=17, March 2022: n=122, November 2022: n=37) black petrels were newly banded over all 2022 trips. Including the April 2021 preliminary trial captures, a total of 241 black petrels have been caught over the cumulative 9 days (April 2021: n=55 over 3 days, January 2022: n=17 on 1 day, March 2022: n=130 over 3 days, November 2022: n=39 over 2 days). Of these, 8 were previously banded at a terrestrial colony, representing 3% of total captures. The average daily capture rate of tākoketai/black petrel for each trip is highly variable; 18 per day in April 2021, 17 per day in January 2022, 43 per day in March 2022, and 20 per day in November 2022, with the average daily capture rate of black petrels for all trips being 27. The highest average catches were in the first and last light periods of the day (7-9am and 5-7pm).

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$75,000 over one year.

Recommendations

- Trips need to be undertaken towards the start of the breeding season, i.e., mid-November through to early February, with several trips throughout the breeding season to allow WMIL staff to capture more birds.
- A large amount of bait should be taken to facilitate creating more feeding frenzies and theoretically more birds behind the back of the boat for capture.
- Future work should be clarified much further in advance to increase the success of this work particularly dealing with ever changing weather and swell conditions, COVID disruptions, moon phases, and aligning the WMIL team and the skipper's schedules.
- Undertake future work around the dimmest phases of the moon.
- Undertake work further north with either the same skipper (El Pescador Charters) or another suitable vessel (i.e., with a duckboard), to target other areas of this species range.
- Future work should budget for a team of three (minimum) to have flexible flying and accommodation costs, as well as the rising costs of diesel fuel for boat charters and covering the cost of higher bait use.

Review milestones

- Draft final report made available on the CSP webpage in June 2022
- Final reports made available on the CSP webpage in October and December 2022

Citation

Bell, E.A., Welch, M. & Lamb, S. 2022. Key demographic parameters and population trends of tākoketai/black petrels (*Procellaria parkinsoni*) on Aotea/Great Barrier Island: 2021/2022. POP2021-01 final report prepared by Wildlife Management International for the Department of Conservation, Wellington. 35 p.

Burgin, D. 2022. Summary report for at-sea capture work for tākoketai/black petrels 2022. POP2021-01 final report prepared by Wildlife Management International for the Department of Conservation, Wellington. 18p.

Weblink

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202122-annual-plan/pop2021-01-black-petrel-research-final-report.pdf>

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202122-annual-plan/pop2021-01-black-petrel-research-at-sea-final-report.pdf>

3.4 POP2021-02 Identification of protected coral hotspots using species distribution modelling

Specific objectives

1. To collate, curate and analyse cold water coral records from existing seabed towed camera transects in the New Zealand region.
2. To identify hotspots for selected protected coral species in the New Zealand EEZ using predictions from abundance-based species distribution models.
3. To better understand the historical effects of fishing on observed patterns of coral distribution and relative abundances.

Rationale

This project will focus on abundance data to identify high conservation value hotspots for protected corals across the New Zealand EEZ. This is a novel modelling approach that builds upon available regional-scale habitat suitability models to improve our knowledge of coral abundance and distribution (rather than previous presence-absence models), and our knowledge of how current and historical commercial fishing effort shapes those patterns. As the first component of the project includes collation and analysis of new seabed imagery data to inform the model, the project will also serve to audit data available for future image-based coral research. Model outputs can inform future models, risk assessments, and management strategies that consider ecological processes, coral biology, and the impact of fishing on ecosystem services provided by deep-sea corals.

Project status

This project is in progress, as it is a two-year project that will end in Jun 2023.

Summary of the methods and key findings

The first year of the project has focused on analysing and compiling faunal observation data from NIWA's Deep-Towed Image System (DTIS), that will feed into abundance-based Species Distribution Model (SDM) development in Year 2. The results will be presented to the CSP Technical Working Group in Autumn 2023.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$70,000 over year one and \$40,000 over year two.

3.5 POP2021-03 Seabird population research: Chatham Islands

Specific objectives

1. Collect and download data files from archival tags and trail cameras deployed in early 2021 on Motuhara Island.
2. Continue to band large sample of albatrosses and giant petrels, and GPS map nesting sites to help inform demographic parameters about these species.
3. Collect drone imagery of the colony to use for population counts.

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. In January 2021, an opportunity became available to carry out work on three species of albatross and petrels on Motuhara (Forty-fours), a privately owned seabird island off Chatham Islands. This work replaced other projects planned for the subantarctic islands and called off due to COVID-19 concerns. Toroa Consulting Ltd had negotiated access to Motuhara with the landowners and they approved a programme of work to attach satellite tags to albatross and giant petrels. In addition, 55 GLS tags (archival tags) were placed on a sample of breeding northern Buller's albatross. Toroa Consulting Ltd also banded a large sample of northern giant petrel chicks as well as some adults of the two species of albatrosses. Trail cameras were left in situ to collect data on breeding success of these three species in 2021. To capitalise on this programme of work a visit is required in 2022 to recover technical equipment and continue banding of adults and chicks to build a robust sample of marked birds for future demographic modelling.

Project status

Complete.

Summary of the methods and key findings

Field work took place in January and February 2022 after significant weather delays (original trip was planned for August and then December). All the trail cameras placed in 2021 were relocated and SD cards removed for downloading of images (1 image was taken every hour until the camera batteries ran out or the SD card filled up). Most cameras continued to work for about 9 months covering the breeding season of the northern royal albatross and northern Buller's albatross and captured the laying period for northern giant petrels in August. The cameras were refreshed with new batteries and left in situ for a second year of monitoring. The report details fledgling rates from the nests visible in the cameras and some analysis of non-breeder activity in the colony at the end of each day.

The 55 global location sensing tags (GLS or geolocators) placed on the northern Buller's albatross in 2021 were searched for by the field team and 49 of these tags were recovered from breeding birds. A few tags had faults but most had a year of data available for later analysis of movements near New Zealand and on migration. All functioning tags were redeployed on the same birds for a second year of data collection.

During the field trip breeding birds were counted in marked study quadrats and the numbers compared with drone flights taken over the colony. Birds in study plots continued to be banded and a search was made for previously banded birds from earlier expeditions.

Recommendations

- Need to recover GLS tracking tags on northern Buller's albatross and download trail camera images in the 2022/23 summer.
- Analysis is needed of the GLS tags to determine movements and behaviour of northern Buller's albatross across the annual cycle.

Project logistics summary statement

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

Review milestones

- Draft final report made available on the CSP webpage in July 2022
- Final report made available on the CSP webpage in December 2022

Citation

Bell, M. 2022. Motuhara seabird research: field trip report January 2022. POP2021-03 final report prepared by Toroa Consulting Limited for the Conservation Services Programme, Department of Conservation. 12 p.

Weblink

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202122-annual-plan/pop2021-03-chatham-island-seabird-research-2022-final-report.pdf>

3.6 POP2021-04 Flesh-footed shearwater population monitoring

Specific 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.

Project status

Complete.

Summary of the methods and key findings

Ohinau and Lady Alice Islands

During the 2021/22 season we monitored 261 and 302 study burrows on Ohinau and Lady Alice Islands respectively. The breeding success (burrows with an egg that produce a chick that is likely to survive to fledging) on Ohinau Island was 59%, similar to the 58% measured in the 2020/21 season. Breeding success on Lady Alice Island was 51%, which was also similar to the 48% measured in 2020/21 season. There were no detectable differences in breeding success between study and burrowscope (control) burrows, indicating no impact of handler disturbance. We were able to identify 73% of the birds in breeding study burrows on Ohinau Island and 93% in burrows on Lady Alice Island. An additional 349 and 165 flesh-footed shearwaters were banded on Ohinau and Lady Alice Island respectively.

Titi Island

Burrow transects were carried out on Titi Island to gather data for an updated population estimate for flesh-footed shearwaters known to breed on the island. It is estimated that there are a total of 528 (250 – 806, 95% CI) occupied flesh-footed shearwater burrows on Titi Island with an average burrow occupancy of 15% calculated across all colony areas. Through this transect work, it was also possible to calculate a population estimate for the tītī/sooty shearwaters (*Ardenna grisea*) (Threat Status - At Risk: Declining) breeding on the island. It is estimated that there are a total of 1,038 (544 - 1,533, 95% CI) occupied sooty shearwater burrows on Titi Island with an average burrow occupancy of 25%, calculated as an average across all colony areas.

The flesh-footed shearwater population estimate presented here for Titi Island is slightly higher than the previous estimate carried out by Baker et al. (2010) and Waugh et al. (2014). We conclude that our estimates are not necessarily reflective of a population increase, but more likely a result of more

in-depth and higher-quality sampling and analysis techniques giving a more accurate estimate of population sizes compared to the two previous estimates. We recommend another future population estimate be undertaken in 5 years, utilising the same methods to support long term population trend analyses on Titi Island.

Recommendations

- Population monitoring on Ohinau and Lady Alice Islands be continued with 200 breeding study burrows monitored annually over two surveys (Dec/Jan and Apr/May).
- The number of burrowscope burrows monitored annually continue to be 50 on each island.
- A survival analysis be undertaken to estimate adult survival on each island.
- There is continued, focussed effort to band and recapture as many flesh-footed shearwaters on the surface and in burrows on both islands.
- Simultaneous sample of 10 juvenile and 10 adult flesh-footed shearwaters be tracked using PTTs in April/May to determine migration routes, and any differences between adult and juvenile mortality during this period.
- This should involve undertaking plastic collection from the surface of colonies, necropsy of dead individuals found at colony sites, as well as the lavage technique, as used by Lavers et al. (2021).
- The following islands should be considered for surveys to update population estimates:
 - Green Island, Mercury Islands
 - Mauitaha, Hen and Chicken Islands
 - Wareware and Muriwhenua Islands, Hen and Chicken Islands

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$60,000 over three years.

Review milestones

- Draft final report published on the CSP website June 2022
- Final reports published on the CSP website November 2022

Citation

Burgin, D., and Ray, S. (2022). Flesh-footed shearwater population monitoring and estimates: 2021/22 season. POP2021-04 final report prepared by Wildlife Management International Limited for the New Zealand Department of Conservation, Wellington. 24p.

Burgin, D. & Lamb, S. 2022. Toanui/flesh-footed shearwater (*Ardenna carneipes*) population estimate for Titi Island, Marlborough Sounds: January 2022. POP2021-04 final report prepared by Wildlife Management International Limited for Department of Conservation, Wellington. 23p.

Weblink

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202122-annual-plan/pop2021-04-flesh-footed-shearwater-monitoring-ohinau-and-lady-alice-islands-2021-22-final-report.pdf>

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202122-annual-plan/pop2021-04-flesh-footed-shearwater-monitoring-titi-island-2021-22-final-report.pdf>

3.7 POP2021-05 Age estimation of white sharks

Specific objectives

1. To estimate age and growth of New Zealand great white sharks (*Carcharodon carcharias*).
2. To associate age estimates with tissue samples of New Zealand great white sharks used for close-kin mark recapture population estimates.

Rationale

Age and growth data is essential to estimating population growth rates and can be used to estimate other important demographic parameters such as maximum age, natural mortality, and age at maturity. In addition, the 2018 assessment of the status of the Eastern Australian – New Zealand great white shark population used sex-specific parameters estimated from genetic identification of half-sibling pairs. The detection of these pairs requires knowledge of the year of sampling and age or estimated age (from length) at sampling. Although the samples used in this analysis were obtained from across the species' Australian range, none of New Zealand samples came from sharks of known age. At present there are no age-at-length data available for juvenile great white sharks from New Zealand and only a single estimate of age for an adult.

Project status

Complete.

Summary of the methods and key findings

Vertebral banding patterns and microCT imaging were used to estimate age and growth for New Zealand white sharks for the first time. Vertebrae were obtained from white sharks reported dead from sources including commercial and recreational fishing vessels, and beach cast specimens over a 30-year period (1991 to 2021). Most white shark samples were collected around the North Island and were sampled throughout the year. The final sample (n = 38) included 20 females (1.52 to 5.36 m total length, TL), 12 males (1.87 to 4.85 m TL), and six unsexed sharks (2.26 to 3.0 m TL).

Vertebrae were difficult to read, particularly when counting the narrow increments near the margin of the vertebrae from old sharks. There was strong agreement between readers for age estimates of young New Zealand white sharks, but large disagreement for older sharks. Growth was modelled for both readers separately. Nearly half of the individuals were young (1–2 years old) and only six sharks were estimated to be older than 10 years of age. One shark (1.53 m TL) had no fully formed growth bands or distinct birth band, and was likely captured shortly after birth. Maximum age estimates from the band counts for Reader 1 and Reader 2, respectively, were 30 and 45 years for males (4.85 m TL) and 19 and 44 years for females (5.36 m TL).

The preliminary work here suggests New Zealand white sharks are relatively fast growing initially, and possibly long-lived. The relationship between length and growth was found to be nearly linear for young New Zealand white sharks. White sharks are born at approximately 1.5 m TL during the summer months (January, February) and deposition of opaque banding likely occurs in the winter months (May to August). White sharks were estimated to double their birth length to 3 m TL within five years, equating to an annual growth rate of approximately 30 cm per year. This rate of growth is similar to estimates from previous studies from Australia, South Africa, and California. Growth appeared to slow at approximately 3 m in length, which may be indicative of changes in diet, movement or habitat, or a reallocation of energy from somatic growth to reproductive development (i.e., maturity). Age-at-maturity could not be assessed here because of the small sample size, particularly for large individuals. However, based on known length-at-maturity estimates, age-at-maturity may occur at 7–10 years for

males and 14+ to 22+ years for females. Additional samples of large sharks will be needed to comprehensively understand age and growth of white sharks that inhabit New Zealand waters.

Age estimates could not be validated and bomb radiocarbon dating is unlikely to provide any useful insight here because samples are unlikely to be old enough for this validation technique.

Recommendations

- Continued collection of biological sampling, particularly of larger sharks
- Investigate alternative non-lethal means of ageing
- Complete a New Zealand-Australia white shark growth study
- Assessment of vertebrae elemental composition Project logistics summary statement

Summary of the methods and key findings

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

Review milestones

- Draft final report published on the CSP website July 2022
- Final report published on the CSP website August 2022

Citation

Finucci, B., Ó Maolagáin, C. 2022. Preliminary age estimation of New Zealand white shark (*Carcharodon carcharias*). POP2021-05 final report by NIWA for Department of Conservation. 50 p.

Weblink

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202122-annual-plan/pop2021-05-age-estimation-of-great-white-sharks-final-report.pdf>

3.8 POP2021-06 Fur seal population estimate and bycatch analysis: Cook Strait

Specific objectives

1. To identify New Zealand fur seal colonies and / or haul outs within the Cook Strait which could overlap with fisheries.
2. To increase the understanding of interactions between New Zealand fur seals and the commercial hoki fishery within this area.

Rationale

New Zealand fur seals (*Arctocephalus forsteri*) are the most frequently bycaught marine mammal in New Zealand due to spatial and temporal overlap between fur seal foraging areas and commercial fishing areas (Mattlin 1987, Rowe 2009). Despite an estimated increasing population trend overall (Baker et al. 2019), high mortality rates in the Cook Strait area may be at an unsustainable level for local colonies. The hoki trawl fishery targets this area annually from late-June to mid-September, peaking effort in July and August. A range of mitigation methods have been trialled (such as a seal exclusion device) though further research and trials are needed. To better inform mitigation options going forward it's important to know the following: which colonies, sex and age class are the most impacted, and in what season, and is the bycatch likely to have a detrimental impact on the colonies in question? The focus areas of this project target answering these questions with the end goal of making recommendations of the most appropriate mitigation options.

Project status

In progress, year one delayed due to animal ethics approval and iwi consultation on some of the methodologies.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$60,000 over year one and \$60,000 over year two.

3.9 POP2021-07 Otago and Foveaux shag census

Specific objective

To provide an updated breeding population census and assess the population trend to adequately inform risk assessment and species management.

Rationale

Endemic to Southern New Zealand coastal waters and harbours, Foveaux shag (*Leucocarbo stewarti*) and Otago shag (*Leucocarbo chalconotus*) populations are respectively 'Nationally Vulnerable' and 'At Risk - recovering'. Formerly recognised singularly as Stewart Island shag, in 2016 Foveaux and Otago shags were classified as two genetically distinct species (Rawlence et al., 2016). The last population estimates are based on data from 1981 and early 1990's respectively and urgently need updating to inform evidence-based species conservation management and risk assessment. In 2021, preliminary studies were undertaken (BCBC2020-24) to identify current colony locations and develop a methodology for conducting a population survey. The current project will build on findings from BCBC2020-24 and complete three consecutive breeding population censuses to provide a robust comparison to the previous population estimates. Both species are known to be susceptible to incidental set-net fishery pressures and breeding colony disturbance. It is also noted that, whilst not relevant to CSP levied projects, there are also emerging threats to population stability arising from areas such as indirect fisheries pressures from the expansion of aquaculture in the Foveaux Strait region and plans to increase open seas aquaculture on the East and South Coasts of the South Island in areas these shag species are known to inhabit.

Project status

Complete.

Summary of the methods and key findings

Comprehensive surveys were conducted in targeted visits of current breeding sites. Aerial photographs for Otago shag counts were taken using a drone where appropriate (six colonies) or vantage-point DSLR photographs where a drone could not be flown (one colony). Building on animal response trials in previous work, these drone overflights during the breeding season first determined the drone flight height appropriate at each site to cause minimal disturbance. Survey flights were all taken within a week of each other, at the start of the breeding season in September 2021. Photographs were stitched and counted, recording the number of apparently nesting Otago shags. To correct counts of apparently nesting shags (apparently on nest, or AON), we collected ground-truthing data assessing nest contents at one colony (Pukekura), finding that 0.74 of apparently nesting Otago shags were actually breeding at the start of September. The size of the breeding population is then calculated as the raw count of apparently nesting pairs multiplied by the nest-contents correction. Since surveys took place at the very start of the breeding season, we expect to have missed some birds yet to lay, so figures should be understood as minimum breeding population estimates. The breeding colonies ranged in from the small southern colony at Kinakina Isl (estimated 32–33 breeding pairs) to the very large colony at Sumpter Wharf comprising some 504 breeding pairs (best estimate; range 496–511). The Otago shag population estimate—at least 1,275–1,332 breeding pairs at the start of the 2021 breeding season—is roughly similar to the last whole-population count in 2007. Despite different methods used, we believe this comparison is reasonable because independent counts of five colonies in 2021, using the vantage-point methods of earlier work, gave comparable numbers to our

estimates from aerial photographs. However, for re-assessment of population trends to be robust the population size estimate should first be repeated, considering the 15-year interval since the last regular colony counts and the unknown population dynamics in that interval.

Recommendations

- Repeat the population estimate to allow robust re-assessment of the current trend status in the Otago shag breeding population size.
- Otago shag population size estimate to be repeated at regular intervals over time to monitor the population's trend.
- Improve the accuracy of estimates and reduce potential biases and reliance on assumptions by considering photographic timing, occupancy and detection rates.

Project logistics summary statement

This project was 100% Crown funded. The planned cost for the project was \$60,000 over two years (\$20,000 year 1 and \$40,000 year 2)

Review milestones

- Draft final report published on the CSP website May 2022
- Final report published on the CSP website August 2022

Citation

Parker, G.C.; Rexer-Huber, K. 2022. Otago shag population census. Report for POP2021-07 for the Department of Conservation. Dunedin, Parker Conservation.

Weblink

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202122-annual-plan/pop2021-07-otago-shag-breeding-population-size-2021.pdf>

3.10 POP2021-08 Assessment of causes of low burrow occupancy rates in Westland petrels

Project objective

To provide an updated breeding population census and assess the population trend to adequately inform risk assessment and species management.

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. Westland petrels only breed on the West Coast of the South Island at Punakaiki. The species is bycaught on commercial longlines and is rated as a medium-high risk species from commercial fishing activity. Uncertainty around current levels of burrow use and occupancy rates by breeding birds has affected population estimates for this species. These rates vary between different studies but are typically half those observed in other closely related species. The status of the birds maintaining burrow sites but not apparently breeding in them is still unclear. A large pool of non-breeding birds, especially of one sex, may have implications for the risk assessment modelling for this species in terms of total population size estimates. The movements of birds outside the breeding season and especially younger age classes are still a significant gap in our knowledge of this species.

Project status

This project is in progress, as it is a two-year project that will end in Jun 2023.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$60,000 over year one and \$40,00 over year two.

4. Mitigation Projects

4.1 MIT2020-01 Hook-shielding use in the surface longline fishery

Project Objectives

1. Facilitate ongoing use of hook-shielding devices in the surface longline fishery.
2. Assess the operational and bycatch reduction effectiveness of hook-shielding devices used in the surface longline fishery.

Rationale

Surface longline fisheries in New Zealand pose a bycatch risk to a range of seabird species, and implementation of highly effective mitigation has continued to be challenging (for example developing effective yet practical tori line designs for small vessels, and safety concerns regarding some line weighting options). Hook-shielding devices represent a new, stand-alone, mitigation option for hook setting in pelagic longlines, and is recognised globally as a best practice mitigation option. These devices physically protect the barb of the hook until it has sunk below the reach of seabirds. As a stand-alone method, it overcomes the difficulties encountered in deploying effective traditional mitigation options such as tori lines and line weighting. This project forms part of a Government supported roll-out of Hookpods, currently the only proven and available hook-shielding device, to the domestic surface longline fleet to address the bycatch risk posed during hook setting.

Project status

Shipping and technical issues delayed delivery of new Hookpods, support for implementation rephased into 2022/23.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$110,000 over year one and \$30,000 in year two.

4.2 MIT2021-01 Protected species liaison project

Overall objective

To coordinate Liaison Officer effort and target protected species bycatch reduction by encouraging vessel operators to meet best-practice bycatch mitigation.

Rationale

To effectively reduce the risk of interactions with protected species, it is important for vessels to be using best practice mitigation and take all necessary steps, both regulatory and nonregulatory measures, to avoid interactions. To measure success of mitigation and identify areas where further development is needed across each fleet, there needs to be consistency in the mitigation measures used while still allowing for innovation. Through the NPOA-Seabirds, a suite of best practice mitigation standards for each method have been developed; these mitigation standards will underpin the work that the Liaison Officers do and will be rolled out as part of the Liaison Programme through the Protected Species Risk Management Plans (PSRMPs). The purpose of the PSRMPs is to outline the vessels' current practices and work towards achieving all the best practice mitigation standards, and Liaison Officers will record where vessels are not able to achieve all standards and why. These notes will be shared with MPI for evaluation, where they will either reassess the mitigation standards or investigate how to better assist vessel operators to achieve the set standards. Auditing of PSRMPs by Fisheries Observers will then describe the steps the vessel is taking to meet the mitigation measures outlined in their plan and highlight areas for improvement.

Project status

In progress.

Summary of the methods and key findings

In the 2021-22 fishing year (1 October 2021 - 30 September 2022), the liaison programme reviewed and updated 126 PSRMPs and established 26 new PSRMPs for inshore and Highly Migratory Species (HMS) vessels. A total of 55 PSRMP audits were completed by Observer services. These were comprised of 3 surface longline, 7 bottom longline, 34 trawl and 11 set net audits. None of the surface longline vessels audited were using hook-shielding devices.

The Liaison Programme received 63 triggers that were reported by 28 different vessels through NFPS-Catch reporting. Notable incidents included some crested penguin and hoiho captures in the set net fishery, as well as some large capture events for white-chinned petrels in the surface longline fleet. This has led to further questions around seabird capture risk during the soak period and what potential mitigation options could be available. There was a significant decrease in reported black petrel captures in the bottom longline fleet this year.

Please note, all numbers listed are tentative and will be verified and finalised in the 2021-22 Liaison Programme Annual Report.

Recommendations

The efficacy of the Liaison Programme depends on the connection of fishers with Liaison Officers, the monitoring of bycatch mitigation practices at sea, and the real-time communication of information influencing bycatch risk.

The ongoing difficulties in placing observers due to watchkeeping, will continue to limit Liaison Programme activity. The cameras rollout provides a good opportunity for receiving further information on protected species interactions and mitigation practices. Ongoing work with Fisheries New Zealand will be critical moving forward. This year, improvements have been made to allow for real-time data and response, but the intended platform responsible for keeping project activities organised and informing targeted engagement is still in development. The completion of this database (shared between FNZ and DOC) will be fundamental to the efficacy of Liaison Programme operations.

Project logistics summary statement

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

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4.3 MIT2021-02 Cetacean interactions with pot fisheries

Project Objectives

1. Update the previous analysis of cetacean entanglements.
2. Hold a workshop with fishers to explore mitigation options that could be implemented in New Zealand pot fisheries.

Rationale

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

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

Project status

Complete.

Summary of the methods and key findings

In this project we update previous work on cetacean entanglements in New Zealand waters. We consider spatial and temporal trends in pot fishing effort, and entanglement information held by the Department of Conservation. We also review recent entanglement mitigation information and consider mitigation and management methods investigated in other jurisdictions. Further, we convened a workshop of expert stakeholders to share information, better understand entanglement risks and issues in the New Zealand rock lobster fishery, and proactively consider how to manage the entanglement issue with industry involvement. In New Zealand waters, pot fishing occurs in all Fisheries Management Areas except FMA 10 (Kermadec). Fishing effort reported has declined significantly from 1990 to 2021, with this decline driven by a reduction in pot fishing effort targeting rock lobster (*Jasus edwardsii*). Pot fishing targeting other species represents <10% of effort on average. Other species targeted with this method include packhorse lobster (*Jasus verreauxi*), ling (*Genypterus blacodes*), blue cod (*Parapercis colias*), paddle crab (*Ovalipes catharus*), and hagfish (*Eptatretus cirrhatus*). Pot fishing occurs around the main islands of New Zealand, and the Chatham Islands, with effort varying monthly among target species. Pot soak

times vary within and between target species. Since 1980, entanglements in pot fishing gear have been detected along the north-east coast of the North Island, Cook Strait and Marlborough, east coast of the South Island, and Fiordland and Stewart Island. Most recorded entanglements over time have involved humpback whales (*Megaptera novaeangliae*; 62%), followed by orca (*Orcinus orca*; 16%). Most entanglements have been reported in June, with almost all of these involving humpback whales. Orca entanglements have occurred in the spring and summer months. Entanglement events involving other cetacean species comprise 22% of those reported and have occurred occasionally through the year. Ecological factors relevant to entanglements are generally not well understood. However, the migration of humpback whales along the New Zealand coast continues to be a higher risk period based on entanglement reports. The fishing gear type most recently described in entanglement reports is 'cray' (rock lobster). Recent literature showed a breadth of work on entanglement mitigation and management. Approaches included gear-associated measures (gear modifications, acoustic deterrents and ropeless fishing), spatial and temporal closures, and investigations of whale ecology to understand and account for distribution and entanglement risks.

Recommendations

- Increase consistent reporting of entanglement events and pot soak times to DOC
- Grow relationship between fishers and disentanglement teams
- Increase knowledge of cetacean spatial and temporal distribution
- Update electronic reporting codes to include all cetacean taxa
- Characterise NZ pot fishing gear for future assessment
- Foster adoption of mitigation measures already in use by some fishers
- Investigate galvanic timed releases in entanglement hotspots

Project logistics summary statement

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

Review milestones

- Draft final report published on the CSP website in July 2022
- Final report published on the CSP website in August 2022

Citation

Pierre, J. P., How, J. R., Dunn, A. 2022. Whale entanglements with New Zealand pot fisheries: characterisation and opportunities for management. MIT2021-02 final report prepared by JPEC for Department of Conservation, Wellington. 79 pp.

Weblink

<https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202122-annual-plan/mit2021-02-cetacean-interactions-with-pot-fisheries-final-report-redacted.pdf>

4.4 MIT2021-03 Methods for increasing sink rates for bottom longline

Project Objectives

1. To identify options for increasing the sink rate of hooks in small bottom longline fisheries.
2. To test the performance and efficacy of methods to increase the sink rate of hooks in small bottom longlines.

Rationale

Inshore bottom longline fisheries pose seabird bycatch risk to some of the seabird species at highest risk from commercial fisheries, such as black petrel and flesh-footed shearwater. The mitigation standard introduced by the NPOA-Seabirds 2020 contains expectations around achieving sink depths of hooks by the end of the aerial extent of the tori line (10m deep at high-risk times and 5m deep at other times). Achieving some of the standard sink rates has been challenging in some segments of the fleet.

Project status

Scoping workshop held in November 2021, with at-sea trials postponed to 2022-23.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$80,000 over one year.