Conservation Services Programme
DRAFT
Annual Research Summary
2019-20

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1. Introduction

1.1 Purpose

This report outlines the research carried out through the Conservation Services Programme Annual Plan 2019/20 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 2018[1].

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.

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

3. Developing population management plans, where appropriate.

Detailed objectives for CSP are provided in the Conservation Services Programme Strategic Statement[2].

1.4 Development of the Annual Plan

The Conservation Services Programme Annual Plan 2019/20[3] 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 2019/20 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 2019/20 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 2019/20. 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:

14 December 2018	Initial CSP Research Advisory Group (RAG) meeting – review and gap analysis.
February 2019	Updated medium-term research plans, initial list of research proposals and draft CSP RAG prioritisation framework circulated to CSP RAG.
8 March 2019	Second CSP RAG meeting to discuss and prioritise initial research proposals.
24 March 2019	Additional feedback received from CSP RAG on research proposals and their prioritisation.
3 May 2019	Draft CSP Annual Plan 2019/20 released for public consultation.
2 June 2019	Public consultation period closed.
28 June 2019	Summary of public submissions and response to comments completed.
9 July 2019	Director-General of Conservation conveyed the Conservation Services Programme Annual Plan 2019/20, 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/csp-strategic-statement-2018.pdf

[3] Available to download from: https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/plans/final-csp-annual-plan-2019-20.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, the 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 2019/20 were divided into three main areas:

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

2. Interaction Projects

2.1 INT2019-01 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 help to identify where the most significant interactions are occurring. The information can also be used to inform development of ways to mitigate those interactions and adverse effects. Such data contributes to assessments of the risks posed to protected species by commercial fishing and whether mitigation strategies employed by fishing fleets are effective at reducing protected species captures.

The CSP Observer Programme continued to purchase baseline services for “offshore” fisheries from FNZ 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 due to COVID-19 and other delays in 2020 and will be added to this report at a later date.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $1,217,040. Services were provided by Fisheries New Zealand Observer Services.

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

Overall objective

To determine which marine mammal, turtle and protected fish species are captured in fisheries and their mode of capture.

Specific objectives

1. 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).

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

Phases one and two completed in 2018/19 and phase three is in progress.

Summary of the methods and key findings

1 July 2016 to 30 June 2017

162 marine mammal bycatch events occurred during this period, 113 of these events had photos of sufficient quality to allow for expert identification of taxa. Observer identification of marine mammals was 100% correct in this year. Nineteen protected fish were bycaught during this period, with one case of an incorrect ID (one spine tail devil ray recorded as a manta ray, subsequently updated in COD database following expert ID). Two turtles were bycaught during this time period and both observer ID's were correct.

1 July 2017 to 30 June 2018

115 marine mammal bycatch events occurred during this period, 82 of these events had photos of sufficient quality to allow for expert identification of taxa. Observer identification of marine mammals was 100% correct in this year. Twenty protected fish were bycaught during this period, with all ID's presumed correct (not all events had corresponding observer photos). Four turtles were bycaught during this time period with all observer ID's correct.

1 July 2018 to 30 June 2019

106 marine mammal bycatch events occurred during this period, 89 of these events had photos of sufficient quality to allow for expert identification of taxa. Observer identification of marine mammals

was 100% correct in this year. Eight protected fish were bycaught during this period, with all ID's correct. No turtles were bycaught during this time period.

Recommendations

Marine mammals

Estimating age class was difficult from the available data and photos for many events. Better photos need to be taken to allow for more reliable age class determinations and if accurate ages of bycaught animals are to be determined, tooth samples should be collected and processed.

There were some events for which no photos were available, or the photos taken were of poor quality. The instructions provided to observers should be reviewed and an increased effort should be made to collect a full range of good quality photos from all interaction events.

Correct assignment of sex was good for males but relatively poor for females and very few events were able to be assessed due to a lack of appropriate photos. Additional training and/or training materials should be made available to observers to help with sex determination. If an accurate sex determination is required, then consideration should be given to using DNA molecular methods from samples collected from each individual.

Protected fish and reptiles

All observed interactions require photographs or video footage where possible for expert ID. Further observer training and/or resources required to differentiate between great white sharks (protected) and porbeagle sharks (not protected) to avoid misidentification.

Project logistics summary statement

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

Review milestones

- Draft final reports for 2016/17, 2017/18 and 2018/19 made available on the CSP webpage on 18 October 2019
- Final reports for 2016/17, 2017/18 and 2018/19 made available on the CSP webpage on 19 November 2019

Citations

Childerhouse S, Johnston O. 2019. INT2017-03: Identification of marine mammals captured in New Zealand fisheries 2016/17. Prepared for the Department of Conservation. Cawthron Report No. 3422. 20 p.

Childerhouse S, Johnston O. 2019. INT2017-03: Identification of marine mammals captured in New Zealand fisheries 2017/18. Prepared for the Department of Conservation. Cawthron Report No. 3422. 19 p.

Childerhouse S, Johnston O. 2019. INT2017-03: Identification of marine mammals captured in New Zealand fisheries 2018/19. Prepared for the Department of Conservation. Cawthron Report No. 3439. 18 p.

Weblinks

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/int2017-03-mm-id-2016-17.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/int2017-03-mm-id-2017-18.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/draft-reports/int2017-03-mm-id-2018-19.pdf

2.3 INT2018-03 Development of observer photograph protocols and curation

Specific objectives

1. To review observer protocols for photographing bycaught protected species.
2. To review the process of collection and recording of photograph metadata.
3. To scope an improved database for observer photographs.

Rationale

Digital photo images and associated metadata collected by observers provide an invaluable resource for the identification of protected species that are bycaught in, or otherwise interact with, commercial fisheries. Although a general photography protocol exists, the quality of these photographs is often variable, and researchers using the data for identification have recommended improvements to the current processes. Updated protocols and guidelines that are more detailed will improve the successful utilisation of this form of observer data.

Image data is currently captured in the photo log. This data helps identify the location of interactions between the protected species and fishing gear and identify factors that may have contributed to the interaction.

Project status

Cancelled - funds returned to industry.

Project logistics summary statement

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

2.4 INT2018-04 Improving the collection of data and samples from bycaught basking sharks

Specific objectives

1. To create tools that provide commercial fishers with information on how to collect biological samples from bycaught basking sharks.
2. Provide commercial fishers with permits to retain bycatch basking sharks.

Rationale

Basking sharks are caught incidentally in New Zealand trawl and setnet fisheries, with most captures in the recent years reported from deepwater trawl fisheries. They have been protected since December 2010, and the last review of bycatch was undertaken in 2017. Due to their naturally low population sizes, presumed slow growth rates, and very low reproductive rates, basking sharks are believed to be vulnerable to over-fishing.

The life history, movement and behaviour of basking sharks make them particularly hard to study. Consequently, information on their populations and biology is difficult to obtain and depends on a slow, incremental accumulation of knowledge about them. Targeted research on basking sharks is likely to be difficult and expensive. The limited availability of specimens, the low chance of encountering one on any particular vessel, and the difficulty of working on a large animal during a commercial fishery operation, all hinder the collection of biological data. Furthermore, the paucity of surface sightings of basking sharks in recent decades makes them difficult to locate for tagging studies.

Before the protection of basking sharks in December 2010, most reported captures came from observers. However, after the protection and the introduction of the NFPS form at the same time, reports of captures by commercial fishers have provided a more comprehensive data source than observer reports. Additional opportunistic research activities aboard commercial fishing vessels will offer increased opportunity to further understanding of the population characteristics of basking sharks and therefore their susceptibility to fisheries impacts. This includes increasing the priority of observer research activities for basking sharks, as well as supplementing fishers with the right tools and encouraging them to sample any bycaught basking sharks when an observer is not on board.

Project status

In progress.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $20,000 per annum over two years.

2.5 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 captures in New Zealand fisheries (for dead specimens discarded at sea and returned dead specimens).
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. Seabirds 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 fishing 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 necropsies. In order 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 form 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 fishing vessels 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 into Fisheries New Zealand databases and will inform seabird bycatch estimates, ongoing risk assessments, research and modelling of the effects of fisheries bycatch on seabird populations. Furthermore, the mode of capture and associated information will

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

Project status

In progress.

Project logistics summary statement

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

2.6 INT2019-03 Characterisation of marine mammal interactions

Specific objectives

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

Rationale

The Marine Mammal Risk Assessment[4] includes 35 species of marine mammals that inhabit New Zealand waters. Five of these species are classified under the New Zealand Threat Classification System[5] as Not Threatened, two as At Risk-Naturally Uncommon, one as At Risk-Recovering, two as Nationally Vulnerable, one as Nationally Endangered and four as Nationally Critical, with the remaining species classified as Data Deficient as not enough information exists to properly determine their threat status.

Not all marine mammals have been observed interacting with commercial fisheries in New Zealand. Most beaked whales and large whales (except for Humpback whales) have a relatively low incidence of being bycaught. While prior work has been conducted for specific fisheries, (e.g. MIT2012-03), there is a need for holistic analyses of the overall nature of marine mammal interactions. This project will support the work being done through the International Whaling Commission's Bycatch Mitigation Initiative.

Project status

In progress.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $25,000 over one year.

[4] Available for download from https://fs.fish.govt.nz/Page.aspx?pk=113&dk=24554

[5] Available for download from https://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs29entire.pdf

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

Overall objective

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).

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

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.

2.8 INT2019-05 Coral biodiversity in deep-water fisheries bycatch

Overall objective

To use DNA sequencing of observer-sampled octocoral specimens to genetically quantify the species-level diversity contained within deep-water fisheries bycatch, to improve understanding of fishery impacts.

Rationale

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

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

Project status

Complete.

Summary of the methods and key findings

The overlap in habitat between deep-sea corals and commercial fish species results in unintentional bycatch. The impact of commercial fisheries on coral communities has typically been measured as bycatch biomass and estimates of coral diversity from fisheries observer records and benthic surveys. Among protected gorgonian corals, the identification of species by in situ observations and morphological study of specimens are known to underestimate species diversity. Archived specimens collected by observers were used to examine the genetic diversity of bottom-trawled bycatch gorgonian corals to determine the accuracy and precision of observer and taxonomist identifications, and to re-examine the effects of bottom trawling on protected coral diversity.

Selection criteria identified a final pool of 129 bycatch specimens of gorgonian corals as amenable to genetic analysis and 91 of these were sampled, producing viable DNA sequence data for 62 specimens at three genetic markers. Among these, we found a minimum of 34 different species that were distributed among seven protected families of octocorals. Our rate of discovery of unique species indicates that many more species remain unsampled and that we have not yet documented the limits of gorgonian coral diversity within the sampled bycatch community. In addition, our results present the first broad-scale examination of octocoral diversity in New Zealand and demonstrate that many species remain to be discovered and described.

Comparisons of bycatch identification methods indicated an increasing level of precision and accuracy with increased technicality as specimens were progressed from visual identifications by observers, to morphological identifications by taxonomists, to genetic barcoding in this study. Overall, genetic

barcoding and morphological study showed similarly high levels of identification accuracy, but barcoding resolved identifications to finer taxonomic scales.

The genetic and taxonomic diversity uncovered was spread across the New Zealand Exclusive Economic Zone (EEZ) and adjacent South Pacific Regional Management Organisation (SPRFMO) zones. Within the EEZ, bycatch samples were examined from seven Fisheries Management Areas (FMAs) and ten target fisheries. Due to differences in sampling effort and observer coverage by target fishery, the most specimens and most diversity was recovered from observed trips targeting orange roughy. As a first look at the species diversity of octocoral bycatch, our sampling design did not allow for quantitative comparisons between fisheries.

Recommendations

The high diversity of gorgonian octocorals uncovered within bycatch supports a role for genetic barcoding in routine identification and assessment of fisheries impacts. This could be integrated into the ongoing bycatch sampling related CSP project (INT2019-04). We recommend a regional assessment and comparison of coral genetic diversity among Quota Management Areas for each trawl fishery, and the consideration of evolutionary and genetic diversity in impact assessments and management decisions. Better understanding of the evolutionary processes and timescales that underpin the diversity of affected corals can improve our predictions of how they may be impacted by commercial fisheries, as well as their ability to recover from these impacts.

The sampling and submission for archiving of coral specimens by fisheries observers builds a valuable resource, as available voucher material is produced for more regions than could be feasibly achieved through targeted research trips. Continued support for observer collections of protected corals for the purposes of genetic investigation of species diversity is warranted.

Managers and policy makers could reconsider the intrinsic value of biodiversity, the ways that it can be used as a measure of community health and resilience, and the limitations of how it is estimated. An evolutionary perspective could be incorporated, or hierarchical taxonomic diversity could be used as a proxy for genetic diversity.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $22,000 over one year. Services were provided by NIWA.

Review milestones

- Results presented at the CSP TWG on 6 August 2020
- Final report made available on the CSP webpage in September 2020

Citation

Bilewitch, J.P. and Tracey, D. 2020. Coral biodiversity in deep-water fisheries bycatch. Final report for INT2019-05 prepared by NIWA for the Conservation Services Programme, Department of Conservation. DOC19304-INT201905. NIWA Client Report 2020223WN. 36 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/int2019-05-coral-biodiversity-in-deepwater-fisheries-bycatch-final-report.pdf

2.9 INT2019-06 Post-release survival of seabirds

Specific objectives

1. To investigate options for assessing the post-release survival of seabirds that interact with commercial fisheries in New Zealand.
2. To identify operational, biological and environmental factors which may constrain the assessment of post-release survival of seabirds using tracking tags or other means.
3. To provide recommendations on the most effective methods to assess post-release survival of seabirds.

Rationale

Currently, the fate of seabirds post-interaction are unknown beyond life status at release. Live release of seabirds after interactions may result in injuries or stress, limiting the likelihood of long-term survival. To improve estimates of the true mortality rate due to commercial fishing interactions there is a need to reduce uncertainty around the fate of seabirds post-release across species and interaction types.

Further research in this area could substantially refine post release mortality estimates and the factors which drive it.

Project status

Complete.

Summary of the methods and key findings

Research determining post-release survival of seabirds interacting with New Zealand commercial fisheries has not previously been undertaken. This project reviewed methodologies and tracking devices used to study seabird survival and assesses their suitability for development of a future field-based project to determine post-release survival rates.

With recent technological advances the use of miniature satellite tracking devices was determined to be the most effective method to assess the fate of released seabirds following accidental capture by fishing vessels. A range of operational, biological and environmental factors may constrain a tracking study of injured seabirds. Some of these factors have the potential to significantly impact the likelihood of successfully monitoring the post-release survival.

Assessment of the health of live seabirds that have interacted with fishing vessels will first need to be carried out to select suitable individuals to track survival and ensure tracking maximises identifying cryptic mortality rates. Individuals with severe injuries that will not survive, and those with no injuries that will likely survive, should not be tracked. Birds with moderate injures where survival probability is uncertain should be tracked, as these provide the best opportunity to understanding true cryptic mortality rates. To achieve this a “Seabird Heath Assessment Tool” has been developed to guide future research.

Recommendations

It is recommended that a review be undertaken of existing seabird injury data, held by Fisheries NZ (FNZ) as recorded by fisheries observers on Observer Protected Species Interaction (PSI) forms, and electronic monitoring (EM) video footage, to categorise (using the health assessment tool) and

investigate the number, nature and extent of injuries sustained by seabirds returned alive at-sea, in order to refine the following field-based recommendation. Considering the above factors, a field-based programme utilising satellite tracking with Teleonics TAVseries Platform Transmitter Terminals (PTTs) is recommended as the best method to assess post-release survival of seabirds that interact with commercial fisheries. Although relatively expensive, this is the only method which is likely to return sufficient data on behaviour and post-release survival. Target species for tracking should include control groups (healthy seabirds), medium sized seabirds (i.e. black petrel, flesh-footed shearwater, and Buller's shearwater) in FMA1 and FMA9, and albatross species in FMA5 and FMA6. The study should aim to track ≥30 birds from each group which would likely require a 3 to 5 year study period. It is likely that survival rates between albatross, and medium sized petrel and shearwaters is different, and a post-release survival tracking study will need to investigate both groups of birds.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $10,000 over one year. Services were provided by Wildlife Management International.

Review milestones

- Results presented at the CSP TWG on 15 May 2020
- Final report made available on the CSP webpage in August 2020

Citation

Bell, M.D. 2020. Investigation of options for assessing the post-release survival of seabirds that interact with commercial fisheries in New Zealand. Final Report for project INT2019-06 prepared by Wildlife Management International Ltd for the Conservation Services Programme, Department of Conservation. 33 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/int2019-06-post-release-survival-of-seabirds-final-report.pdf

3. Population Projects

3.1 POP2017-03 Salvin's albatross Bounty Islands population project

Specific objectives

1. To estimate the population size of Salvin's albatross at the Bounty Islands.
2. To describe the at-sea distribution of Salvin's albatross breeding at the Bounty Islands.

Rationale

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and the National Plan of Action – Seabirds[6] objectives. It was developed at the request of the CSP Research Advisory Group (CSP RAG). Key components of research described in the CSP seabird plan 2017 for delivery in 2017/18 were identified and prioritised by the CSP RAG.

This project covers prioritised components involving field work for Salvin's albatross at the Bounty Islands. Recent population estimates of Salvin's albatross at the Bounty Islands (part of CSP project POP2012-06) using ground and aerial methods found contrasting evidence of population trend. The at-sea foraging distribution of this population is described from only a small sample size of individuals due to device failure in a recent study (also part of POP2012-06).

Project status

Complete.

Summary of the methods and key findings

Ground-based work

This project involved the deployment, and in some cases retrieval, of tracking tags on breeding Salvin's albatrosses (*Thalassarche salvini*) on the Bounty Islands, and to complete ground-based surveys. This fieldwork involved deploying transmitting Global Positioning System (GPS) and Platform Transmitting Terminal (PTT) tracking devices and geolocation data loggers (Global Location Sensing (GLS) tags) on breeding birds on Proclamation Island, Bounty Islands; banding and recapturing birds in the study area; completing counts of breeding and non-breeding birds along transects at various time of the day; and deploying automated time-lapse cameras that covered part of the study area.

In the first year of the project (October 2018), 14 transmitting GPS tags were deployed on breeding Salvin's albatrosses. All but one of the deployed tags produced locations for periods of approximately 100 days following deployment. In the second year of the project (October 2019), a further four transmitting GPS tags and 12 PTT tags were deployed on breeding Salvin's albatrosses, which also operated successfully, on average, for approximately 100 days. Additionally, in the first year of the project, 54 GLS tags were deployed on breeding Salvin's albatrosses, of which 33 were successfully retrieved in the second year of the project. The location data acquired from these different tags revealed that Salvin's albatross at the Bounty Islands exploited waters to the east of mainland New

[6] National Plan of Action – 2020 to reduce the incidental catch of seabirds in New Zealand Fisheries. Available at: https://www.fisheries.govt.nz/dmsdocument/40652-National-Plan-Of-Action-Seabirds-2020-Report

Zealand, with 'hotspots' located towards the east coast of the northern part of South Island and the southern part of North Island, with further 'hotspots' towards the central and western sections of the Chatham Rise, and also Mernoo Bank. There was some relatively limited evidence that waters off the Stewart-Snares shelf were also favoured, together with waters to the southeast of the Bounty Islands. These results appear to support the idea that Salvin's albatrosses at the Bounty Islands and at the Western Chain in the Snares Islands, the only other New Zealand breeding site for this species, tend to utilise separate areas within the New Zealand region during the breeding season, with birds from the Western Chain exhibiting a more westerly distribution.

Over the course of the project's two field trips, a total of 141 breeding Salvin's albatrosses were banded, all but one with both metal and plastic leg bands, at a study site on Proclamation Island. In both years, birds banded in 1985 and 2012 were resighted, and of the 98 birds banded in 2018, 57 were resighted in 2019. In the first year of the project, replicated ground-truthing counts were completed at the same time as an aerial photographic survey of breeding Salvin's albatross was undertaken. The ground-truthing revealed that a mean of 47% of birds were actively breeding.

Finally, in the first year of the project, six trail cameras were deployed in the study site covering a total of approximately 41 active nests. Each camera was set to take photographs at hourly intervals during daylight hours, and all cameras were retrieved in the second year of the project. All but one camera produced imagery, three for the entire year's deployment and two for part of the year.

Aerial-based work

Aerial work involved photography of the islands in mid-October 2018 via a series of parallel transects conducted via a fixed-wing aircraft modified to permit photography via two co-located portholes installed in the floor of the aircraft. It was anticipated that at this time, birds would have completed egg laying and that most of the birds that attempted to breed in 2018/19 would still be attending active nests. Photomontages were constructed of each transect flown and from these a complete series of overlapping images that covered the entire area of the islands where albatrosses were nesting was created. Counts of all Salvin's albatrosses were then made using MOUSECOUNT software. The total count of nesting Salvin's albatross pairs (Apparently Occupied Sites – AOS) was estimated to be 57,350 (95% CI 56,871 — 57,829). Analysis of close-up photographs showed 72% of the birds visible in photographs were sitting on nests. Ground counts at Proclamation Island indicated the proportion of birds assessed as apparently occupying sites was 0.65. However, the mean proportion of birds occupying a nest site containing an egg was 0.47 (range 0.41-0.52).

The estimated annual counts for all breeding sites in the Bounty Islands, adjusted to account for the presence of non-breeding birds, differed greatly, depending on the source of the correction factor used. The estimates derived from corrections were 41,723 (95% CI 41,315 — 42,132) and 26,955 (95% CI 26,626 — 27,283) annual breeding pairs, based on close up photos taken across all colonies, and ground counts on Proclamation Island, respectively. It is recommended that future aerial counts are undertaken a month earlier, at the completion of egg-laying, when there is likely to be substantially fewer loafing birds present in the colonies.

The total mean estimated Area of Occupancy of Salvin's albatross in October 2018 was 18.371 ha (range 17.649-18.905).

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $120,000 per annum over two years. Services were provided by NIWA and Latitude 42.

Review milestones

- Results for 2018/19 presented at the CSP TWG on 31 May 2019
- Final reports for 2018/19 published on the CSP website in June 2019
- Results for 2019/20 presented at the CSP TWG on 4 June 2020
- Final report for 2019/20 published on the CSP website in July 2020

Citation

Baker, B. 2019. Aerial survey of Salvin's albatross at the Bounty Islands, 2018. Final report to the Conservation Services Programme, Department of Conservation. Latitude 42, Australia. 11 p.

Sagar, P., Charteris, M., Parker, G., Rexer-Huber, K., Thompson, D. 2018. Salvin's albatross Bounty Islands population project. Final report to the Conservation Services Programme, Department of Conservation, prepared by NIWA. 18 p.

Thompson, D., Sagar, P., Briscoe. D., Parker, G., Rexer-Huber, K. and Charteris, M. 2020. Salvin's albatross Bounty Islands population project. POP2017-03 final report prepared by NIWA for the Conservation Services Programme, Department of Conservation. 23 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pop-2017-03-salvins-albatross-bounty-islands-aerial-component.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pop2017-03-bounty-islands-ground-component.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/pop2017-03-salvins-albatross-bounty-islands-final-report-2019-20.pdf

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

Overall objective

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

Specific objectives

1. Estimate adult survival, other demographic parameters and the population size of Gibson's albatross on Adams Island.
2. Estimate adult survival, other demographic parameters and the population size of White-capped albatross on Disappointment Island.

Rationale

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds[7] Objectives. It was developed at the request of the CSP Research Advisory Group (CSP RAG). Key components of research described in the CSP seabird plan 2017 for delivery in 2017/18 were identified and prioritised by the CSP RAG. This proposal covers prioritised components involving field work at the Auckland Islands, which have been developed to maximise cost and logistical efficiencies between components. Supporting rationale for all the components is summarised in the CSP seabird plan 2017.

Project status

Complete.

Summary of the methods and key findings

Gibson's albatross. Nesting success was 56% in the 2018-19 breeding season. The survival rate of adult females and males is once again similar, having recuperated from the dramatically low female survival recorded in 2006–08. However, at 90% the survival rate for both sexes this remains 6% lower than before the population crash in 2005 and is likely incompatible with population recovery given ongoing limited chick production. The total estimated number of breeding pairs of Gibson's wandering albatrosses showed slow improvement between 2008–2013, but these gains appear to have stalled. In 2019–20 the island-wide breeding population (3,861 pairs) was the lowest recorded since the years following the crash (2008–10). In the study area 96 Gibson's albatross pairs bred in 2019–20. This is the first time nest numbers there have fallen below 100 since the crash in 2006–08. There were only seventeen new recruits into the study colony (new breeding birds banded). Breeding and non-breeding/failed females have different survival rates. Satellite tracking in 2019 showed breeding birds foraged largely in the Tasman Sea, while those that had failed moved further west into the Great Australian Bight. Together, survival, breeding numbers and recruitment show the slow Gibson's albatross population recovery recorded over the decade 2007–2016 has stalled.

[7] National Plan of Action – 2020 to reduce the incidental catch of seabirds in New Zealand Fisheries. Available at: https://www.fisheries.govt.nz/dmsdocument/40652-National-Plan-Of-Action-Seabirds-2020-Report

White-capped albatross. Banded white-capped albatrosses were resighted at a rate of 0.26 in the study colony of 679 banded birds. This resighting rate is likely lower than previous years due to a short island visit cut to just 5½ hours in colony due to unworkable weather. Four GLS tracking devices were retrieved, and one further bird which had lost its GLS (or had it removed) was resighted. Adult survival is estimated as 90% (95% CI 86–93), taking into account different detection rates of nesting birds and those not on nest during colony visits.

Recommendations

Gibson's albatross. The gradual improvements in the demography of Gibson's albatross over more than a decade following the crash in 2005–06 appear to have stalled. The slowly increasing number of birds nesting on the island 2006–16 are decreasing again, down to numbers not seen since 2005–10, and recruitment has also dropped. Particularly low nesting numbers were recorded this year along with more than a decade of low chick production and high annual mortality for such a K-selected species (and higher than it used to be), the conservation status of Gibson's wandering albatross remains of concern. Monitoring the size of the population and its structure and trend on Adams Island remains a priority.

White-capped albatross. Future visits should take place in early February when mate changeovers are most frequent, over at least five days to increase resighting rates and provide some contingency for poor weather. Since birds' state appears to be useful for parameter estimates, longer visits would help improve survival estimates by improving the confidence in assigning breeding/non-breeding states to birds seen.

Exploratory analyses showed that while the data are suitable for point estimates of survival, time-varying annual survival rates are not yet possible. More resightings are needed to allow estimation of time-varying annual parameters like survival rates, population size and population rate of change.

To assess how our very brief resighting visits affect demographic parameter estimates, we suggest that data from other densely-colonial biennially breeding *Thalassarche* could be useful. Where comprehensive resighting data exists, the comprehensive dataset could be sub-sampled to mimic brief island visits and assess the impact of effort on parameter estimates.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. This is a three-year project and the planned cost for the project was $90,000 per annum over three years. Services were provided by Albatross Research and Parker Conservation.

Review milestones

- Results for 2017/18 presented at the CSP TWG on 24 May 2018
- Final reports for 2017/18 published on the CSP webpage in December 2018
- Results for 2018/19 presented at the CSP TWG meeting on 31 May 2019
- Final report for 2018/19 year made available on the CSP webpage in June 2019
- Results for 2019/20 presented at the CSP TWG meeting on 25 June 2020
- Final report for 2019/20 year made available on the CSP webpage in July 2020

Citation

Rexer-Huber, K., Thompson, D.R., Parker, G.C. 2018. White-capped albatross mark-recapture study at Disappointment Island, Auckland Islands. Report to the Conservation Services Programme, Department of Conservation. Parker Conservation, Dunedin. 15 p.

Elliot, G., Walker, K., Parker, G., Rexer-Huber, K. 2018. Gibson's wandering albatross population study and census 2017/18, June 2018. Report prepared by Albatross Research for the Conservation Services Programme, Department of Conservation. 16 p.

Rexer-Huber, K., Elliott, G., Thompson, D., Walker, K., Parker, G.C. 2019. Seabird populations, demography and tracking: Gibson's albatross, white-capped albatross and white-chinned petrels in the Auckland Islands 2018–19. Final report to the Conservation Services Programme, Department of Conservation. Parker Conservation, Dunedin. 19 p.

Rexer-Huber K., Elliott G., Walker K., Thompson D. and Parker G.C. 2020. Seabird population research: Gibson's albatross and white-capped albatross in the Auckland Islands 2019–20. Final report to the Conservation Services Programme, Department of Conservation. Parker Conservation, Dunedin. 30 p.

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https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pop2107-04-wca-final-report.pdf

https://www.doc.govt.nz/contentassets/f2d679dc8fa5486e9edee23f8a60fcf7/pop2017-04-gibsons-final-report.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pop2017-04-auckland-is-seabirds-final.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/pop2017-04-auckland-island-seabirds-research-final-report-2019-20.pdf

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

Overall objective

To carry out improved habitat suitability modelling for protected corals in the New Zealand region to help identify areas of risk from interactions with commercial fishing gear.

Rationale

A number of protected coral taxa occur as bycatch in commercial fisheries in New Zealand. In order to refine our understanding of the overlap between commercial fishing effort and corals and to assess potential fishing impacts across their distribution, it is important to quantify the spatial extent of corals in New Zealand in relation to these impacts. This project will expand on the work done by Anderson et al. 2014, by carrying out improved and refined habitat modelling using new data, including *in situ* coral records collected by researchers and the CSP Observer Programme during the past four years, the trawl footprint for the most recent fishing year available, and a regional environmental layer. Shallow water coral data (<200 m) will be included in the modelled outputs. Updating the predicted distribution maps for protected corals defines areas of suitable habitat, helps to assess risk from commercial fishing, and informs the management of these fragile and long-lived animals.

Project status

Complete.

Summary of the methods and key findings

To estimate the overlap between commercial fishing and corals under present and future climate conditions, and thus the potential vulnerability of these protected species, it is first necessary to predict the present and future spatial extent of corals. This work extends upon previous coral habitat suitability modelling studies by utilising updated modelling techniques, incorporating additional coral presence records, and by using regional environmental predictor layers for the current and future climate conditions based on the New Zealand Earth System Model (NZESM). Models were produced for all protected coral taxa considered in initial consultations with stakeholders. Selection was based on the need to produce models that cover a range of protected coral taxa and the requirement for a sufficient number and spread of presence records.

Environmental predictors were derived primarily from outputs of the NZESM, but several fixed predictors, including revised and updated sediment data layers, seafloor slope and Underwater Topographical Feature (UTF) were also considered. Model coefficients were used to produce two sets of prediction grids for each model type; one for present-day environmental conditions (means from the period 1995 to 2014), and one for the predicted environmental conditions at the end of the 21st century (2080 - 2099), assuming only moderate mitigation and adaptation to climate change.

Model performance was shown to be acceptable for all taxa, and although predicted taxa distributions largely agreed with previous studies, additional presence records extended the predicted distributions into new areas for some taxa. For the region as a whole, future habitat suitability ranged from somewhat less suitable (e.g. *Corallium* spp.) to somewhat more suitable overall (e.g. *Enallopsammia rostrata),* across the 12 taxa examined. For some taxa, especially the hydrocorals, predicted future habitat suitability remained largely unchanged.

The risk to corals from interaction with fishing gear was assessed by comparing predicted coral distributions with the aggregated swept area from historical bottom fishing. Overlaying the regions of greatest habitat suitability with the most highly fished regions revealed considerable variability in vulnerability among taxa, both in degree and location. The greatest overlaps were seen for hydrocorals and the shallower scleractinian species, whereas the deeper scleractinians, gorgonians, and black corals were less vulnerable. Little change in overlap at the end of the century was predicted for many of the modelled taxa. However, a higher future level of overlap off the west coast of the South Island was predicted for the thicket-forming *Madrepora oculata*, the alcyonaceans *Keratoisis* and *Lepidisis* spp., and the black coral *Leiopathes* spp. A lower level of future overlap was predicted for the hydrocoral genus *Stylaste*r along the east coast of the North Island.

Recommendations

Further improvements in habitat suitability models for protected corals will be possible with the continued expansion of the area surveyed around New Zealand. Improvements in the prediction of future distribution of corals will require advancements in the precision of NZESM model outputs, with finer resolutions than those currently available. Assessment of the impact of alternative emissions pathways would also be a useful extension of this work, particularly applying a less conservative "business-as-usual or "worst-case-scenario" future that may provide more contrast with present distributions. Furthermore, it will be ideal to incorporate measures of uncertainty in the environmental predictors used in future habitat suitability modelling efforts (Foster et al. 2012, Stoklosa et al. 2015) and, if utilising species presence data from multiple sampling gears, gains could be made by incorporating a gear catchability parameter into the model structure.

To further improve the estimation of risk to protected corals from commercial fishing, and to assist the development of measures to protect representative areas of protected coral habitat we recommend working towards a quantitative Level-3 Ecological Risk Assessment for the Effects of Fishing (ERAEF) on protected deep-sea corals (*after* Hobday et al. 2011). This level of assessment would be a natural extension of the Level-2 Productivity-Susceptibility-Analysis (PSA) previously undertaken for DOC (Clark et. al 2014).

Project logistics summary statement

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

Review milestones

- Results presented at the CSP TWG on 5 March 2020
- Final report published on the CSP webpage in July 2020

Citation

Anderson, O., Stevenson, F. Behrens, E. 2020. Improved habitat suitability modelling for protected corals in New Zealand waters. POP2018-01 Final report prepared by NIWA for the Conservation Services Programme, Department of Conservation. 108 p.

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https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/pop2018-01-coral-habitat-suitability-final-report.pdf

3.4 POP2018-02 Hoiho population and tracking project

Specific objectives

1. To collect key demographic data on poorly studied hoiho colonies.
2. To collect dietary and condition data at poorly studied colonies to allow for comparison between sites.
3. To improve fine scale distribution and foraging data.

Rationale

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives[8].

Hoiho (Yellow-eyed penguins) are listed as 'Endangered' in both the NZ Threat classification and with the IUCN. They face a range of threats, both marine and terrestrial, and recent poor breeding success and disease events at some colonies have highlighted the precarious nature of hoiho (Ellenberg & Mattern 2012; Webster 2018). Direct fishing mortality, particularly in setnets, along with indirect effects of habitat modification and reduction of prey availability adversely affect hoiho, particularly on the mainland, Rakiura and Whenua Hou populations.

Key knowledge gaps lie in having representative tracking data over all sites and life stages to better understand foraging behaviour and fisheries overlap, and the site-specific identification of prey items to determine drivers for differing breeding success, animal condition and disease susceptibility across colonies.

Project status

In progress.

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 per annum over two years.

[8] National Plan of Action – 2020 to reduce the incidental catch of seabirds in New Zealand Fisheries. Available at: https://www.fisheries.govt.nz/dmsdocument/40652-National-Plan-Of-Action-Seabirds-2020-Report

3.5 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 Critical (Baker et al. 2010) and are incidentally killed each year 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. Approximately 70% of New Zealand sea lions breed at the Auckland Islands, where population data has been collected since the mid-1990s, including 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. A literature review to identify potential indirect effects of commercial fishing on the Auckland Islands population as part of CSP project POP2010-01 highlighted a number of key information gaps that currently 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 collected during previous years in order to determine the key demographic factors driving the observed population decline of New Zealand sea lions at the Auckland Islands. It 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).

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. This research project is scoped to collect pup count information required to manage the impact of commercial fishing on the Auckland Islands population. It is envisaged that other research, and/or management actions, will be progressed as part of the TMP, and may be delivered alongside the research programme proposed here to provide logistical synergies.

Project status

2018/19 and 2019/20 complete, 2020/21 cancelled due to COVID-19 health concerns and funds will be returned to industry.

Summary of the methods and key findings

2018/19. During the 2018/19 field season, a total pup production estimate of 1,679 was acquired for sea lion colonies at Enderby Island (Sandy Bay 319, South East Point 0), Dundas Island (1,295) and Figure of Eight Island (65). This estimate is 6% lower than the 2017/18 estimate of 1,792; 44% lower than the peak pup count of 3,021 in 1997/98, and 12% higher than the lowest recorded pup count of 1,501 in 2008/09. The 2018/19 estimate appears to continue a relatively stable trend over the past 11 years following steady declines since the 1990s.

Flipper tags and microchips were used to permanently mark 767 pups (312 at Enderby, 400 at Dundas, and 55 at Figure of Eight). One hundred pups on each of Enderby and Dundas Islands were weighed and measured.

The population monitoring conducted in 2018/19 also included 44 daily counts of sealions at Sandy Bay, six whole-island sea lion counts of Enderby Island, and 3,296 total tag resightings acquired from the Auckland Islands (once matching occurred to remove any re-sights that were not comparable to an existing tag). Sea lion pup mortality investigations for 2018/19 were reported separately. The project outputs contribute to ongoing research aiming to inform future management decisions for the species.

2019/20. This season was significantly impacted by financial and vessel constraints resulting in the original plan for a six-week field season being reduced to 13 days. During the 2019/20 field season, total pup production was estimated at 1,740 for the Auckland Islands. This estimate is 3.6% higher than the 2018/19 estimate of 1,679, continuing the relatively stable trend over the past 12 years since the lowest pup production recorded in 2008/09. Total pup production was estimated at 289 on Enderby Island (Sandy Bay n=289; South East Point n=0); 1,398 at Dundas Island; and 53 at Figure of Eight Island.

Flipper tags were used to permanently mark 510 pups (284 at Enderby, 200 at Dundas, and 26 at Figure of Eight) in 2019/20. All tagged pups on Enderby were microchipped but no chipping was done on Dundas or Figure of Eight. One hundred pups at Dundas Island, 98 pups at Sandy Bay, and 26 pups at Figure of Eight Island were weighed and measured. No resight effort was possible on Dundas and Figure of Eight Islands due to the limited time spent at each site. Tag resighting was undertaken between 19 and 28 January at Enderby Island. After removing duplicates of the same animal recorded on the same day, a total of 259 individual resights were collected. Sea lion pup mortality investigations were only planned for carcasses found on Enderby and only one gross post-mortem was completed during the 2019/20 season. The cause of death for this pup was inconclusive due to moderate decomposition and extensive scavenging of the carcass. No additional planks for pups were installed as there was no obvious need for these.

Recommendations

- A suggested earlier start date/longer field season in order to be present for births and to acquire a complete season count of dead pups (and thus a more accurate pup production estimate). Development of clear goals and guidelines on the areas in which to search for animals in the daily count and in the dead run to allow for consistency over the years.
- Determine and take additional action steps to move forward with *Klebsiella pneumonia* research (i.e. ivermectin controls/ trials, etc.)
- Further advancement in the development of the shark/distinct scaring photo ID library if specific shark predation type data is desired to be derived from it.
- Additional time spent on Dundas Island to allow for effort into re-sighting there.
- Ensure continued use of the M-R as the estimate method for Dundas.
- Potentially change to different PIT tags for Dundas, and if so, change to one that would have options of a fixed scanner.
- Existing ‘planks for pups’ ramps should be reassessed in the upcoming field season if necessary. Monitor number of pups who were rescued or died from getting stuck in holes at all sites.
- Trial mark-recapture at Shoal Point next year, marking pups at the edge of colony and letting them mix overnight.
- Optimise necropsies to get better data on causes of pup mortality at Campbell Island.

- Add to work plan structured and regular surveys at Paradise Point, Campbell Island and a designed survey for other areas.

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 over four years. Services were provided by internally recruited staff.

Review milestones

- Final results for 2018/19 presented at the CSP TWG meeting on 26 March 2019
- Final report for 2018/19 published on the CSP website in June 2019
- Final results for 2019/20 presented at the CSP TWG meeting on 14 April 2020
- Final report for 2019/20 published on the CSP website in May 2020

Citation

Dodge, H. 2019. New Zealand Sea Lion Monitoring and Pup Production at The Auckland Islands 2018/19. Final report for the Conservation Services Programme. 32 p.

Melidonis, M.C. and Childerhouse, S. 2020. New Zealand Sea Lion (Rāpoka) Monitoring on the Auckland Islands for the 2019/20 Season: Field Research Report. Prepared for the Department of Conservation. 23 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pop2018-03-sea-lion-pup-count-auckland-islands.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/nz-sea-lions/fieldwork-reports/report2020-nzsl-pop-auckland-island.pdf

3.6. POP2018-04 Flesh-footed shearwater: Population monitoring

Specific objectives

1. To estimate the current population size of flesh-footed shearwaters at Motumahanga Island, Taranaki.
2. To obtain updated estimates of the population size of flesh-footed shearwaters nesting at the Chicken Islands (Lady Alice, Whatupuke and Coppermine Islands).
3. To estimate key demographic parameters of flesh-footed shearwater at Lady Alice Island/Mauimua and Ohinau Islands.
4. To carry out simultaneous tracking of flesh-footed shearwaters at Lady Alice (Hauraki Gulf) and Ohinau Islands (Bay of Plenty) in one breeding season during the incubation and early chick rearing period.
5. To describe the breeding phenology, particularly egg-laying dates at two breeding sites to assess if inter-annual and site variation exists.

Rationale

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. This proposal delivers on recommendations arising from POP2015-02, which was implemented to address priority population estimate gaps and better estimate key demographic rates.

Population monitoring of flesh-footed shearwaters on Ohinau and Lady Alice Islands was carried out under CSP project POP2015-02. It was recommended that ongoing and repeated monitoring of both islands should continue so a more robust conclusion about the population trends of flesh-footed shearwaters in New Zealand can be made. It was recommended that recapture efforts need to be consistently large scale to provide a robust mark-recapture dataset and help determine survivorship. It was also found that the precise breeding phenology was not well understood, and the timing of past surveys relative to egg-laying can greatly influence population estimates. Further investigation of laying dates is thus proposed to ensure comparable and accurate monitoring can be achieved in future years (by assessing annual and site related variability in this parameter).

Previous research under project POP2015-02 did not include the breeding site at Motumahanga Island in Taranaki. Recent captures of flesh-footed shearwaters in the bottom longline fishery in this area has highlighted concern for this population, where the only population estimates date from the late 1980s.

Tracking of flesh-footed shearwaters in 2017-18 has shown that these birds can exhibit broad variability in foraging behaviour with birds tracked in 2018 travelling much further offshore than those tracked in 2017. A project to track birds from both a Hauraki Gulf colony (Lady Alice Island) and Bay of Plenty colony (Ohinau Island) in the same breeding season will determine whether birds from these populations mix at sea during incubation and early chick rearing periods. This will also help improve our understanding of fisheries risk by assessing the relative rates of inshore (<50km offshore) versus pelagic (>50km offshore) foraging trips.

Project status

2018/19 and 2019/20 complete, year three is in progress.

Summary of the methods and key findings

During the 2019/20 breeding season 274 and 288 study burrows on Ohinau and Lady Alice Islands were monitored respectively. A total of 216 study burrows on Ohinau Island were breeding and we were able to identify 408 of the 432 (94%) partners occupying these study burrows. On Lady Alice Island, 202 study burrows were breeding and 358 of 404 (89%) of partners occupying these study burrows were identified. We were unable to determine breeding success for the 2019/20 season but the rate of failure during incubation in January was similar to the 2018/19 season.

Breeding flesh-footed shearwaters were tracked simultaneously on Ohinau and Lady Alice Islands during the incubation and chick-rearing stages. On Ohinau Island, GPS devices were deployed on 26 individuals during incubation and 27 individuals during chick-rearing and this yielded 21 tracks and 50 tracks respectively. On Lady Alice Island, GPS devices were deployed on 29 individuals during incubation and 34 individuals during chick-rearing and this yielded 20 tracks and 55 tracks respectively.

The average length of incubation foraging trips was 11.8 days and 4,665 km for Ohinau Island birds and 16.6 days and 4,734 km for Lady Alice Island birds. Lady Alice birds undertook significantly longer trips in respect to duration. The average length of foraging trips during chick-rearing was 3.1 days and 1,205 km for Ohinau birds and was 4.8 days and 1,536 km for Lady Alice birds. There was considerable variation in all aspects of foraging trips during chick-rearing which is likely due to a dual-foraging strategy.

There was considerable overlap of foraging areas between Ohinau and Lady Alice birds indicating that birds from different populations mix at sea during the breeding season. All birds from Ohinau Island foraged either down the East Coast of the North Island or out towards the Louisville Ridge. During incubation, nearly half of Lady Alice birds foraged in the same locations while the remaining birds foraged inshore off the West Coast of the North Island or offshore in the Tasman Sea. During chick rearing, areas closer to each of the colonies had greater importance but birds still utilised some of the more distant foraging locations identified during incubation in order to maintain their own body weight and condition.

Recommendations

As the biggest current quantifiable threat to the population viability of flesh-footed shearwaters is adult mortality associated with commercial longline and trawl fisheries, the new tracking data presented here can be used to improve estimates of the at-sea distribution and habitat use of adult flesh-footed shearwaters during the breeding season. These improved estimates can then be used to improve spatially explicit models of bycatch risk and help determine mitigation measures to help reduce the bycatch of flesh-footed shearwaters. Further at-sea distribution data will be retrieved from up to 59 GLS's carried by adults during the 2020 non-breeding season.

In the upcoming 2020/21 field season, population estimates will be carried out on Whatupuke and Coppermine Islands (Objective 2). The four islands that we have already surveyed; Middle, Ohinau, Lady Alice and Motumahanga Islands, have all shown substantial increases from previous estimates. These estimates have accounted for an additional 7,500 breeding pairs, which represents at least a 50% increase on the 10,000 – 15,000 estimate given by Waugh et al. (2013). The population estimates for Coppermine and Whatupuke Islands will provide greater insight into the trends of flesh-footed shearwaters breeding in New Zealand.

As much time as practical will continue to be invested in to recapturing birds on the surface at night-time on Ohinau and Lady Alice Islands. For the coming season, field teams will be established on each island prior to the commencement of egg laying (i.e. from the end of November). This has been found to be the most active period for flesh-footed shearwaters on the islands with large numbers of breeders and non-breeders present on the surface at night-time. On the same trip we will determine the egg-laying dates for all study burrows on both islands and draw comparisons to the 2016/17 season when this was last measured simultaneously for both islands (Objective 5).

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $100,000 per annum over 3 years. Services were provided by Wildlife Management International Limited.

Review milestones

- Final results for 2018/19 presented at the CSP TWG meeting on the 17 July 2019
- Final 2018/19 report published on the CSP website in August 2019
- Final results for 2019/20 presented at the CSP TWG meeting on the 25 June 2020
- Final 2019/20 report published on the CSP website in August 2020

Citation

Crowe, P., Bell, M. 2019. Flesh-footed shearwater population monitoring and estimates: 2018/19 season. Report prepared by Wildlife Management International Limited for the New Zealand Department of Conservation, Wellington. 32 p.

Crowe, P. 2020. Flesh-footed shearwater population monitoring and at-sea distribution: 2019/20 season. Report prepared by Wildlife Management International Limited for the New Zealand Department of Conservation, Wellington. 39 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pop2018-04-flesh-footed-shearwater-research-final-report.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/pop2018-04-flesh-footed-shearwater-research-2019-20-final-report.pdf

3.7. POP2018-06 Protected coral connectivity in New Zealand

Specific objectives

1. Review existing literature examining genetic connectivity for New Zealand corals.
2. Assess genetic connectivity of a key deep-sea coral species highlighted by the pilot ecological risk assessment (ERA) as 'high risk', which will further inform the to support the identification of distinct populations for management purposes.

Rationale

The management and conservation of deep-sea coral communities requires an understanding of how coral populations are connected in environments that are challenging to monitor. Larval or gametic connectivity between populations underpins coral genetic diversity, which in turn influences population resilience and ability to adapt to natural and anthropogenic stresses. The recolonisation potential of protected deep-sea corals in impacted areas is largely unknown for several key groups in the New Zealand region and highlights an information shortfall when carrying out ecological risk assessments (ERA's). Outputs of this work will spatially define multi-specific coral genetic units ('populations') across New Zealand, which can be used to identify potential source and sink areas, can contribute to our understanding of coral resilience, and can help to develop appropriate management measures.

Project status

Complete.

Summary of the methods and key findings

This project sought to examine population delimitation and connectivity of a single black coral species, *Bathypathes patula*, by building upon the preliminary results of a previous study, including an increased sample size and testing novel genetic markers for resolution of genetic variation.

DNA barcoding was used to successfully determine the relationships of 77 specimens of *B. patula* housed within the NIWA Invertebrate Collection (NIC), using a combination of five genetic markers. Four markers were adapted from previous studies, but one was newly developed for this project and shows promise for distinguishing black coral populations and species. However, our results indicated that, in reality, the tested specimens belonged to a cryptic complex of at least five different genera- not a single species - and no obvious subdivision of these genera into species or populations was discernible from over 2000 base pairs of DNA sequence data. We suggest that this complexity warrants a reconsideration of past estimates of anthropogenic effects on *B. patula*, and allowances for hidden diversity should be made during management considerations for black coral species.

Although a population genetic analysis could not be achieved due to multiple species being present in our sample, the hidden taxa uncovered in this study increases our knowledge of black coral diversity in New Zealand and greatly expands the known distribution of one of the cryptic taxa, *Telopathes tasmaniensis,* to include locations across the Exclusive Economic Zone.

The co-occurrence of *B. patula* and *T. tasmaniensis* was also examined and it was found that their geographic and bathymetric distributions largely coincide. This presents additional difficulty in distinguishing these and other cryptic species, since it appears that gross similarities in their morphology make genetic barcoding the most reliable tool for telling them apart. However, given that

we were not able to reliably discriminate multiple species within any of the cryptic genera we sampled, the use of higher-resolution genetic techniques is advisable for future efforts to document species diversity and population connectivity among black corals. While it remains prohibitively expensive for routine identification, genomic approaches comprise the most effective methods for resolving population-level differences for black corals, including connectivity analysis. Given recent reductions in per-sample costs, the ability to resolve relationships at a wide range of taxonomic levels, and amenability to the use of older collections material, we recommend that future attempts to measure the connectivity of black coral populations should employ Ultra-Conserved Elements (UCE) or RADseq – both are contemporary methods that have shown much promise among related groups of deep-sea corals.

Recommendations

- Investigate the feasibility of employing genetic barcoding during routine identification of new NIC black coral specimens (especially the Schizopathidae). Ideally barcoding should be accomplished using at least two loci (*ND5-igr-ND1* mtDNA and *NSL* nDNA loci). This would avoid underestimates of diversity and assist with assessments of how many conspecifics are available for genetic connectivity analyses.
- A genetic connectivity assessment of a New Zealand black coral species is still needed, which is contingent upon increased sampling plus development of a suitable genetic methodology. The most cost-effective and powerful approach to genetic connectivity analysis would be to employ a UCE genome-scale method, which may partially overcome the limitations of small sample sizes and older archival material.
- A reassessment of the distributional limits and prevalence of *B. patula* and *T. tasmaniensis* are needed in light of the current study. An in-depth taxonomic assessment is required of the other cryptic taxa uncovered here, to determine their identity and occurrence before a similar distributional study can be undertaken.

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. Services were provided by NIWA.

Review milestones

- Final results presented at the CSP TWG meeting on the 6 August 2020
- Final report published on the CSP website in August 2020

Citation

Bilewitch, J.P. and Tracey, D. 2020. Protected coral connectivity in New Zealand. Final Report for project POP2018-06 prepared by NIWA for the Conservation Services Programme, Department of Conservation. DOC19306-POP201806. 32 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/pop2018-06-protected-coral-connectivity-final-report.pdf

3.8. POP2019-01 Investigation of electronic device options to assess distribution, diving and foraging behaviour of Hector's dolphins

Specific objectives

1. To determine currently available options that would be suitable for assessing the fine scale distribution, diving and foraging behaviour of Hector's dolphins**.**
2. To identify operational, biological and environmental factors which may constrain the assessment.
3. To provide recommendations on the most effective method to assess behavioural aspects of Hector's dolphins.

Rationale

Substantial work has been undertaken to assess and address the risk of fisheries bycatch to Hector's and Māui dolphins through the Hector's and Māui dolphins Threat Management Plan[9]. However, fully understanding the risk is limited by gaps in our knowledge on the fine scale distribution and behaviour of the dolphins.

Satellite tagging has been proposed in the past as a tool to fill knowledge gaps. However, technology at the time required invasive techniques to deploy the tags on dolphins and was considered high risk for use on Hector's and Māui dolphins.

The last time the technology was considered was at the formation of the Māui dolphin Research Advisory Group in 2014. Technology has likely progressed since then. The purpose of this project is to assess the current state of the technology to see if it has advanced enough to answer questions about Hector's and Māui dolphin distribution and foraging behaviour while minimising the potential risk of the tag deployment to the dolphins.

Project status

Complete.

Summary of the methods and key findings

Previous research programmes on tagging of Hector's dolphins have demonstrated that electronic tagging can aid in investigating important aspects of biology and ecology, which is also supported by many international tagging programmes on other cetacean species reviewed in this report. While both New Zealand studies had relatively small sample sizes, the researchers concluded that Hector's dolphins are suitable candidates for satellite telemetry studies and that the risk to this species from capture, handling and tagging appears low. Unfortunately, neither of these previous projects included a comprehensive follow-up research programme and so there is little scientific literature available from which to assess any potential short- or longer-term impacts on tagged animals.

This report identifies several general research areas that could be addressed by tagging and provides recommendations for the tagging methods that can best address these different research areas. It is important that any proposed research project is carefully evaluated against specific research

[9] Available to download at: https://www.doc.govt.nz/our-work/our-work-with-maui-dolphin/hectors-and-maui-dolphin-threat-management-plan/

questions in any future study to ensure that appropriate methods and tagging techniques can be selected. It will be necessary to consider a wide range of issues well in advance in order to confirm that the chosen method can deliver required outcomes for a specific research question. These include issues such as sample size, animal welfare, cost, and considerations of accuracy and precision of data but, just as important, are considering public and Treaty Partner views. Notwithstanding these issues, electronic tagging has the potential to address the current knowledge gap in spatial/temporal distribution patterns (particularly around diving performance, nocturnal behaviour, and diurnal distribution) that is needed in order to better inform Hector's dolphin conservation management, especially in relation to interactions with fishing.

Recommendations

There are a wide variety of electronic tag types and attachment methods suitable for Hector's dolphins, all of which have different advantages and disadvantages, and can be used to answer a diverse range of potential research questions. A range of recommendations about the best tagging method to address each area of research is provided within this report, but it is not possible to determine the optimal tagging programme unless there is a specific research question and the relative weighting of potential competing considerations (e.g. tag retention vs animal welfare vs sample size vs cost) are stated. Nevertheless, as a general rule, the higher the quality and quantity of data produced, the higher the impact on individual dolphins.

The assessment of any proposed tagging programme should follow a strict evaluation process. A risk assessment should form part of the assessment and evaluation process undertaken for any potential tagging project. As with all animal welfare considerations, a risk assessment needs to be undertaken within the context of a research question so that risks can be quantified and mitigated.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $20,000 over one year. Services were provided by Cawthron Institute.

Review milestones

- Final results presented at the CSP TWG meeting on the 4 June 2020
- Final report published on the CSP website in July 2020

Citation

Childerhouse, S., Johnson, O. 2020. POP2019-01 Electronic devices to assess distribution, diving and foraging behaviour of Hector's dolphins. Prepared for the Conservation Services Programme, Department of Conservation. Cawthron Report No. 3512. 63 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/pop2019-01-electronic-device-options-for-hectors-dolphin.pdf

3.9. POP2019-02 Fish shoal dynamics in North-eastern New Zealand

Specific objectives

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

Rationale

North-eastern North Island waters, from the Three Kings Islands to East Cape, are notable for large numbers of seabirds gathering and feeding in association with concentrations of zooplankton and fish, variously known as a 'fish shoals', 'work ups', 'boil ups', 'bust ups', or 'bait balls'. While the mega marine fauna feeding activity has been described to varying degrees, the zooplankton and fish responsible for these events and the dynamics which drives them is poorly understood in New Zealand. This project extends upon past projects (INT2016-04 and POP2017-06) which highlighted how little is known about fish shoaling activity. There is a need to understand the processes that determine different fish shoaling as many seabirds are dependent on surface shoaling fish that make prey species available as a food source, commercial fisheries also target these fish shoals. Further research into shoaling patterns over time is beneficial considering evident reductions in seabird populations (e.g. red-billed gulls and white-fronted terns).

The purse seine fishery spotter database (aer_sight) contains records of search effort and sightings of pelagic schooling species (mainly skipjack tuna, kahawai, blue mackerel, jack mackerel and trevally) dating from June 1960 to the present day. This long-term data set will enable thorough investigation into the temporal and spatial patterns of shoaling activity.

Project status

In progress.

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 one year.

3.10. POP2019-03 Antipodes Island seabirds research

Specific objectives

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

Rationale

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. This proposal delivers priority research components of the CSP seabird plan 2017 involving field work at Antipodes Island. The proposal has been developed to maximise cost and logistical efficiencies between components. Research on Antipodean albatross is planned in 2019/20 outside of CSP and will provide further cost and logistical efficiencies if progressed. Supporting rationale for all the components is summarised in the CSP seabird plan 2017. Methods will be developed and tailored to each species and site and will maximise comparability to previous estimates where they exist.

Project status

Postponed to 2021/22 due to COVID-19 health concerns.

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.

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

Specific objectives

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

Rationale

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. This proposal delivers priority research components of the CSP seabird plan 2017 involving 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

Year one complete, year two delayed to 2020-21 due to COVID-19.

Summary of the methods and key findings

Counts of breeding Southern Buller's albatrosses (*Thalassarche bulleri bulleri*) were conducted at Snares Islands/ Tini Heke from 11-17 March 2020. This was the same time of year and followed similar methods to previous counts that have occurred in 1969, 1992, 2002 and 2014. The total of 5,164 breeding pairs recorded along the East Coast, North Promontory, South Coast and West Coast was very similar to the 5,305 breeding pairs estimated in the same areas in 2014 though it is important to note that the current survey of North East Island was incomplete due to adverse weather. The result indicates that the increase in size of the breeding population over the period 1969-2002 has not continued. An additional 621 breeding pairs were estimated on Broughton Island in 2019.

A total of 245 birds previously banded in the study colonies as breeding adults of unknown age were recaptured. A further 77 breeding birds were banded in the study colonies - these are presumed to be first-time breeders. Estimates of annual survival of birds banded as breeders continued to decline, with an estimate of 0.889 in 2017. During the period 1992-2004, all chicks that survived to near fledging in the study colonies were banded and survival rates monitored via return to the study colonies in subsequent years. In 2020, 125 of these birds were recaptured, with birds from cohorts banded between 1999-2004 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 162 known-age birds recaptured, 13 were found breeding for the first time, and so were recorded as being recruited to the breeding population. A bird banded as a chick on Big Solander Island in 2002 was recaptured on an empty nest. One bird banded as a chick in 1972, was recaptured at 48 years of age.

Fifty Global Location Sensing (GLS) tags were attached to the metal leg bands of breeding birds in the Mollymawk Bay study colony; these will be retrieved during 2021 and 2022. A GPS device was used to record latitude and longitude coordinates at waypoints around the perimeter of each of the three

study colonies, and trail cameras will be installed in 2021 at nest sites determined from this year's study.

Recommendations

- Estimating adult survival by gender would be a natural extension of the overall adult survival estimates presented here. Survival estimates by gender will be incorporated into the final annual report at the end of the third year (2022) of this project.
- A more comprehensive modelling approach could be applied to the entire dataset to estimate parameters other than adult survival. However, a comprehensive re-modelling of Southern Buller's albatross data would be beyond the scope of this project and would ideally require a separate project that could incorporate 'new' data from 2008-2022 when this project is completed.

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. Services were provided by NIWA.

Review milestones

- Final results for 2019/20 presented at the CSP TWG meeting on the 15 May 2020
- Final report for 2019/20 published on the CSP website in July 2020

Citation

Thompson, D. & Sagar, P. 2020. Southern Buller's albatross, Snares Island/Tini Heke population project 2019/20. POP2019-04 final annual report prepared by NIWA for the Conservation Services Programme, Department of Conservation. 24 p.

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https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/pop2019-04-southern-bullers-snares-final-report-2019-20.pdf

3.12. POP2019-05 New Zealand fur seal: Bounty Islands population assessment

Specific objectives

1. To determine the population trend of fur seals at the Bounty Islands, to the extent possible using existing data.
2. To recommend future data collection protocols to better estimate the population size and trend of fur seals at the Bounty Islands.
3. To investigate the feasibility of estimating the population trend of fur seals at the Bounty Island through aerial surveys conducted by Unmanned Aerial Vehicle (UAV).

Rationale

New Zealand fur seals are captured in the southern blue whiting trawl fishery around the Bounty Islands at one of the highest rates of any trawl fishery (Abraham et al, 2017), however, information on their population level and trend at this site is poor. Data on fur seals has been collected during a number of surveys of other species at the Islands, notably Salvin's albatross. This data exists as on ground observations and aerial photographs and may be informative in assessing population trends.

Project status

Complete.

Summary of the methods and key findings

Because many of the Bounty Islands are inaccessible to boat-based landings, aerial photographs are considered the most effective way to estimate fur seal population numbers across the whole island group and assess trends over time. Aerial photographs taken from aeroplane or boat-based helicopter have been used to count fur seals and, more recently, Salvin's albatross. However, surveys involving aeroplane charter or helicopters are logistically demanding and expensive. Drones hold promise as an alternative way to obtain aerial photographs suitable for estimating fur seal numbers at reduced effort and cost. Relative to piloted aerial surveys, drone surveys have low operational costs, simple logistical requirements, and are relatively low risk for operators, while providing data that are systematic and repeatable. As with any survey method drones also have limitations, notably in battery life and potential for wildlife disturbance.

This study aimed to assess previous aerial photographs and whether a drone could be used for aerial surveys to quantify NZ fur seal population size at the Bounty Islands without impacting on seals, penguins and albatrosses there. In the NZ subantarctic islands drones have been used successfully for a range of wildlife monitoring at the Antipodes and Auckland Islands but had not been used at the Bounty Islands prior to this project.

A DJI Mavic 2 Pro drone fitted with a high-quality Hasselblad camera was used with aperture priority to minimise overexposure. Preliminary animal disturbance trials showed that drone operations had little apparent effect on animals, when operated with due caution, and obtained excellent imagery at 40m for counting fur seals and other animals. By 'due caution' we mean careful choice of launch site, to be as far as possible from seal clusters, checks of the busy airspace relative to planned flight height; and avoiding flight heights below 20m. Resolution was such that at the top of the island, fur seal pups could be identified, and animal behaviours observed (yearlings playfighting, pups suckling). The islands

are steep-sided, so images are lower resolution near sea level where animals are ~80m below the camera. This could be addressed by flying the drone to obtain a digital elevation model, then programming drone flight to maintain a given distance to land.

Counts of fur seals ashore on Proclamation Island in 2019 (1,154 individuals ashore, including at least 341 pups) compare to 972 fur seals at a similar time in 2018. This suggests little change in numbers on Proclamation, considering the variable proportion of seals at sea at any given time. No recent ground-truthing data are available, but we expect that a small proportion will have been missed in deep shade and under overhangs.

For a population size estimate of fur seals at the Bounty Islands, overflight at Proclamation, Tunnel, Ranfurly and the Spider Island group would need to be expanded to include all other islands in the group. Depot Island could be flown from Proclamation, but other islands may best be approached by boat and the drone flown from deck. Boat-based flight poses its own challenges, being limited by swell as well as wind, and rigging and interference from the steel boat can affect ease of launch and landing. For data from all islands, more batteries and charging options will need to be considered as battery life is the primary factor limiting coverage.

Recommendations

- Drone flight around busy mixed colonies of seals and seabirds should carefully consider animal behaviour. In general, all flights should involve at least one observer to help the pilot monitor animal reactions, especially around launch and landing. For drone flight at the Bounties, we suggest that:
    - The density of flying Salvin's albatrosses above the islands be checked relative to planned flight elevation for every flight since airspace busyness changes in short timescales and likely at other times of year;
    - A launch site away from fur seal clusters be chosen;
    - The drone ascends promptly to flight elevation to reduce seal restlessness;
    - Overflight below 20m be avoided.
- High-quality imagery was obtained with overflight at 40m.
- Overflight should target overcast conditions since there is less dark shading, increasing count accuracy.
- Ensure plenty of batteries are available, with a good charging method (battery bank, small generator).
- Ground-truthing data are needed to assess the accuracy of counts from any aerial photographs.
- Aerial photographs from 2010 and 2013 should be counted to gauge changes in fur seal numbers over time and viewed together with historical data.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $30,000 over one year. Services were provided by Parker Conservation.

Review milestones

- Final results presented at the CSP TWG meeting on the 5 March 2020
- Final report published on the CSP website in April 2020

Citation

Rexer-Huber K., Parker G.C. 2020. Bounty Islands drone trials: feasibility for population assessment of NZ fur seal. POP2019-05 final report for the Conservation Services Programme, Department of Conservation. Parker Conservation, Dunedin. 18 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/pop-2019-05-fur-seal-bounty-islands-final-report.pdf

3.13. POP2019-06 Spotted shag population review

Specific objectives

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

Rationale

The Conservation Services Programme Seabird medium term research plan 2017 (CSP seabird plan 2017) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. This proposal delivers priority research components of the CSP seabird plan 2017 involving spotted shags. Supporting rationale for all the components is summarised in the CSP seabird plan 2017.

The current taxonomy of many shag species in New Zealand is under review and it was identified that a taxonomic review of spotted shags was required, this is now being progressed externally to CSP. It is thought the northern spotted shag populations (now confined to the inner Hauraki Gulf) differ from the spotted shag populations breeding from the Cook Strait south (Szabo 2017). The northern population of spotted shags has contracted in range to one or two breeding sites in recent years. Previously the birds bred across multiple sites including both east and west coast colonies in northern New Zealand.

Project status

Funds for this research were no longer required and were reallocated to another high priority, at-risk shag species.

Project logistics summary statement

This project was 100% Crown funded. The planned cost for the project was $10,000 over one year.

4. Mitigation Projects

4.1 MIT2017-01 Protected species liaison project

Overall objectives

1. To provide Liaison Officers to the relevant inshore and surface longline fishing fleets, to assist those fleets to reduce their protected species bycatch.
2. To coordinate the Liaison Officer roles with wider efforts targeted at protected species bycatch reduction in relevant fisheries to achieve the greatest reduction in bycatch possible.

Specific Objectives

Objective	Fishery	Area
1	Surface Longline	A – Northern North Island
		B – West Coast South Island
2	Bottom longline	A – Northern North Island
3	Inshore Trawl	A – East Coast South Island
		B – Northern North Island
		C – West Coast South Island
4	Setnet	A – East Coast South Island
		B – South Coast South Island

Rationale

To effectively reduce the risk of interactions with protected species it is important for vessels to take the latest developments in mitigation technology and be able to adapt them to their specific operations. Translating the latest scientific research and fishing regulations into operational parameters is not always a straightforward process. To achieve a meaningful reduction of risk to a species it is necessary for there to be consistency in the application of mitigation measures across all fleets interacting with the species. Protected species Liaison Officers have formed a vital interface between skippers, government, and researchers. Other projects and processes are also underway, which aim to reduce protected species bycatch, including the work of collaborative groups involving industry and eNGOs, and processes driven by the Ministry for Primary Industries. Coordinating Liaison Officers with these other processes allows this project to maximise synergies.

Over the past four years, Liaison Officers have been iteratively rolled out across a series of inshore and HMS fisheries, prioritised based on risk. In the past, this roll out has focused on seabird interaction, however with increased embedding of this programme it is now appropriate to expand to other protected species interactions, namely marine mammal, turtle, protected fish and benthos interactions. The scope of this project also expands to include a wider range of inshore fishing methods.

The process to date has involved development and documentation of vessel-specific mitigation practices in Protected Species Risk Management Plans, implementation of these plans into vessel practice, review by government fisheries observers, and subsequent review and improvement by Liaison Officers where relevant. Currently there are a series of parallel and complimentary processes in place tasked with embedding operational procedures into inshore fishing activities. A coordination

role as part of this project will be critical to aligning these approaches to ensure that maximum value will be gained.

The liaison role will include issuing mitigation gear to vessel operators as well as an education component. Conservation Management Measure CMM2008-03 requires Western Central Pacific Fisheries Commission (WCPFC) Members to adopt the United Nations Food and Agriculture Organisation (FAO) Guidelines to Reduce Sea Turtle Mortality where appropriate.

Project status

Complete.

Summary of the methods and key findings

There are currently three Liaison Officers throughout the country with arrangements for a fourth officer to cover the south and southeast portion of the South Island. There has been a steady increase in PSRMPs since the programme first began. The 2017-18 year was largely focused on surface longline (SLL) and bottom longline (BLL) vessels, while the aim for 2018-19 was to expand to trawlers and set net vessels. There have also been opportunistic PSRMPs in dredging, jig and Danish seine fishing methods. By the end of the 2017-18 fishing year, the Liaison Programme covered 90 vessels with PSRMPs, and by the end of the 2018-19 fishing year, coverage increased to 196 vessels.

Over the last year the programme has put a large focus on tidying up historical information and procedures. Data collected has been converted from free text to more quantifiable reporting metrics, which has helped identify areas for improvement as well as enable easier and more streamlined reporting. Additionally, a lot of time has gone into investigating and developing the current list of active fishing vessels applicable to the Liaison Programme. The current database has made great improvements, but still has its limitations and undergoes refinement regularly. Additionally, note that previous annual reports were aligned with the financial year, while this final report is aligned with the fishing year. This is to maintain consistency for NPOA-Seabirds reporting.

In the 2018/19 financial year, 54 PSRMPs were reviewed and updated from previous versions (21 surface longline, 24 bottom longline and 9 trawl), and new plans were developed for 72 vessels (5 surface longline, 4 bottom longline, 58 trawl, 2 set net, 1 Danish seine, 1 dredge and 1 jig). Plans covered both regulatory measures and voluntary approaches to protected species bycatch reduction. In 2018/19, seven observer audit forms were received by the liaison coordinator. These audits were completed during observer placements on surface longline vessels. In one case, the audit information showed conformance with the vessel's PSRMP. In two cases, non-conformance was recorded but practice differed in a positive direction, to further reduce bycatch risk (e.g. heavier snood weights). Five vessels were reported not conforming with PSRMP fish waste discharge practices.

In the 2019/20 fishing year, 114 PSRMPs were reviewed (29 surface longline, 39 bottom longline, 43 trawl and 3 set net). An additional 25 new PSRMPs (2 surface longline, 9 bottom longline, 10 trawl, 2 set net and 2 Danish seine) have been developed. Engagement with set net and trawl fishing in some areas was delayed due to the progression of the Hector's and Māui dolphins Threat Management Plan (TMP) and replacement of the Southland Liaison Officer.

Liaison Officers conducted a series of port calls visiting vessels and sharing information with vessel operators, skippers and crew. They also provided information relevant to protected species, bycatch mitigation, and mitigation materials. Liaison Officers gave advice from shore in response to some

bycatch events, when notified that vessels had reached specified bycatch triggers at sea. Triggers were developed as a risk management tool, to prompt vessel operators to evaluate their mitigation strategies and seek Liaison Officers' input to work on reducing future capture risks. In 2018/19, 16 trigger events were reported from surface longline, 8 from bottom longline, and 2 from trawl vessels. In 2019/20, 39 trigger events from 16 different vessels were reported. These largely comprised SLL and BLL methods and were mostly in relation to black petrels and flesh-footed shearwater interactions. Liaison Officers responded to triggers by working with operators to identify and address bycatch risks to reduce the likelihood of future captures when possible. The majority of suggested changes have been in relation to the quality and functionality of the tori line; however, they have also included adding additional weighting to the line, shifting to night-setting, and changing fishing locations.

A coordinator supported Liaison Officer activities, communicated with Programme participants and stakeholders and provided whole-of-programme reporting throughout the project term.

Recommendations

The efficacy of the liaison programme depends on fishers and Liaison Officers connecting, and the implementation of bycatch mitigation practices being monitored at sea. Both of these components are essential for the programme to deliver the best return on investment, that is, reducing the risk of protected species bycatch at sea.

This year, we have updated Protected Species Risk Management Plan (PSRMP) templates to align with the Mitigation Standards released with the NPOA- Seabirds (2020). It is recommended that Checklists are filled out alongside new and updated PSRMPs so that we can identify where and why there may be gaps in adopting 'best-practice' measures described in the Mitigation Standards.

PSRMP Observer Audit forms need to be updated in order to align with changing legislation and ensure consistent data collection and accurate feedback to operators regarding their protected species bycatch mitigation practices. Improvements to these forms will also assist with relevant annual reporting for the NPOA- Seabirds.

Furthermore, there is the need to increase Liaison Officer capacity. The Protected Species Liaison Programme is particularly interested in engaging with harbour set netters, and with the newly developed purse seine Operational Procedures finalised, we anticipate incorporating purse seiners in the future as well.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $140,000 per annum over three years. Services provided by JPEC and DOC staff.

Review milestones

- Final results for 2017/18 presented at the CSP TWG meeting on the 9 Oct 2018
- Final report for 2017/18 published on the CSP website in November 2018
- Final results for 2018/19 presented at the CSP TWG meeting on 7 Nov 2019
- Final report for 2018/19 published on the CSP website on 22 November 2019
- Progress report for 2019/20 published on the CSP website on 8 June 2020

Citation

Pierre, J. 2018. Protected species liaison coordination 2017/18. Final report for CSP project MIT2017-01. Prepared by JPEC Environmental Consulting for the Department of Conservation, Wellington. 36 p.

Pierre, J. 2019. Protected species liaison coordination 2018/19. Final report for CSP project MIT2017-01. Prepared by JPEC Environmental Consulting for the Department of Conservation, Wellington. 63 p.

Plencner, T. 2020. Liaison programme progress report 2019/20. Prepared by the Department of Conservation. 12 p.

Weblink

https://www.doc.govt.nz/contentassets/4d83b3260a4d43d5afe98dcf193b90b5/mit2017-01-ps-coordination-final-report.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/mit2017-01-ps-ccordination-final-report.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/mit-2017-01-liaison-project-project-update2.pdf

4.2 MIT2018-02 Haul mitigation for small longline vessels

Project Objectives

1. To develop effective and practical options to mitigate the capture of seabirds on haul in small vessel longline fisheries.

Rationale

Historically most research and development of resources has been invested in line setting mitigation methods, however, a significant portion of interactions, between longline vessels and seabirds occur at hauling. While many of these interactions result in live releases, injuries are often sustained, and the long-term fate of the animals is unclear. Additionally, dehooking and untangling seabirds poses a health and safety risk to crew as well as unnecessary delays to fishing operations. Therefore, it is mutually beneficial to invest in strategies which effectively mitigate against interactions at hauling.

Project status

In progress.

Project logistics summary statement

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

4.3 MIT2018-03 Setting mitigation for small longline vessels

Project Objectives

1. To test one or more existing devices for setting baited hooks at depth in order to assess efficacy in New Zealand conditions.

Rationale

The small vessel surface longline fishery poses substantial risk to most high- and very high-risk seabirds (see Table 7 of the CSP seabird plan 2017). Despite current mitigation requirements and use, implementation of proven mitigation strategies is known to be variable both within and between these fleets.

Ensuring that baited hooks are unavailable to seabirds depends largely upon their sink rate, this is primarily influenced by the amount of weight and floatation on the line, variables which also have effects on target catch and fishing operation. Several devices have been developed to mechanically force the line or hooks to a preset depth immediately aft of the vessel. Significant research and development have been undertaken on these devices, however, to date none have reached the commercial application stage.

To provide robust advice on best practice to fishers it is important that new or adapted mitigation options are backed up with adequate testing of efficacy across a range of New Zealand conditions and fishing operational variables.

Project status

In progress.

Project logistics summary statement

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

4.4 MIT2018-04 Options for temporal and spatial management of key fisheries to reduce risk of interactions with protected species

Project Objectives

1. Designing options for quantitatively assessable spatial and temporal management of key fisheries using available fisheries, environmental, and biological data;
2. Provide recommendations on key data gaps which limit the ability to measure the effectiveness of potential options.

Rationale

Significant research has gone into mitigation methods for fisheries interactions with protected species. However, in some cases, such as set-netting interactions with seabirds, no proven mitigation methods have been identified outside of spatial/temporal restrictions. Due to the inherent trade-offs with such restrictions it is critical that decisions are underpinned with best available information and transparent robust process.

Using, as an example, penguin and other seabird interactions with setnet fisheries this project will draw together empirical evidence and expert advice to provide a range of options for spatial and temporal management considering their associated costs and benefits.

Project status

Cancelled - funds returned to industry.

Project logistics summary statement

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

4.5 MIT2019-01 Dolphin dissuasive device mitigation in inshore fisheries

Project Objectives

1. To develop a methodology for the assessment of a dolphin dissuasive device in inshore fisheries.
2. To provide recommendations on further research.

Rationale

Dolphin Dissuasive Devices (DDD) are thought to limit interactions between dolphins and fishing nets by emitting high frequency ultrasound signals. Signals can be modulated (in length and width) to limit the potential of dolphins adapting to the signal. DDDs are currently used in the deepwater jack mackerel fishery (two units deployed either on bridles facing backwards over the net or placed on the headline getting coverage immediately in front of the trawl mouth). Currently there is anecdotal evidence that shows that these devices may be effective but little quantitative research to support this.

Project status

Complete.

Summary of the methods and key findings

Dolphin Acoustic Deterrent Devices (ADD; also commonly referred to as pingers) are thought to persuade marine animals to avoid the noise source. While there is little quantitative data or empirical evidence from New Zealand research as to the efficacy of ADDs, there is anecdotal information that they may be effective in reducing dolphin bycatch in set net fisheries. In New Zealand, ADDs are being used by some fishers in the deep-water jack mackerel trawl fishery and also in some inshore set net fisheries, targeting a range of different fish species, but their efficacy in these various settings has not been formally tested. However, there is some international evidence for their success in overseas fisheries. This project reviewed the use of ADDs internationally and provides recommendations for a potential experimental trial of these devices in NZ inshore commercial fisheries.

The main conclusions drawn from the ADD literature as it relates to Hector's and Māui dolphin bycatch mitigation are:

- While success rates across marine mammal species have been variable, there have been significant examples of large reductions in bycatch through the use of ADDs
- Limited ADD trials with Hector's and Māui dolphins in New Zealand have produced ambiguous results, but provide some indication that Hector's dolphins display avoidance behaviour around active ADDs
- ADDs appear most successful for cetaceans that are neophobic (i.e. fear of anything new), are easily startled, and have large home-ranges. They are, therefore, more likely to be effective for phocoenids (i.e. porpoises) than coastal delphinids such as Hector's and Māui dolphins which are boat-positive and unlikely to be strongly neophobic. As such, ADDs may be a less effective mitigation method for Hector's and Māui dolphins but this requires testing to confirm. Assessment of ADD efficacy will not be possible to assess without well designed, repeatable field trials
- Prior to undertaking field trials, the ADD effectiveness must be evaluated against several key considerations:
    - What reductions in bycatch are achievable?

    - Are any reductions likely to meet management goals?
    - What sample sizes would be necessary in order to yield sufficient statistical power to quantify effectiveness?
- If ADDs are implemented, assessment of long-term effectiveness would require dedicated enforcement and compliance monitoring regimes as well as high levels of observer coverage
- The focus of this review has been on mitigating impacts from commercial inshore fisheries; however, any effective mitigation option should also be applied to recreational fisheries wherever possible.

Recommendations

There is evidence to support the trial of ADDs as a mitigation tool to reduce bycatch of Hector's and Māui dolphin in NZ inshore fisheries. Therefore, it is recommended that a staged approach to research is undertaken and that initial trials that pose no risk to dolphins should be undertaken. Results from initial trials will provide critical data needed to evaluate the potential of progressing research to a pilot scale field study.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $20,000 over one year.

Review milestones

- Final results presented at the CSP TWG meeting on the 4 June 2020
- Final report published on the CSP website in July 2020

Citation

Childerhouse, S., Johnson, O. and Tremblay-Boyer, L. 2020. Review of dolphin acoustic deterrent device mitigation in inshore fisheries. Prepared for the Conservation Services Programme, Department of Conservation. Cawthron Report No. 3507. 34 p + appendices.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/mit2019-01-review-of-dolphin-acoustic-deterrant-device-mitigation-final-report.pdf

4.6 MIT2019-02 Review of mitigation techniques to reduce benthic impacts of trawling

Project Objectives

To review modified trawl fishing gear applicable to the New Zealand inshore trawl fleet**.**

Rationale

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

Project status

Complete.

Summary of the methods and key findings

Around the world there have been numerous attempts by fishing technologists, fishers, and others to mitigate the benthic impacts of bottom trawling through gear modification. Most of these efforts have focused on eliminating seabed contact, and thus avoiding habitat impact by lifting trawl components into the water column, including the use of semi-pelagic trawl doors, elevated sweeps and bridles, and groundrope removal. Other efforts that have attempted to minimise or reduce seabed contact include increasing upper bridle length to lighten groundrope contact and increasing the diameter (surface area) of sweeps and lower bridles to reduce impact per unit area. These efforts have been tried in many fisheries, although efficacy is questionable because fishers cannot precisely control and regulate trawl contact with the seabed. Subsequently, quantifying the efficacy of these modifications is extremely difficult, and no reports were found in the literature describing the success of these modifications.

This review involved describing remedial efforts through trawl gear modification and discussing their potential application by the New Zealand bottom trawl fleet, including relative impact on seabed contact (footprint), fisher profitability, and handling and operation of the trawl. Not all methods described to reduce seabed contact are expected to be equally applicable across all New Zealand bottom trawl fisheries. Some may be better suited to inshore fisheries than deepwater fisheries. Several may also not be applicable at all, but their inclusion serves to stimulate ideas that may ultimately result in the development of new methods to reduce seabed contact by bottom trawl gear in New Zealand fisheries.

Recommendations

It is recommended that consideration be given to prioritising the testing of semi-pelagic trawl doors and cluster discs attached to sweeps and lower bridles, particularly in the inshore bottom trawl fishery. Each of these modifications has the potential to significantly reduce seabed contact, and efforts

overseas to test these gears have shown encouraging results, despite presenting minor handling challenges. Semi-pelagic trawl doors are relatively more expensive than bottom-tending doors, but reduced fuel consumption, and a short amortisation (pay-back) period, makes them an attractive option to fishers. Their impact on target catch is negligible when operated correctly, and they can be used on bottom trawlers of all size ranges and engine power. The use of cluster discs is a relatively inexpensive option to mitigate seabed contact, and their immediacy of application is high. The possibility of catch loss underneath the sweep is a risk, however, particularly in fisheries that target flatfish or other species close to the seabed. Bottom trawlers of all sizes and engine power can conceivably apply this gear modification with success.

Other possible options to mitigate seabed contact include controllable trawl doors, trawls rigged with a raised footrope and drop chains, and semi-pelagic trawls. Controllable trawl doors provide benefits similar to semi-pelagic trawl doors, with the addition of control over their position in the water column. The expense of these doors, however, likely precludes their attractiveness to smaller fishing enterprises. It is also unclear if they can be operated whilst attached to a bottom trawl, as most efforts to date indicate use attached to a midwater trawl. Depending on the target species, raised footrope trawls and semi-pelagic trawls may not be a viable option due to catch loss underneath the trawl net.

As next steps, we also recommend seeking feedback from the New Zealand bottom trawl industry on the potential for gear modification, impact reduction, and improved operational efficiencies. Also, a review of the 2020 Fisheries NZ and NIWA audit of New Zealand trawl gear, and collaboration with the seafood sector to establish agreed principles and objectives associated with protecting benthic habitats.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $20,000 over one year. Services were provided by Terra Moana Ltd.

Review milestones

- Final results presented at the CSP TWG meeting on the 15 May 2020
- Final report published on the CSP website in July 2020

Citation

Eayrs, S., Craig, T. and Short, K. 2020. Review of mitigation techniques to reduce benthic impacts of trawling. MIT2019-02 final report prepared by Terra Moana Limited for the Conservation Services Programme, Department of Conservation. 135 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/mit2019-02-mitigation-techniques-to-reduce-benthic-impacts-of-trawling-final-report.pdf

4.7 MIT2019-03 Lighting adjustments to mitigate against deck strikes/ vessel impacts

Project Objectives

To investigate if lighting adjustments (colour and strength) have the potential of reducing the occurrence of vessel impacts in commercial fishing.

Rationale

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

Project status

In progress.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $20,000 over year one and $40,000 in year two.

4.8 MIT2019-04 Optimum batching interval for discharge management on vessels in the scampi fishery

Project Objectives

To investigate offside batching intervals of discharge in reducing seabird interactions around fishing vessels.

Rationale

Batching intervals are currently utilised as a discharge management measure across commercial fisheries, yet limited data is collected on this practise (e.g. no data on time between discharge outfalls). Following recommendations from MIT2017-02, this project aims to investigate varied batching intervals with the objective of determining if an 'optimum' batching discharge interval exists in reducing seabird activity around working fishing vessels and seabird interactions with fishing gear or the vessel. Batching may be beneficial in disrupting the flow of attractant for seabirds to fishing vessels; therefore, reducing abundance and potential capture during haul and the subsequent set of fishing gear. The key aspects of batching discharge involve: a holding period of fish waste, offal or returned baits (for a minimum of 30 minutes) and swift discharge (five minutes or less) as opposed to continuous discharge (Pierre et al. 2012; Kuepfur and Pompert 2017).

The scampi fishery is a bottom trawl fishery conducted by a small number of vessels <32 metres in length. Vessels typically conduct 2-3 long, slow speed tows per day. The fishery is characterised by a relatively high proportion of non-target bycatch (due to the small mesh size of trawl nets) which is currently discharged at sea. On-board fish waste management equipment differs across vessels, though may consist of holding/storage tanks for bycatch that can be periodically discharged via a chute, other vessels store fish bycatch in bins prior to discharge.

Project status

Complete.

Summary of the methods and key findings

Batch discharge of fish waste is used as a seabird bycatch mitigation tool in fisheries, including the New Zealand scampi trawl fisheries. Fish waste is accumulated aboard the vessel, and then discharged as rapidly as possible. Batching aims to reduce seabirds feeding around fishing vessels, thereby reducing the risk of fatal seabird interactions with fishing gear. Following experimental studies in New Zealand and overseas, batching is considered a best-practice mitigation strategy in guidelines from the Agreement on the Conservation of Albatrosses and Petrels (ACAP). For this strategy, ACAP recommends a minimum interval of two hours between batches. The Deepwater Group's Operational Guidelines for New Zealand scampi fisheries specify a shorter minimum interval of 30 minutes between batches but have a particular focus on avoiding discharges around setting or hauling of the net. Most seabird captures in scampi fisheries are net captures.

This project reviewed existing observer data with the aim of determining if an 'optimum' batch discharge interval could be identified. Scampi fishing occurs in five key regional fisheries in New Zealand, using target bottom trawling. Like other crustacean trawl fisheries around the world, bycatch in the scampi fishery is high. Statutory data from the Ministry for Primary Industries' electronic reporting regime, introduced gradually from 2018, allows a characterisation of the retained and

discarded catch by the different regional scampi fisheries. The SCI 3 fishery on the western Chatham Rise has the highest rates of bycatch fish discards and the greatest proportion of catch retained in processed form. Numbers of seabirds observed around scampi fishing vessels are consistent between regions, although the composition of the seabird assemblage does vary regionally. Seabird captures have, however, varied with the highest estimates in the Chatham Rise and subantarctic scampi fisheries.

Routine data collection by fisheries observers currently only provides qualitative, trip-level information on vessel batching practices and is primarily focused on assessing vessels' adherence to their Vessel Management Plans. The limited resolution of data on batching precludes a detailed investigation into the effects of variation in batch interval and batch discharge times on either seabird attendance or seabird captures. If fisheries managers require a more detailed understanding of how variation in batching parameters affects seabird attendance around scampi vessels, we suggest that an experimental approach would be more efficient than increasing the detail of observational data collection. Experimentation allows the covariates of interest to be modified while other covariates are held constant. In contrast, analyses of observational data have to address between-vessel variation in addition to temporal and spatial variation and may detect little variation in batching practice.

In future, simple image-based data collection technologies could be developed to provide information on both batching practice and seabird attendance in place of intensive data collection by observers.

Recommendations

- For a more detailed understanding of the effect of batching parameters (i.e., time between discharges, discharge duration etc.) on seabird attendance at vessels, an experimental approach should be pursued.
- To better characterise batching practices, vessel operators should be consulted about keeping logs of discharge times and volumes.
- Development of simple, image-based data collection technologies should be considered to provide information on both batching practice and seabird attendance in place of intensive data collection by observers.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $20,000 over one year. Services were provided by Pisces Research.

Review milestones

- Final results presented at the CSP TWG meeting on the 3 September 2020
- Final report published on the CSP website in October 2020

Citation

Middleton, D and Abraham, E. 2020. Assessing management of fish waste discharge in the scampi fishery. Final report for MIT2019-04 prepared by Pisces Research Ltd for the Conservation Services Programme, Department of Conservation. 36 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/final-reports/mit2019-04-scampi-batching-final-report.pdf

Appendix

Biodiversity 2018 Projects

BCBC2018-01: Development of underwater line setters for use in bottom longline fisheries

Drone-based Salvin's albatross population assessment at the Bounty Islands

BCBC2019-03: Seabird population research, Campbell Island 2019-20

BCBC2019-05: Indirect effects of commercial fishing in the Marlborough Sounds on the foraging of king shag

BCBC2019-07c: Stakeholder engagement in assessment of recreational fisheries bycatch of marine protected species