

Conservation Services Programme Annual Research Summary 2013-14

Katie Clemens-Seely
Conservation Services Programme
Department of Conservation
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1. Introduction

1.1 Purpose

This report outlines the research carried out through the 2013/14 Conservation Services Annual Plan, and provides updates on multi-year projects started in previous years.

1.2 Background

The Conservation Services Programme (CSP), part of the Department of Conservation (DOC), originated in 1995 after an amendment to the Fisheries Act 1983 allowed for a Conservation Services Levy to be charged to the fishing industry, to recover the costs of research related to the impact of commercial fishing operations on marine protected species in New Zealand waters, and the development of ways to mitigate bycatch. The Minister of Conservation can also require the production of population management plans, which can include the setting of maximum-allowable levels of fishing-related mortality for threatened species.

1.3. CSP Vision and Objectives

The CSP vision is that:

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

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

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

Detailed outcome-based objectives for CSP are provided in the Conservation Services Programme Strategic Statement 2013¹.

1.4 Development of the Annual Plan

The Conservation Services Programme Annual Plan 2013/14² describes the conservation services to be delivered as the Conservation Services Programme (CSP), and subject to cost recovery from the commercial fishing industry. As such, this Annual Plan forms 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 2014. In the development of this Annual Plan a series of discussions were held with Ministry for Primary Industries (MPI) staff to harmonize the CSP and MPI research programmes for 2013/14 and to ensure there was no duplication. A formal consultation process was also used as described on the next page.

¹ Available to download from <http://www.doc.govt.nz/csp-strategic-statement-2013>

² Available to download from <http://www.doc.govt.nz/conservation/marine-and-coastal/conservation-services-programme/csp-plans/csp-annual-plan-2013-14/>

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 2013/14 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 2013/14. This process was developed jointly by the CSP team at the DOC and the Inshore Fisheries team at MPI in consultation with the Seafood Industry Council and the Federation of Commercial Fishermen.

Deepwater observer coverage was developed jointly by the CSP team at DOC and the deepwater fisheries team at MPI.

The public consultation process on the entire plan was as follows:

20 March 2013	Initial CSP research proposals for 2013/14 circulated to stakeholders
22 March 2013	Joint CSP-MPI presentation of initial research proposals to stakeholders
5 April 2013	Close of comments on initial CSP research proposals
17 April 2013	Draft Conservation Services Programme Annual Plan 2013/14 released for public consultation
29 May 2013	Public consultation period closes
14 June 2013	Summary of public submissions and response to comments completed
Mid-June 2013	Director-General of Conservation conveys the Conservation Services Programme Annual Plan 2013/14 as amended in accordance with public comments to the Minister of Conservation

1.6 Explanation of reporting 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 agency that provided the services, the project budget (excluding administration costs), identification of the relevant provisions within the Fisheries (Cost Recovery) Rules 2001 that determine cost allocation and review milestones. Finally, a citation and weblink are provided to enable ease of access to the final research reports.

Conservation Services Programme activities in 2013/14 were divided into three main areas:

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

2. Interaction Projects

2.1 INT2013-01 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 other relevant information on protected species interactions that will assist in assessing, developing and improving mitigation measures.

Rationale

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

The CSP Observer Programme will continue to purchase baseline services for “offshore” fisheries from MPI Observer Services, given the scale of their operation, which allows observers to be placed strategically across New Zealand Fisheries. Where data collection involves using techniques beyond observation and recording, providers with specific expertise and/or equipment will be considered. For the purposes of providing costings, the rate provided by MPI Observer Services has been used. As such, for the purposes of planning, costings for observer coverage are based on those provided by the MPI Observer Services to provide a best estimate.

Project status

Completed.

Summary of the methods and key findings

One of the tools to gain a better understanding of the nature and extent of interactions between commercial fisheries and protected species is the placement of Government observers onboard commercial fishing vessels operating within the New Zealand Exclusive Economic Zone (EEZ). The observers collect both quantitative and qualitative information on interactions, both of which can and have been used to identify key areas of importance. The observations can also help in the development and assessment of mitigation strategies aimed at reducing the impact of commercial fisheries on protected species.

Observer coverage is, where possible, planned jointly with the Ministry for Primary Industries to ensure that coverage objectives are aligned. For the purposes of planning observer coverage, fisheries are divided into two broad categories: firstly, those fisheries that are poorly known and generally characterised by small vessel, owner operated fleets operating in the inshore, the second; better understood deepwater fisheries which have been subject to long-term monitoring.

While the majority of the 'poorly understood' fisheries operate in the inshore area (i.e. to around 200 m depth), some small vessels, particularly bottom longline vessels under 36 m, will operate in deeper waters such as the Chatham Rise. Details of the approach used to set days in these fisheries are described in the Joint Department of Conservation/Ministry of Fisheries Inshore Observer Programme 2011/12 plan. In general, coverage in these fisheries was aimed at reducing uncertainty around the risk to particular protected species identified in both the level 1 and level 2 risk assessments and assessing mitigation options for interactions identified.

For better observed fisheries long-term datasets exist which allow for ongoing monitoring to detect whether changes are occurring in the nature and extent of captures. In these offshore fisheries where higher levels of coverage are already undertaken CSP purchases a portion of existing observer time to allow data collection to be spread strategically over the fishing fleet.

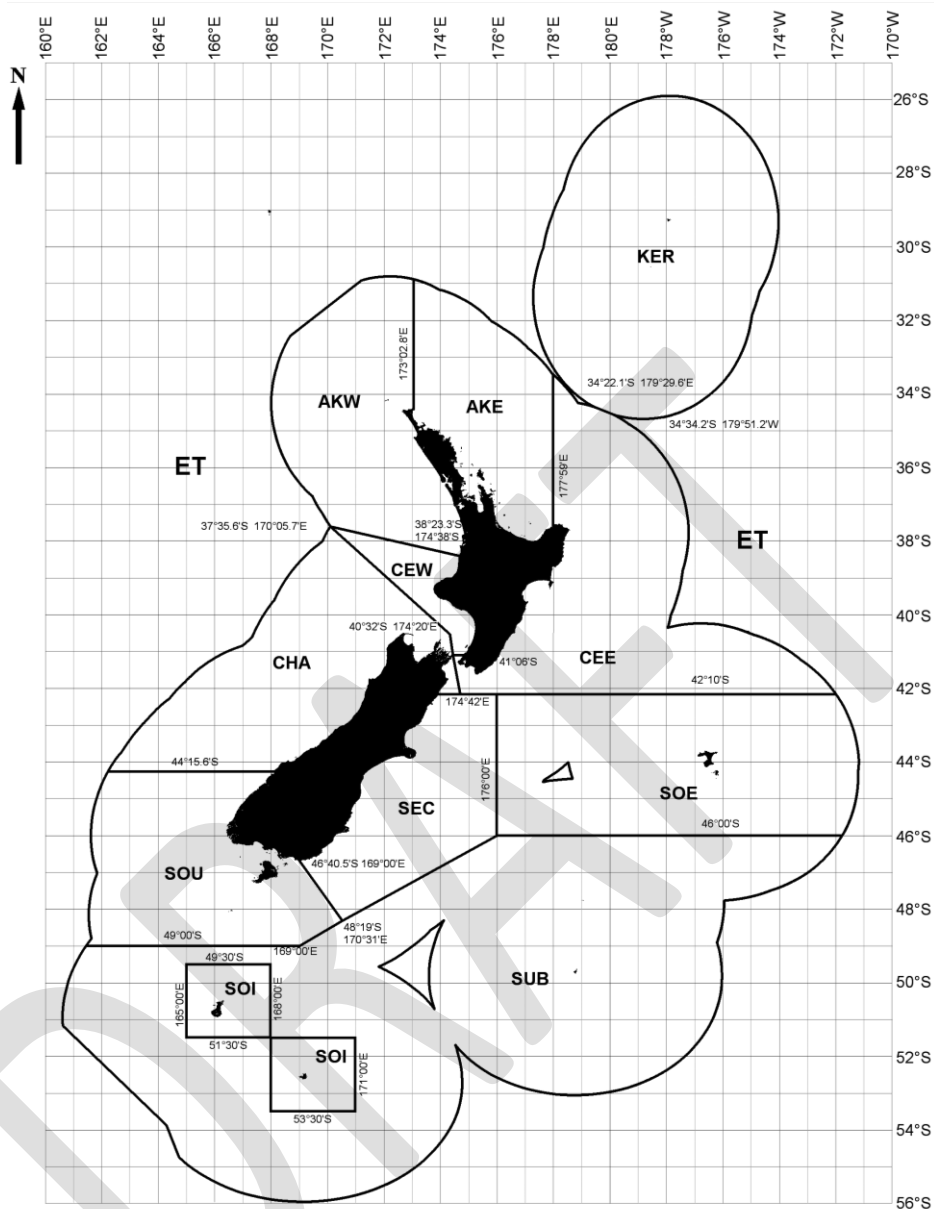
The observer coverage presented in this report extends work conducted in previous years.

The remainder of this document is divided into separate 'fisheries' where certain target species are grouped according to fishing method. For each 'fishery' an overall summary of commercial effort, observer effort and protected species bycatch is provided by Fisheries Management Area (Figure 1). Protected species interactions are then broken down by fate of the animal (live or dead) and method of interaction.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$1,021,140. Services were provided by the Ministry for Primary Industries Observer Services.

Figure 1: New Zealand Fisheries Management Areas (source: Ministry of Fisheries)



Key:

AKE	FMA 1	East North Island from North Cape to Bay of Plenty
CEE	FMA 2	East North Island from south of Bay of Plenty to Wellington
SEC	FMA 3	East coast South Island from Pegasus Bay to Catlins
SOE	FMA 4	Chatham Rise
SOU	FMA 5	South Island from Foveaux Strait to Fiordland
SUB	FMA 6	Subantarctic including Bounty Island and Pukaki Rise
SOI	FMA6A	Southern offshore islands – Auckland and Campbell Islands
CHA	FMA 7	West Coast South Island to Fiordland including Kaikoura
CEW	FMA 8	West North Island from South Taranaki Bight to Wellington
AKW	FMA 9	West North Island from North Cape to North Taranaki Bight
KER	FMA 10	Kermadec
ET		Outside NZ EEZ

2.2 INT2013-02 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 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 commercial fishing waters. Birds with significant differences in conservation status can appear morphologically similar. The accurate determination of the taxon of seabirds captured in New Zealand fisheries is vital for examining the potential threat to population viability posed by incidental fisheries captures. Observers on commercial vessels are not always able to identify seabirds at sea with high precision and the assessment of the age-class, sex and provenance of captured individuals requires autopsy in the majority of 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 lower cost than returning carcasses and performing necropsy. In order to maximise cost efficiencies, and in recognition of increased observer coverage levels in the offshore Foreign Charter Vessel fleet, 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).

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

Information gained through this project will link to Ministry for Primary Industries databases, seabird bycatch estimates, and will inform ongoing risk assessment, research and modelling of the effects of fisheries bycatch on seabird populations. Further, the mode of capture and associated information will enable robust analyses to be made of the factors contributing to seabird capture events and inform the development of appropriate mitigation strategies.

Project status

Due for completion in June 2016.

Summary of the methods and key findings

This summarises identification work completed on dead birds caught and returned and/or using photographs from 1 July 2013 to 31 March 2014. A total of 239 seabirds (comprising of 19 taxa) were returned from 32 vessels between 1 July 2013 and 31 March 2014. Seabirds returned to date were dominated by five species (white-chinned petrel *Procellaria aequinoctialis* (n = 77, 32.2%), Salvin's albatross *Thalassarche salvini* (n = 47, 19.7%), NZ white-capped albatross *Thalassarche steadi* (n = 40, 16.7%), sooty shearwater *Puffinus griseus* (n = 32, 13.4%) and Buller's albatross *Thalassarche bulleri bulleri* (n = 11, 4.6%)). These five species accounted for 86.6% of all returns to date. The remaining 14 taxa had either captures of between two and nine individuals or single captures. Due to the length of some fishing trips and subsequent transport it is possible some birds captured in this period may not have been received at the time of writing the quarterly report. Any further specimens received will be reported at a later date in the final report.

Examination of photographs from Ministry of Primary Industries observers gave a total of 57 birds that were reported captured or photographed as bird interactions with fishing vessels (and may include some non-capture interactions) for this period. A total of 19 seabirds were photographed and another 36 interactions were recorded by observers for the period 1 July 2013 to 31 March 2014. Of these records, 46 were of live bird interactions and 11 birds were dead. Complete examination of these photographs could not be compared with the full (1 July 2013 to 31 March 2014) Ministry of Primary Industries Central Observer Database ("COD") extract information as WMIL received an extract with data missing for January and March 2014.

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. Services were provided by Wildlife Management International Ltd.

Review milestones:

- Presentation of yearly results at the CSP TWG meeting on 20 May 2014;
- Presentation of yearly results at the CSP TWG meeting on 4 May 2015.

Citations

Bell, E. 2015. Identification of seabirds captured in New Zealand fisheries: 1 July 2013 – 30 June 2014. Report prepared by Wildlife Management International for the New Zealand Department of Conservation, Wellington, 43p.

Weblink

[http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/bell-int2013-02-final-report-\(1-july-2013-to-30-june-2014\).pdf](http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/bell-int2013-02-final-report-(1-july-2013-to-30-june-2014).pdf)

2.3 INT2013-03 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 Ministry for Primary Industry 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 is a new project and is designed to complement the existing seabird identification project. Observers routinely collect samples of genetic material from these taxa, and these can be used to resolve uncertain identification determinations from photographs.

Project status

Completed.

Summary of the methods and key findings

New Zealand fur seals *Arctocephalus forsteri* make up the majority of the by-catch with 103 animals (verified and unverified combined) representing 64.8% of all by-catch. The short-beaked common dolphin *Delphinus delphis* was the next largest group (29 animals, 18.2% of total), followed by the New Zealand sea lion *Phocarctos hookeri* (24 animals, 15.1% of total). The other species represented are the Dusky dolphin *Lagenorhynchus obscurus*, Hector's dolphin *Cephalorhynchus hectori* and one unidentifiable pinniped (but either NZ fur seal or NZ sea lion), represented by one animal each and 0.6% of total catch.

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. Services were provided by Anton van Helden Marine Mammal Consultant.

2.4 INT2013-04 Optimisation of observer data collection protocols

Overall objective

To review the data collected by fisheries observers in relation to understanding the interaction with protected species, and refine efficient protocols for future data collection.

Specific objectives

1. To examine the information historically collected by observers on factors relevant to protected species interactions.
2. To provide recommendations on refinement or development of data collection protocols to allow for more informative and efficient data collection.

Rationale

The data collected by observers are used primarily to inform fisheries management, risk assessment and mitigation development. Historically, much of this information was in the form of ad-hoc observations and diary comments, with various protocol improvements over time (e.g. development of standardised CSP Protected Species Abundance Form). As our understanding of protected species interactions has developed, so has our understanding of the factors which influence these interactions. Therefore it is timely and appropriate to have a reassessment, from a protected species perspective, of the data collected by observers. This will identify the most useful observations and where necessary refine and standardise the protocols and recording factors. The work will allow for more efficient use of observer time and more timely analysis of data returned. With refinement of CSP objectives currently underway as part of the development of a new CSP Strategic Statement, this project will ensure observer data collection protocols will be fully aligned to the new objectives going forward.

Project status

Completed.

Summary of the methods and key findings

The deployment of independent fisheries observers is widely recognised as a key component of best practice fisheries management. In New Zealand, observers have been a critical component of the commercial fisheries management regime since the mid-1990s. The data collection approaches and protocols used by observers in New Zealand fisheries have generally become more detailed over time, as well as covering a greater number and diversity of protected species groups and fishing gears.

Here, we review the strategic framework that generates information needs that may be addressed by fisheries observers and evaluate current observer data collection protocols in that context. The review covers international and national agreements, legislation, policies, management plans, and international approaches to observer data collection, as well as manuals, briefing notes, protocols, and forms used by observers in New Zealand fisheries. Broadly, the strategic documents reviewed focused on the achievement of sustainability in environmental management and/or the

conservation of biological diversity. Information needs that creates for New Zealand in relation to commercial fisheries encompass the characteristics of the fishing operations, the nature and extent of protected species captures, the status of captured animals, the operational and environmental factors that may contribute to captures, and, measures in place to avoid or reduce captures. Protocols and forms currently used by observers to collect data from New Zealand fisheries partially address these information needs. Scope for improvement includes ensuring clarity and consistency in observer instructions, the addition of new fields or amendments to current fields on current data collection forms, the creation of new forms to capture additional information, and, the discontinuation of forms, fields, and metrics that are redundant or no longer useful.

Priority areas in which to improve information collection relate to longline gear and protected species bycatch mitigation, purse seine gear and protected species interactions, mitigation of seabird strikes on trawl warps, cryptic mortality of protected species interacting with commercial fisheries, and coral bycatch. However, the most significant current impediment to meeting information needs is the paucity of observer coverage achieved in some fisheries, especially smaller-vessel fisheries operating in inshore areas. Ultimately, this results in a piecemeal understanding of protected species interactions with New Zealand commercial fisheries and compromises New Zealand's ability to deliver on domestic and international obligations. Regular review of the data collection approaches observers implement, combined with ensuring effective coverage of New Zealand commercial fisheries, will maximise the current and future benefits gained from observer deployments.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$40,000. Services were provided by Dragonfly Science Ltd.

Review milestones:

- Presentation of methodology at the CSP TWG meeting on 21 November 2013;
- Presentation of draft final report at the CSP TWG meeting on 12 December 2014.

Citations

Pierre, J. P., Thompson, F. N., and Mansfield, R. 2015. Optimisation of protocols employed by New Zealand government fisheries observers for protected species data collection. Report prepared by Dragonfly Data Science for the New Zealand Department of Conservation, Wellington. 79p.

Weblink

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/reports/optimisation-of-protocols-employed-by-new-zealand-government-fisheries-observers-for-protected-species-data-collection-2015.pdf>

2.5 INT2013-05 Assessment of cryptic seabird mortality on trawl warps and longlines

Overall objective

To estimate appropriate fishery and species group specific scalars to allow the robust quantification of total mortality from standard observed levels of seabird captures.

Specific objectives

1. To estimate appropriate fishery and species group specific scalars to allow the robust quantification of total mortality from standard observed levels of seabird captures.
2. To provide recommendations on future data collection, to refine these estimates further and monitor change over time.

Rationale

Recent level-2 seabird risk assessment identified the considerable uncertainty in scalars to account for unobserved or unobservable seabird mortality, or cryptic mortality. Whilst scalars have been estimated for some fisheries, their suitability to the full range of New Zealand trawl and longline fisheries is mostly untested. This project will focus designing data collection protocols, and analysis of results, to develop scalars for the inshore trawl and bottom longline fisheries, where quantitative information on cryptic mortality is particularly sparse. It is envisaged that the CSP Observer Programme will provide a platform for the collection of at-sea information.

Project status

Completed.

Summary of the methods and key findings

Understanding the nature and extent of protected species interactions between commercial fisheries and marine protected species is an essential component of best practice fisheries management. Interactions between protected species and fishing gear may be lethal or non-lethal. Mortalities due to injuries incurred during these interactions can result in the death of protected species at the time interactions occur, or sometime afterwards.

Challenges with detecting mortalities when they occur (e.g., due to dead animals not being landed on the vessel deck) or when mortalities are delayed (e.g., due to injuries that eventually cause death) result in underestimates of the true extent of protected species bycatch. Mortalities occurring in such circumstances may be termed “cryptic”. While the potential for cryptic mortalities associated with fishing operations has been acknowledged for some time, uncertainty associated with the nature and extent of cryptic mortality limits the confidence with which current estimates of this mortality can be applied. In this project, we explore scalars of cryptic mortality appropriate to the New Zealand context, based on fishery and seabird-species groups.

We review available information to inform the exploration of these scalars, and recommend options to improve the estimation of cryptic mortality in specific species/fishery groupings. Our review shows that while some empirical information is available particularly relating to pelagic longline fisheries and trawl warp strikes, overall, the knowledge base constrains the accuracy with which cryptic mortality can be assessed. To improve the estimation of cryptic mortality of seabirds in New Zealand fisheries, the information gaps considered most important to resolve relate to bottom

longline fisheries, trawl net captures, aerial warp strikes, and subsurface attacks on longline baits. Work on this project continues.

Project logistics summary statement

This project was planned as a two year project covering the periods 01 July 2013-30 June 2014 (proposed cost \$40,000) and 1 July 2014-30 June 2015 (proposed cost \$70,000). Following feedback received during the procurement of these services, the project was restricted to a one year review project during 2014-15 to provide recommendations on potential future data collection. The implemented project was funded jointly by CSP and MPI. The CSP component was 100% funded via Conservation Service Levies on the fishing industry. Services were provided by Dragonfly Science Ltd.

Review milestones:

- Presentation of draft final report at the CSP TWG meeting on 25 November 2014.

Citations

Pierre, J. P., Richard, Y., and Abraham, E. R. 2015. Assessment of cryptic seabird mortality due to trawl warps and longlines. Report prepared by Dragonfly Data Science for the New Zealand Department of Conservation, Wellington. 51p.

Weblink

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/reports/assessment-of-cryptic-seabird-mortality-due-to-trawl-warps-and-longlines-final-report.pdf>

3. Population Projects

3.1 POP2012-02 New Zealand sea lions – demographic assessment of the cause of decline at the Auckland Islands

NOTE: This multi-year project (POP2012-02) was consulted on in 2012/13.

Overall objectives

To determine the key demographic factors driving the observed population decline of New Zealand sea lions at the Auckland Islands.

Specific objectives

1. To identify which demographic parameters are the key drivers of the observed population decline of New Zealand sea lions at the Auckland Islands.
2. To identify potential demographic mechanisms through which both direct and potential indirect effects of fishing can impact on the population level of New Zealand sea lions at the Auckland Islands, or increase the susceptibility of the population to such effects.

Rationale

New Zealand sea lions are classified as Nationally Critical, 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 75% of New Zealand sea lions breed at the Auckland Islands, where population data have been collected since the mid-1990s, including estimates of pup production and resighting of marked animals. Over the last decade there has been a considerable decline in pup production at the Auckland Islands, and while disease events have occurred over this period, direct fishing bycatch is the major known anthropogenic impact on the population. In contrast, pup production appears to have increased on Campbell Island, the second major breeding location for the species. A literature review to identify potential indirect effects of commercial fishing on the Auckland Islands population as part of CSP project POP2010-01 has recently been completed. The review highlighted a number of key information gaps that currently prevent a full understanding of any such potential indirect effects.

In order to manage the commercial fisheries impacts on New Zealand sea lions at the Auckland Islands it is critical to understand the key demographic factors driving trends in the population and how fishing impacts on these parameters, or how any demographic processes influencing the population may alter its susceptibility to fishing impacts. This project aims to both identify these key parameters and identify the mechanisms through which fishing impacts are influencing these parameters and hence influencing the population trend.

Project status

Completed.

Summary of the methods and key findings

State space demographic models fitted to mark-recapture, pup census and age distribution observations were developed using NIWA's demographic modelling software SeaBird to estimate year-varying survival, probability of pupping and age-at-first-pupping.

For the Sandy Bay population, variation was observed in all demographic rate estimates when using the optimal model configuration. Generally low pupping rates (including occasional years with very low estimates), a declining trend in cohort survival to age 2 since the early 1990s and relatively low adult survival (age 6-14) since 1999 may be sufficient to explain declining pup counts at Sandy Bay since the late 1990s. Similar time-trends in survival at age were obtained with respect to year for the Dundas population when adopting a similar model configuration to that used for Sandy Bay.

In addition, a correlative assessment was conducted with the aim of identifying the potential causes of demographic variation and population change in NZ sea lions at the Auckland Islands.

Year-varying demographic rate estimates for females at Sandy Bay were related to a collated dataset of climatic, dietary, biological and fishery-related observations. Hypothetical biological and demographic responses to candidate drivers of population change were identified prior to the correlative assessment.

In most cases, the time series of available data were short and were mostly available for the period of population decline and this compromised the power of correlative assessments.

A correlation with cohort survival to age 2 years was consistent with disease-related mortality affecting a decline in survival after 2005. Prior to 2005, pup mass at 3-weeks appeared to have been a good predictor of cohort survival to age 2.

Poor correlations were obtained when relating survival at ages 2-5 (juveniles) or age 6-14 (adults) to estimated captures and interactions in the Southern arrow squid trawl fishery at the Auckland Islands (SQU6T). However, a strong negative correlation was observed between survival at ages 6-14 (1999-2004) and cohort survival to age 2 in the previous year (1998-2003), which would be consistent with the high energetic costs of lactation affecting maternal survival during this time period.

Climate indices including Inter-decadal Pacific Oscillation (IPO) and sea surface height (SSH) were well-correlated with the occurrence of an array of key prey species in the diet, from an analysis of scats. However, a longer time series of climate and diet data, with cyclic fluctuations, would be needed to establish a causative correlation with diet.

Variable diet composition, a decline in maternal condition, changes in milk quality and in pup mass, and depressed pupping rates, are all consistent with changes in nutritional status, though some of these responses could also occur in response to pup mortality that was not driven by nutritional stress.

Project logistics summary statement

This project was 90% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$50,000. Services were provided by the National Institute of Water and Atmospheric Research.

Review milestones:

- Initial results presented at CSP TWG meeting on 20 May 2014,
- Draft final report presented at the CSP TWG meeting on 26 August 2014.

Citation

Demographic assessment:

Roberts, J., and Doonan, I. 2014. NZ sea lion: demographic assessment of the causes of decline at the Auckland Islands: demographic model options – demographic assessment. Report prepared by the National Institute of Water and Atmospheric Research for the New Zealand Department of Conservation, Wellington. 142p.

Correlative assessment:

Roberts, J., and Doonan, I. 2014. NZ sea lion: demographic assessment of the causes of decline at the Auckland Islands: demographic model options – correlative assessment. Report prepared by the National Institute of Water and Atmospheric Research for the New Zealand Department of Conservation, Wellington. 58p.

Weblink

Demographic assessment:

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/reports/NZ-sea-lion-demographic-assessment-causes-decline-auckland-islands-part-1.pdf>

Correlative assessment:

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/reports/NZ-sea-lion-demographic-assessment-causes-decline-auckland-islands-part-2.pdf>

3.2 POP2012-06 Salvin's albatross – population estimate and at-sea distribution

NOTE: This multi-year project (POP2012-06) was consulted on in 2012/13.

Overall objective

To estimate the at-sea distribution and population size and trend of Salvin's albatross at the Bounty Islands.

Specific objectives

1. To determine the foraging range of Salvin's albatross at the Bounty Islands.
2. To estimate the population size of Salvin's albatross at the Bounty Islands.
3. To determine the population trend of Salvin's albatross at the Bounty Islands with reference to historic data.

Rationale

Salvin's albatross is endemic to New Zealand, with the main breeding population at the Bounty Islands. Salvin's albatross has been recorded bycaught predominantly in trawl fisheries, in relatively high numbers, and has been identified as at potentially high risk from commercial fisheries impacts. There is poor knowledge of Salvin's albatross currently, limited mainly to study of the small population at The Snares Islands. In late 2011 an expedition to the Bounty Islands collected population information on Salvin's albatross on two islands, and initial results suggest a substantial population decline since 2004, in addition to apparent declines from 1997 to 2004. The apparent decline in population combined with relatively high fisheries risk makes obtaining robust population information for this species a high priority requirement to ensure fisheries impacts can be adequately managed. An aerial census of the Bounty Islands was also completed in 2010, and whilst this method showed promise as a suitable monitoring method, ground-truthing is required. No tracking data has been collected for Salvin's albatross at the Bounty Islands. Determining the population trend and foraging ranges of the Bounty Islands population has also been recognised internationally as a research priority.

Project status

Completed.

Summary of the methods and key findings

Salvin's albatrosses *Thalassarche salvini* is an abundant albatross species present throughout the year on all continental shelf areas around New Zealand. This species is essentially endemic to New Zealand, breeding mainly on the Bounty Islands and the Western Chain of The Snares.

The population status of this species is poorly known. In October 2010 and 2013 we completed aerial surveys of the Bounty Islands and photographed all albatross colonies we observed. The photographs were used to compile photo-montages of each colony, and these images were used to count the breeding birds on each island. Ground counts of nesting Salvin's albatrosses were also undertaken on Proclamation Island on 23 October 2013, to determine the proportions of nests containing eggs and non-breeding birds present in the colony. These ground counts indicated that the mean proportion of breeding birds in the colony between 1000 to 1600 hours was 0.74 (range

0.71 — 0.77). The mean proportion of occupied nests that contained eggs over the same period was 0.90 (range 0.88 — 0.91).

Estimated annual counts for all breeding sites in the Bounty Islands were adjusted to account for the presence of non-breeding birds, giving an estimate of the annual breeding pairs in 2013 of 39,995 (95% CI 39,595 — 40,395). For purposes of comparison, we applied the same correction factor to 2010 counts as well, as we have no other basis for determining the proportion of non-breeding birds present in the colony at the time of the 2010 counts. These adjusted figures for 2010 (31,786 annual breeding pairs, 95% CI 31,430 — 32,143) indicate that substantially more birds (26%) were breeding in 2013.

Aerial survey of the Bounty Islands proved to be an effective method of rapidly assessing the population size of Salvin's albatross in the Bounty Islands, and our population estimates represent the first complete population surveys of the species on the archipelago. The proportion of loafing birds in the colonies (25.8%) was high, but this may be normal at this stage (mid-incubation period) of the albatross breeding cycle. If future aerial counts are to be conducted, consideration could be given to conducting surveys earlier in the breeding cycle when the proportion of non-breeding birds present is likely to be lower.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$80,000 for the period 1 July 2012-30 June 2013, and \$120,000 for the period 1 July 2013-30 June 2014. Services were provided by the National Institute of Water and Atmospheric Research (population data review and at-sea tracking) and Latitude 42 Environmental Consultants Pty Ltd (2013 aerial survey).

Review milestones:

- Presentation of at sea distribution at the CSP TWG meeting on 6 June 2014;
- Draft report tabled on 25 July 2014.

Citations

Aerial population estimate:

Baker, G.B., Jenz, K., Sagar, P. 2014. Final Report. 2013 Aerial survey of Salvin's albatross at the Bounty Islands. Report prepared by Latitude 42 Environmental Consultants Pty Ltd for the New Zealand Department of Conservation, Wellington. 10p.

At-sea distribution:

Thompson, D., Sagar, P., Torres, L. Charteris, M. 2014. POP2012-06 Salvin' albatross at-sea distribution draft report. Salvin's albatrosses at the Bounty Islands: at-sea distribution. Report prepared by the National Institute of Water and Atmospheric Research for the New Zealand Department of Conservation, Wellington. 13p.

Weblink

Aerial population estimate:

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/reports/pop2012-06-salvins-aerial-population-estimate.pdf>

At sea distribution:

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/meetings/pop2012-06-salvins-albatross-at-sea-distribution-draft-report.pdf>

3.3 POP2013-01 New Zealand sea lion population project (Auckland Islands)

Overall objective

To estimate New Zealand sea lion pup production in the Auckland Islands and collect data to allow the estimation of key demographic parameters

Specific objectives

1. To estimate New Zealand sea lion pup production at Enderby, Figure of 8 and Dundas Islands.
2. To mark New Zealand sea lion pups at Enderby and Dundas Islands following established techniques.
3. To conduct a three to five week period of resighting previously marked animals at Enderby Island.
4. To update the New Zealand sea lion database.

Rationale

New Zealand sea lions are classified as Nationally Critical, 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 75% of New Zealand sea lions breed at the Auckland Islands, where population data have been collected since the mid-1990s, including estimates of pup production and resighting of marked animals. Since 2001 there has been a considerable decline in pup production at the Auckland Islands. A literature review to identify potential indirect effects of commercial fishing on the Auckland Islands population as part of CSP project POP2010-01 has recently been completed. The review highlighted a number of key information gaps that currently prevent a full understanding of any such potential indirect effects.

In order to manage the commercial fisheries impacts on New Zealand sea lions at the Auckland Islands it is critical to understand the population level and key demographic factors driving trends in the population. CSP project POP2012-02 is currently analysing 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. This project will extend the time series of population data available.

The current SQU6T Operational Plan³ includes a trigger point related to New Zealand sea lion pup production at the Auckland Islands, and this project will provide the estimate for 2013/14.

Project status

Completed.

³ See <http://www.fish.govt.nz/en-nz/Consultations/Archive/2011/Squid+fishery+around+the+Auckland+Islands/default.htm>

Summary of the methods and key findings

Blue Planet Marine (BPM) was contracted by the Conservation Services Programme (CSP) of the Department of Conservation (DOC) to provide services for CSP Project 4522 – New Zealand sea lion ground component for the 2013/14 summer field season. The field component of the work was undertaken from January 6 until 11 March 2014 and was completed successfully. This report provides a summary of the work completed. In summary:

New Zealand sea lion monitoring was undertaken between 9 January and 9 March 2014 at Figure of Eight Island (n=1d), Dundas Island (n=3d) and Enderby Island (n=59d) in the Auckland Islands group. The research closely followed previously used methodology with a few minor exceptions (e.g. monitoring at Dundas Island was 2 days earlier than previously). Overall, the research went well and achieved all stated objectives.

Pup production was estimated for New Zealand sea lion colonies at Sandy Bay (n=290), Dundas Island (n=1,213), Figure of Eight Island (n=72) and South East Point (n=0) with total pup production for the Auckland Islands in 2013/14 estimated as 1575. This total represents an 18% decline on the estimate from 2013 and is the third lowest total pup production recorded for the Auckland Islands.

711 pups were double flipper tagged at Sandy Bay (n=287), Dundas Island (n=400), Figure of Eight Island (n=24) and South East Point (n=0) up until 20th January 2014.

A total of 11,076 individual tag, brand and micro-chip resightings were made during the field season. Most of the resighting records were from tags (n=9,982; 90%) with brand and micro-chip resighting comprising approximately 5% each (n=530 and 560 respectively). This season represents the highest ever number of resighting records collected; five times more than in 2012/13 and 1.4 times more than the previously highest season in 2002/03 (2012/13 = 2,262; 2011/12 = 6,914; 2002/03 = 8,139). Most resightings (99%) were collected on Enderby Island and most (95%) of these at Sandy Bay.

Preliminary estimates of pup mortality to the date of the mark recapture are comparable to previous 'non-epidemic' years with the caveat that these figures do not represent full season surveys as in previous years and so should be viewed as a minimum. Pup mortality estimates to the date of the mark recapture are: Sandy Bay 2%, Dundas Island 6% and Figure of Eight Island 14%. Total pup mortality to 8 March was 73 pups. Data on the cause of death were not included as a deliverable of the DOC CSP contract but this work was undertaken independently by Massey University and Deepwater Group Ltd. It will be reported separately.

Mean pup weights at Sandy Bay were 5% lower than 2012/13 for males and females. Mean pup weights at Dundas Island were 8% and 5% lower than 2012/13 for males and females respectively.

Project logistics summary statement

This project was 90% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$200,000. Services were provided by Blue Planet Marine.

Review milestones:

- Ground survey methodology report for 2013/14 tabled at the CSP TWG meeting on 21 November 2013;
- Presentation of draft ground count results at the CSP TWG meeting on 6 March 2014;
- Presentation of final results at the CSP TWG meeting on 17 April 2014.

Citation

Childerhouse, S., Hamer, D., Maloney, A., Michael, S., Donnelly, D., and Schmitt, N. 2014. Final Report CSP Project 4522 New Zealand sea lion ground component 2013/14. Report prepared by Blue Planet Marine for the New Zealand Department of Conservation, Wellington. 31p.

Weblink

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/reports/nzsl-auckland-islands-ground-survey-2014.pdf>

DRAFT

3.4 POP2013-02 White-capped albatross population estimate (Auckland Islands)

Overall objective

To estimate the population size and trend of white-capped albatross at the Auckland Islands using aerial survey methods.

Specific Objective

1. To estimate the population size of white-capped albatross at the Auckland Island.
2. Determine the population trend of white-capped albatross at the Auckland Island

Rationale

White-capped albatross is endemic to New Zealand and breeds predominantly on the Auckland Islands. This species has been one of the most commonly recorded bycaught protected species in New Zealand waters, particularly in off-shore trawl fisheries, and was identified as one of the seabird species at highest risk from New Zealand commercial fisheries. Updated information on the population trend will assist in determining the susceptibility of this population to fisheries impacts as well as allow future assessment of ongoing fisheries management in regards to impacts on this species. Population modelling in a fisheries context concluded that global fishing bycatch (but not New Zealand fishing only) presents a risk to population viability and highlights the absence of information on juvenile survival and age at first breeding. Updated information on the population trend will assist in determining the susceptibility of this population to fisheries impacts as well as allow future assessment of ongoing fisheries management in regards to impacts on this species.

Project status

Completed.

Summary of the methods and key findings

White-capped albatrosses *Thalassarche steadi* are endemic to New Zealand, breeding on Disappointment Island, Adams Island and Auckland Island in the Auckland Island group, and Bollons Island (50-100 pairs) in the Antipodes Island Group. Between 2006/07 and 2013/14 (hereinafter 2006 and 2013, respectively) we undertook repeated population censuses of the white-capped albatrosses breeding in the Auckland Islands using aerial photography. These population censuses were carried out in either December or January each year to estimate population size and track population trends.

In 2013 we estimated that there were 89,552 (95%CI 88,953 — 90,151), 5,542 (5,393 — 5,691) and 184 (157— 211) annual breeding pairs at Disappointment Island, South West Cape and Adams Island, respectively, based on the raw counts, giving a total for these sites of 95,278 (94,661 — 95,895) breeding pairs.

To assess population trend in total counts we used an appropriate Generalised Linear Model where the response was specified as an over dispersed Poisson distribution and the link was logarithmic. To allow for possible non-linear trend effects we used regression splines with a single knot at 2010. We also assessed trend using software program TRIM (TRends and Indices for Monitoring Data), the standard tool used by the Agreement for the Conservation of Albatrosses and Petrels (ACAP).

Evidence from a series of 'close-up' photographs taken each year (2007-2013) indicates that the number of non-breeding birds present in the colonies differed somewhat between December and January. The proportion was very low in December counts (1-2% of birds present), but higher in the January counts (14% of birds present). Estimated annual counts for all three breeding sites in the Auckland Islands were adjusted to account for the presence of non-breeding birds, giving adjusted estimates of annual breeding pairs of 116025, 90036, 96118, 73838, 76119, 92692, 102273 and 74031 for each year from 2006 to 2013 inclusive. These adjusted figures were used as inputs into models used for assessment of population trend.

Trend analysis for all sites combined using regression splines showed no clear evidence for systematic monotonic decline over the 8 years of the study. This is particularly so if the count for 2006 is excluded. Given this we do not have sufficient evidence to reject the null hypothesis of no systematic trend in the total population. The population size estimates computed from the TRIM model indicate an average growth rate of -3.16% per year ($\lambda = 0.9684 \pm 0.001$; assessed by TRIM as moderate decline). We note, however, that a simple linear trend analysis, as performed by TRIM is not well suited to a data set with high inter-annual variability. Trend analysis using regression splines is more appropriate to such data sets, and the TRIM analysis is only presented because it is currently used by ACAP to assess population trends in albatross populations.

In a global review of fisheries-related mortality of shy and white-capped albatrosses it was estimated that 8,000 white-capped albatrosses were killed each year as a result of interactions with trawl and longline fisheries in the Southern Ocean. This level of mortality highlights the need to continue to acquire accurate population estimates and trends for white-capped albatross populations to assess the impact of fisheries operations on this species. Although annual counts over the last seven years indicate the population is stable, ongoing population monitoring is recommended to clarify if current levels of fishing mortality are sustainable.

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. Services were provided by Latitude 42 Environmental Consultants Pty Ltd.

Review milestones:

- Presentation of operational plan at the CSP TWG meeting on 21 November 2013;
- Presentation of draft final report at the CSP TWG meeting on 17 April 2014.

Citation

Baker, G.B., Jensz, K. Cunningham, R. 2014. White-capped albatross aerial survey 2014. Report prepared by Latitude 42 for the New Zealand Department of Conservation, Wellington. 21p.

Weblink

<http://www.doc.govt.nz/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pop2013-02-white-capped-albatross-survey-2014-final-report.pdf>

3.5 POP2013-03 Gibson's albatross population study (Auckland Islands)

Overall objective

To estimate the population trend, fecundity and age-class survival of Gibson's albatross at the Auckland Islands.

Specific objectives

1. To estimate the population size and trend of Gibson's albatross at the Auckland Islands.
2. To estimate the adult survival of Gibson's albatross at the Auckland Islands.

Rationale

This taxon (*Diomedea antipodensis gibsoni*) is endemic to New Zealand and breeds only at the Auckland Islands. Reported incidental captures have been predominantly from surface longline fisheries. The population has exhibited a marked decline in the population since 2005 due to reductions in adult survival, proportion of adults breeding and breeding success. Adult survival was the parameter contributing most uncertainty to the risk ratio. Further information on population size and trend, and updated estimates of adult survival will inform updated fisheries risk assessment work and allow future assessment of ongoing fisheries management in regards to impacts on this taxon.

Project status

Completed.

Summary of the methods and key findings

The size and trend of the Gibson's wandering albatross population is estimated by counts of active nests in representative parts of their main breeding area, Adams Island, and by mark-recapture estimate of the size of the population in a large & intensively monitored study area there. Albatross nests are counted annually in one low, one medium and one high nest-density area, which collectively supports about 25% of the total population. Nests are counted at the end of the laying period by walking in strips through each block, guided by GPS. Population size and survivorship are estimated by mark-recapture analysis of data collected in a 61 ha study area of medium density albatross nesting habitat. Each year during repeated visits to the study area in January and February the following is undertaken: the nesting success of the previous year's nests are assessed and all chicks produced banded; all birds nesting within the study area are banded or their existing bands recorded and their nests marked and mapped; and all banded non-breeding birds visiting are recorded.

Following a substantial decline in the number of breeding birds and nests in 2005 and 2006 there has been a gradual increase in the number of nests, though the number of birds has remained approximately stable at a new low level. This is because the proportion of birds nesting has increased, while the size of the breeding population remains unchanged. While still lower than before the population crash, nesting success has improved. In time this may replenish the pre-breeding population bank which has been shrinking as birds are pulled into the breeding population to replace all those lost in the population crash. However, if it happens at all, this will be a slow

process, as there has now been nearly a decade when only small number of birds bred and success was very poor.

Adult survivorship is still lower than it was before the crash in 2005 and 2006, though there is now less of an imbalance between male and female survivorship.

The situation for Gibson's albatross has improved since 2006, but it is still far from a healthy population. We are unable to estimate from our data on the breeding population the rate of change occurring in the whole pop i.e. whether it is continuing to decline. Time will tell. A detailed modelling exercise such as the one carried out by Francis et al in 2012 would give a better indication of the trajectory of the whole population.

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. Services were provided by Albatross Research.

Review milestones:

- Presentation draft final report at the CSP TWS meeting on 6 June 2014.

Citation

Elliott, G., and Walker, K. 2014. Gibson's wandering albatross at Adams Island—population study. Report prepared by Albatross Research for the New Zealand Department of Conservation, Wellington. 13p.

Weblink

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/meetings/pop2013-03-gibsons-albatross-final-report-2013-14.pdf>

3.6 POP2013-04 Black petrel population project

Overall objective

To estimate the population trend, fecundity and age-class survival of black petrel at Great Barrier Island (Aotea Island).

Specific objectives

1. To estimate the black petrel population size at Great Barrier Island and describe the population trend by comparing the estimate to relevant existing data.

Rationale

Black petrels are endemic to New Zealand and breed only on Great Barrier Island (Aotea Island) and Hauturu/Little Barrier Island. Black petrels have been observed caught in trawl, surface longline and bottom longline fisheries. Recent level-2 seabird risk assessment identified this species as at greatest risk from commercial fishing in New Zealand, and found estimates of adult survival to be a major source of uncertainty. Considerable research on black petrels on Great Barrier Island and estimates of key population parameters for Great Barrier Island have been made, though estimates of juvenile survival remain highly uncertain. Further time-series data will improve our understanding of the population dynamics and allow future assessment of ongoing fisheries management in regards to impacts on this species.

Project status

Completed.

Summary of the methods and key findings

This report is part of an ongoing long-term study of the black petrel, *Procellaria parkinsoni*, on Great Barrier Island (Aotea Island) that was begun in the 1995/96 breeding season. During the 2013/14 breeding season, 410 study burrows within the 35-ha study area near Mount Hobson were checked and intensively monitored. Of these, 266 were used by breeding pairs, 101 by non-breeding adults, and the remaining 43 burrows were unoccupied.

By 1 May 2014, 185 chicks were still present in the study burrows and 2 had already fledged, corresponding to a breeding success of 70.3%. Nine census grids were monitored within the study area and accounted for 157 of the inspected burrows and 152 study burrows, with 95 burrows being used for breeding. Ninety-two chicks from earlier breeding seasons were recaptured within the Mount Hobson colony area this season (a total of 172 'returned chicks' have been caught since the 1999/2000 season).

Analysis of the stratified census grid and mean transect data estimated that there were 2097 to 2465 birds present in the 35-ha area around Mount Hobson (Hirakimata). Modelling of the black petrel population on Great Barrier Island (Aotea Island) was updated and indicated the population trend may lie anywhere between -2.3% and +2.5% per annum driven primarily by uncertainty over juvenile survival (with the current estimate suggesting a declining population). Thirty-three high-resolution GPS i-Got-U™ data-loggers and 17 Lotek™ LAT1900-8 time-depth recorders were deployed between January 2014 and February 2014 on breeding black petrels to obtain at-sea distribution and foraging behaviour. The at-sea distribution of black petrels was derived from 20 full or partial GPS tracks.

Birds foraged around the northern New Zealand and towards East Cape. Foraging behaviour showed black petrels dived to a maximum of -34.3 m, with over 80% of dives less than 5 m. The majority of dives (67%) were during the day.

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. Services were provided by Wildlife Management International Ltd.

Review milestones:

- Presentation of preliminary analysis of demographic parameters and the population project at the CSP TWG meeting on 20 May 2014;

Citation

Bell, E.A., Mischler, C., Sim, J.L., Scofield, P., Francis, C., Abrahams, E., and Landers, T. 2014. At-sea distribution and population parameters of the black petrels (*Procellaria parkinsoni*) on Great Barrier Island (Aotea Island), 2013/14. Report prepared by Wildlife Management International Ltd. for the New Zealand Department of Conservation, Wellington. 98p.

Weblink

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/meetings/pop2013-04-black-petrel-population-final-report-2014.pdf>

3.7 POP2013-05 Development of coral distribution modelling

Overall objective

To describe the distribution of deep sea corals in relation to areas where they are at risk of interactions with commercial fishing gear.

Rationale

A number of protected coral taxa are known to be bycaught in commercial fisheries in New Zealand, particularly deepwater trawls targeting orange roughy or oreo species. In order to understand the risk to protected corals, and ensure commercial fishing impacts on protected corals is minimised, it is important to quantify the spatial extent of these impacts. This project will expand on recent work to more robustly identify the distribution of deep sea corals by utilising additional sources of information relevant to the distribution of corals. This information will form a vital component of future risk assessment and fisheries management of areas where corals are at highest risk of interactions with commercial fishing gear.

Project status

Completed.

Summary of the methods and key findings

This project was split in to two subprojects:

1. *Refined habitat suitability modelling for protected coral species in the New Zealand EEZ.*

The estimated distributions of protected coral species within the New Zealand region have been updated with recently constructed environmental grids for seafloor saturation levels of aragonite and calcite, forms of calcium carbonate integral to the formation of the endoskeleton of cold-water corals. The new models focussed on distributions of key individual species and genera: four species of reef-building scleractinian corals, four genera of alcyonacean corals, and four genera of antipatharian corals.

The variables with the most influence across all of the models were dynamic topography and bottom temperature. Surprisingly, aragonite and calcite saturation had only a moderate influence in most of the models. As most of the presence records were at locations with supersaturated aragonite and calcite, it was postulated that saturation values above this level may produce only a limited improvement in the corals ability to incorporate these carbonate ions into their skeletons.

A substantial predicted overlap with the 20-year trawl footprint (>50%) occurs across the EEZ for *Goniocorella dumosa*, and low overlaps (<25%) are predicted for *Enallopsammia rostrata*, *Primnoa spp.*, and *Bathypathes spp.* On the Chatham Rise, overlaps >50% occur for *Goniocorella dumosa*, *Solenosmilia variabilis*, *Madrepora oculata*, *Keratoisis spp.* and *Lepidisis spp.*, and all genera of antipatharians except for *Bathypathes*; an overlap of <25% occurs only for *Keratoisis spp.* & *Lepidisis spp.* For all taxa, however, there exist substantial areas of predicted presence outside of the historic trawl footprint in various refuges across the EEZ.

2. Pilot ecological risk assessment for protected corals.

A Productivity-Susceptibility-Analysis (PSA) was carried out for 15 protected coral species or groups assessing the relative risk to protected coral species from deepwater bottom trawling for orange roughy fishery on the Chatham Rise. The PSA produces a plot of susceptibility and productivity scores, and also derives an overall relative risk index. The results can give scientists and managers a better understanding of this type of ecological risk assessment (ERA) methodology, as well as the various aspects and characteristics of a coral species and the fishery that contribute to its risk, and inform potential management approaches.

The assessment considered various sources of information on the distribution of corals and fishing that provided information on the “availability” and “encounterability” attributes. Knowledge of the shape and size of corals, and studies on trawling impacts helped assess the “selectivity” of a trawling encounter, and then biological data such as age, growth, reproduction, colonisation, and dispersal were used to evaluate the “productivity” of a coral species or group, which reflects its ability to recover from trawling.

Black corals (at the order level, and the genus *Bathypathes*) and the gorgonian coral genus *Paragorgia*, were classified as high risk. Most reef-building scleractinian corals, as well as other gorgonian coral taxa, were medium risk, and cup corals and hydrocorals were relatively low risk. These results were consistent with expectations based on the form and biology of the corals, and knowledge of trawling impacts.

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. Services were provided by the National Institute of Water and Atmospheric Research.

Review milestones:

- Draft final report presented at the CSP TWG Technical Working Group on 25 November 2014.

Citation

Anderson, O., Tracey, D., Bostock, H., Williams, M., and Clark, M. 2014. Refined habitat suitability modelling for protected coral species in the New Zealand EEZ. Report prepared by the National Institute of Water and Atmospheric Research for the New Zealand Department of Conservation, Wellington. 46p.

Weblink

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/reports/protected-coral-distribution-modelling-final-report.pdf>

3.8 POP2013-06 Update protected fish review: oceanic whitetip shark

NOTE: This multi-year project (POP2011-06) was consulted on in 2011/12.

Overall objective

To describe population information and the nature and extent of interactions with commercial fishing for oceanic white-tip sharks, to the extent possible from existing information.

Specific objectives

1. To review existing information to describe the nature and extent of interactions between commercial fishing and oceanic white-tip sharks.
2. To identify information gaps in the understanding of the nature and extent of interactions between commercial fishing and oceanic white-tip sharks, and provide recommendations for further research to address any gaps identified.
3. To review existing information to describe population information relevant to assessing risk from commercial fishing to oceanic white-tip sharks.
4. To identify population information gaps relevant to assessing risk from commercial fishing to oceanic white-tip sharks, and provide recommendations for further research to address any gaps identified.

Rationale

The oceanic whitetip shark was afforded absolute protection under the Wildlife Act 1953 in January 2013. This project aims to supplement the review of information on all other protected fish species, conducted as part of CSP project POP2011-03. This information is required in order to understand the nature and extent of adverse effects of commercial fishing on oceanic whitetip sharks, and will identify key information gaps in existing information.

Project status

Completed.

Summary of the methods and key findings

The oceanic whitetip shark, *Carcharhinus longimanus*, was protected under the Wildlife Act in 2013. This study documents and describes its interactions with commercial fisheries in New Zealand waters, and locates and describes the available population information relevant to assessing the risk to this species. Information on catches was obtained from the literature, commercial catch statistics, and observer records. The catch distribution, seasonality, fishing method, and reported totals are described. Population and biological characteristics are reviewed.

The oceanic whitetip shark is a tropical species that is rarely seen or caught in northern New Zealand. Only 19 observer and two commercial fishery records were located (one of which occurred in both datasets). All records came from surface longlines set in the Kermadec Fisheries Management Area or off the northeastern coast of North Island. Captures around North Island were made in the warmer months of the year whereas captures in the Kermadec FMA were made mainly in the cooler months. Most (84%) of the observed sharks were alive when hauled to the vessel, and about half were processed in some way with the remainder being discarded. Few of the observed

sharks were sexed or measured, but those that were comprised equal numbers of males and females, and ranged between 158 and 190 cm fork length.

Given the low commercial reporting rate (1 out of 19 observed sharks) and the low observer coverage of domestic surface longliners, our estimate of the interaction of the surface longline fisheries with oceanic whitetips is substantially under-estimated. Despite that, oceanic whitetips are clearly not caught very often, and are not regarded as a high priority species for research or management.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$8,000. Services were provided by the National Institute of Water and Atmospheric Research.

Review milestones:

- Report tabled at CSP TWG Presentation 26 August 2014.

Citation

Francis, M. P., and Lyon, W. S. 2014. Review of commercial fishery interactions and population information for the oceanic whitetip shark, a protected New Zealand species. Report prepared by the National Institute of Water and Atmospheric Research for the New Zealand Department of Conservation, Wellington. 15p.

Weblink

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/meetings/pop-2013-06-oceanic-whitetip-shark-review.pdf>

4. Mitigation Projects

4.1 MIT2013-01 Sea trials of the Kellian line setter

Overall objective

To test the at-sea feasibility, and to the extent possible, the effectiveness, of reducing the availability of hooks to seabirds by using the improved Kellian line setter, in inshore bottom longline fisheries.

Specific objectives

1. To identify the range of bottom longline gear configurations and conditions that allows effective and safe use of the device by conducting experimental at-sea trials.
2. To describe line sink profiles of bottom longlines set through the device, as a proxy for mitigation effectiveness.
3. To provide recommendations on any further development and refinement of the device that may be required to enable reliable, effective and safe use in commercial bottom longline fishing operations.

Rationale

Recent level-2 seabird risk assessment has highlighted the high degree of potential risk that small vessel (inshore) bottom longline fisheries pose to a number of protected species, such as black petrels and flesh-footed shearwaters. Preliminary results from CSP project MIT2011-04 indicates that substantial improvements in design of the Kellian line setting device have been achieved and a modified prototype suitable for deployment in a commercial fishing environment will shortly be available. The findings from that project are due to be finalised in July 2013. This project will conduct at-sea testing of the modified prototype.

Project status

In progress.

Summary of the methods and key findings

A total of 6 trips were conducted on board the fishing vessel Kotuku, a 10 m bottom longliner fishing from Tauranga. Each trip involved a series of deployments and test runs, generally in calm sea conditions. GoPro cameras were employed to record the attitude of the setter in the water and the passage of fishing gear through the setter.

The setter was deployed and vessel speed was gradually increased from 2 - 4.5 knots, and the tow rope was gradually payed out to a maximum length of 15m. The linesetter sat reasonably straight at low speeds (< 2 knots), pulling slightly to starboard. With a longer tow rope and at higher speeds the setter ran progressively further off to starboard and at a shallower angle, before breaking the surface at about 4 knots. The KLS 2 also appeared to roll over at speed, such that the ball was further out to starboard than the top.

Over the following four trips a series of systematic changes were made to the setter to improve its performance. Changes included adding an adjustable paravane beside the funnel, increasing the

weight of the ball, increasing the length of the stud above the ball, moving the towing point, and adding a second paravane above the ball.

For each of the trips a series of test runs were performed with different settings. Speed through the water (4.5 knots) and tow rope length (10 m) were kept consistent for all runs. The horizontal angle of the setter behind the boat, the depth it was running at, its attitude in the water (angle of pitch and roll) and the loading on the towline were recorded. Following each trip data was analysed, modifications to the setter made, and a 'run sheet' or test plan was formulated to trial different settings for the subsequent trip.

This iterative approach involved balancing of the various forces acting on the line setter so that it ran at depth and straight behind the boat. The extra weight further below the setter also provided more stability, making it less sensitive to small adjustments and less susceptible to towing at large angles of roll. During trip 5 a small amount of gear was deployed through the setter with a couple of momentary hook catch ups, and on examining the video footage it was thought that a more normal set with a longer longline, and more tension in the backbone, would produce a more representative and consistent indication of performance.

A short set through the linesetter was performed with reasonable tension in the backbone, slightly more than would be used under normal fishing conditions, as it was thought that this would help keep the line in the setter. A 15 m tow rope was used, such that the setter ran at an estimated depth of 4 - 4.5 m, and speed through the water was initially 4, and then increased to 5, knots. Hooks were initially set slowly but as no problems were noted they were clipped on at normal (4 m) spacing for the majority of the set. Three hundred baited hooks were set through the device with three weights and 2 floats added to the line after the hooks. On examination of the video footage from the set the line came out of the back roller as the setter was lowered into the water. Therefore the set was conducted with the line running under the back roller. The setter tracked straight behind the boat with minimal (< 5 degrees) clockwise roll and a pitch angle of approximately 15 degrees nose down. The longline rubbed the front edge of the funnel but generally the passage of hooks was clean, either under or beside the funnel. A couple of traces were lost, and a couple of baits were seen coming off on the video, but overall the setter performed well and allowed the line to be set at depth and to catch some fish.

The developments outlined above may be best achieved by taking the setter back to the Australian Maritime College where modifications could be made and subsequent performance assessed in the flume tank. Ideally the setter could then be briefly taken to sea in Australia to confirm that the results from the flume tank can be then be achieved behind a vessel at speeds of 5 - 6 knots. Further development in the flume tank would also provide the opportunity to fine tune the funnel shape and paravane settings to optimise performance, prior to continuing further sea trials in New Zealand where operational performance and workability of the setter can be assessed under normal fishing conditions.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$110,000. Services were provided by Latitude 42 Environmental Consultants Pty. Ltd.

Review milestones:

- Presentation of the proposed methods at the CSP TWG meeting on 21 November 2013;

- CSP Project update posted on 6 May 2015 – draft report describing the sea trials and subsequent design refinements of the Kellian Line setter. Report can be found here <http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/baker-et-al-2015-cls-sea-trials-performance-testing-ms3-report-may-2015.pdf>

Citation

Baker, G. B., Goad, D., Kiddie, B., and Frost, R. 2014. Kellian Line Setter Sea Trials – Initial Performance Testing. Report prepared by Latitude 42 Environmental Consultants Pty Ltd for the New Zealand Department of Conservation, Wellington. 7p.

Weblink

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/cls-sea-trials-initial-performance-testing-draft-report-may-2014.pdf>

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4.2 MIT2013-02 Surface longline mitigation

Overall objective

To test a range of mitigation methods which reduce the availability of surface longline hooks to seabirds at line setting.

Specific objectives

1. To conduct sea trials of a range of mitigation methods which reduce availability of hooks to seabirds.
2. To provide a comparison of these methods in their mitigation effectiveness, highlighting strengths and drawbacks and applicability to differing surface longline configurations and operations.
3. To provide recommendations on any further development and refinement of methods to enable reliable and safe use in commercial surface longline operations.

Rationale

Surface longline fisheries globally have accounted for significant levels of seabird bycatch, and despite the introduction of a number of mandatory mitigation methods for this fishing method in New Zealand, recent level-2 seabird risk assessment has identified that surface longline fisheries still poses considerable risk. International research into seabird mitigation measures has had a considerable focus on developing novel methods for surface longline fisheries, and a number of methods have recently been developed that show good potential to reduce the availability of baited hooks to seabirds, whilst not causing additional safety or operational difficulties for fishermen. Work in New Zealand to test some of these methods is underway as part of CSP project MIT2012-04. The delivery of this project will be dependent on findings reported from MIT2012-04.

Project status

In progress.

Summary of the methods and key findings

Characteristics of surface longline gear that exacerbate the risk of seabird bycatch include its relatively light weight and long snoods, which keep hooks within reach of seabirds for significant periods, the attractiveness of baits to seabirds, and the very long lengths of lines that are deployed with hooks attached. Despite the existence of measures that are effective in reducing seabird bycatch in surface longline fisheries, continued captures in these fisheries demonstrate that the available approaches do not preclude the existence of significant bycatch risk. In particular, safety concerns with line weighting appear to dissuade fishers from utilising this effective bycatch reduction method.

In this project, we explored three novel approaches designed to improve the safety of line-weighting: safe leads, lumo leads, and hook pods. Safe leads comprise a rubber core through which the monofilament snood passes. A lead weight is attached on each side of this core, secured by an o-ring. The safe lead is able to move down the snood when the snood stretches. Lumo leads comprise a lead-filled plastic cylinder which can be fluorescent, through which the snood passes. The unit is secured on the snood by a secure-fitting screw top. Similar to safe leads, lumo leads move on snoods

when the monofilament becomes stretched (and therefore narrower in diameter). Therefore, both safe leads and lumo leads can slide down the snood and fall off if a fish bites off the snood below the weight. This action dampens potentially dangerous recoil. Hook pods operate differently, in that the pod covers the barb of the hook until the unit opens under the pressure of submersion to a certain depth. We tested these three novel line-weights across seven trips on three inshore surface longline vessels fishing in New Zealand waters in 2013 and 2014.

In 2013, at-sea trials were incorporated into normal government fisheries observer coverage. However, this approach was not entirely effective, such that in 2014, at-sea trials were conducted on a vessel engaged in a charter-type arrangement. This approach provided much better opportunities for data collection. The performance of safe leads and lumo leads was determined using time depth recorders to explore gear sink rates and snood-by-snood documentation of fish catch. The performance of hook pods was explored by assessing the practicality of these devices and exploring the depths at which the enclosed hooks were exposed. The final report documenting the findings of this project is currently in preparation.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$70,000. Services were provided by Dragonfly Science Ltd.

Review milestones:

- Presentation of progress report and recommendations at the CSP TWG meeting on 21 November 2013;
- Presentation of draft final report at the CSP TWG meeting on 12 December 2014.

4.3 MIT2013-03 Characterisation of smaller vessel deep water bottom longline operations in relation to risk factors for seabird capture

Overall objective

To characterise the smaller vessel deep water bottom longline fishery with respect to factors relating to seabird capture.

Specific objectives

1. To review observer, fisher, and catch effort data on vessel operations and findings from previous mitigation projects in deep water bottom longline fisheries, and identify key risk factors for seabird interactions.
2. To characterise the range of bottom longline vessels over 20m with respect to factors relation to seabird captures
3. To provide recommendations on mitigation practices in this fishery.

Rationale

Recent level-2 risk seabird assessment has identified considerable risk, and uncertainty, posed by a subset of the bottom longline fishery executed by smaller deep water vessels. In conjunction with targeted observer coverage in that fishery (see CSP project INT2013-01), this project will characterise the range of bottom longline fishing operations and how these have changes over time to identify key factors related to seabird capture, including hook sink rates and mitigation practices currently used.

Project status

Completed.

Summary of the methods and key findings

Amongst bottom longline fisheries, the highest risk to seabirds and the greatest uncertainty in risk estimation have been linked to vessels less than 34 m in overall length that do not target snapper or bluenose. In this project, we characterised, with respect to seabird capture, bottom longline fishing activity executed by these vessels operating in deeper water. We also identified the reasons for the high seabird bycatch risk identified amongst these vessels, and the high uncertainties associated with that risk.

Using Ministry for Primary Industries' data, we confirmed that the bottom longline fleet could be effectively characterised using three size-based vessel strata. Further, the number of hooks is broadly correlated with vessel sizes. Small vessels (< 20 m in overall length) mostly target snapper, set less than 5,000 hooks per day, and less than 500,000 hooks per year. Large vessels (> 34 m) primarily target ling, set more than 10,000 hooks per day, and more than 2,000,000 hooks per year. Between these groups, medium-sized vessels target a range of species, including ling, bluenose, hapuku, school shark, and ribaldo, set less than 10,000 hooks per day and around 500,000 hooks per year.

Amongst this focal group of medium-sized vessels, government fisheries observers have never covered more than 5% of hooks. Amongst medium-sized bottom longline vessels, seabirds most commonly reported caught by fishers from the 2008/09 to the 2012/13 fishing years were white-chinned petrel, sooty shearwater, Salvin's albatross, grey petrel, Westland petrel, and Chatham albatross. These species also dominate the limited observer records of seabird captures. There is considerable diversity in the operations and gear types used by medium-sized bottom longline vessels, including the use of both integrated-weight line and external weighting approaches, J hooks and circle hooks, manual baiting and autoline systems, and monofilament and tarred rope backbones.

The nature and extent of seabird bycatch reduction approaches deployed amongst medium-sized longline vessels is not well understood given the paucity of observer information. However, the available information is sufficient to broadly characterise factors exacerbating seabird bycatch risks. These include the discharge of fish waste during hauling, inconsistent use of streamer lines and that streamer lines used are of poor construction, the use of line-weighting regimes that expose baited hooks to foraging seabirds for extended periods and distances astern vessels, and day-setting. Significant information gaps remain. However, the combination of knowledge available on fishing activities undertaken by bottom longline vessels 20–34 m in length, and mitigation measures relevant to these fisheries, is sufficient to provide for the reduction of seabird bycatch risks but needs to be supported with improved information collection across amongst this vessel group.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$40,000. Services were provided by Johanna Pierre Environmental Consulting Ltd.

Review milestones:

- Draft final report presented at the CSP TWG meeting on 6 June 2014.

Citation

Pierre, J.P., Thompson, F.N., and Cleal, J. 2014. Seabird interactions with the deepwater bottom longline fleet. Report prepared by Dragonfly Science for the New Zealand Department of Conservation, Wellington. 36p.

Weblink

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/reports/mit2013-03-characterisation-of-bll.pdf>

4.4 MIT2013-05 Development of bird baffle design for offshore trawl vessels

Overall objective

To assess, and improve where necessary, the design, durability and performance of bird bafflers currently deployed on trawl vessels >28 m in length.

Specific objectives

1. To design and construct one or more improved bird baffle design(s).
2. To conduct at sea trials of the improved baffle(s) in order to assess efficacy and utility of the design.
3. To produce recommendations in the construction of bird baffle designs in a variety of media in order to maximise uptake in commercial fisheries.

Rationale

Previous work on the assessment and improvement of seabird scaring devices on trawlers >28 m in length, identified that further work is required to improve the design and performance of bird bafflers currently in use. This project will aim to work collaboratively with vessel operators to identify and construct improved bird bafflers.

Project status

Ongoing, currently in at-sea trial stage.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was \$70,000. Services were provided by Clement & Associates.

Review milestones:

- Presentation of proposed methods at the CSP TWG meeting on 21 November 2013.

Non-research mitigation project proposals

The following projects are for non-research services that aim to avoid, remedy or mitigate the impacts of commercial fishing on protected species.

4.5 MIT2012-05 Protected species bycatch newsletter

NOTE: This multi-year project (POP2012-05) was consulted on in 2012/13.

Overall objective

To produce a newsletter to communicate protected species-related information to trawl and longline fishermen.

Rationale

Reducing the impacts of commercial fishing on protected species relies on individual fishermen actively applying best practice mitigation methods to their fishing activity. Applying and developing mitigation methods in specific circumstances requires an understanding of the protected species that may be impacted, and the nature with which they interact with fishing activity. A range of relevant information exists, often the result of research projects, and the newsletter will serve as a vehicle for communication to fishermen, fishing companies, and other interested parties. An evaluation of previous examples of this work indicates that this format shows promise in reaching a broad sector of the fishing community and wider stake holders, and provides recommendations for further development.

Project status

Completed.

Summary of the Methods and Key Findings

Twelve issues of Bycatch Bylines were distributed between September 2012 and June 2014. Newsletters have included stories on protected species management, bycatch reduction measures, legislative changes, research relevant to commercial fisheries, and global contexts for these issues. The newsletter was distributed directly to 996 recipients. This included 812 fishers, 16 regional offices of the Ministry for Primary Industries (MPI), 10 industry associations and Commercial Stakeholder Organisations (CSOs), 145 CSP stakeholders, and 13 other recipients including seafood industry workers and scientists, who were added to the distribution list on request.

The newsletter was also made available online through the Department of Conservation's website. To solicit feedback on the newsletter at the end of the project term, a 10-question survey was electronically distributed to 576 recipients including fishers, CSOs and MPI regional offices. Survey responses were received from 3.1% of recipients. Amongst respondents, 50% said that others they knew read the newsletter. All considered it interesting, at least sometimes. More than half (56%) had accessed links to additional information about a story. Respondents mostly (78%) deemed bimonthly circulation appropriate.

When asked to rank current content from most (1) to least (6) preferred topics, individual responses varied, but newsletter sections scored almost the same across all respondents (summed rank scores: 15 – 17). Comments included that updated information and relevance were the best features of the

newsletter, the publication was good overall and didn't require improvement, and that the focus on protected species could be broadened given the scope of issues fishers are dealing with.

Other feedback received during the project included fisher comments on mitigation measures, support for the newsletter content and style from practitioners working on bycatch, and government fisheries observers advising that the newsletter has been seen on vessels at sea and that it is being read and discussed by fishers. Recommendations for future editions include:

- updating the distribution list;
- confirming whether email recipients would prefer to receive a direct-delivered hard copy;
- confirming the viability of distribution arrangements with CSOs and MPI regional offices;
- considering expanding the scope of the newsletter content, and,
- including information on government fisheries observer coverage.

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. Services were provided by Johanna Pierre Environmental Consulting Ltd.

Review milestones:

- 2013/14 annual review presented at the CSP TWG meeting on 6th of June 2014.

Citation

Pierre, J. 2014. MIT2012-05 Protected Species Bycatch Newsletter. *Bycatch Bylines*. Report prepared by Johanna Pierre Environmental Consulting for the New Zealand Department of Conservation, Wellington. 9p.

Weblink

<http://www.doc.govt.nz/Documents/conservation/marine-and-coastal/marine-conservation-services/reports/mit2012-05-final-report-protected-species-bycatch-newsletter.pdf>

[Bycatch Bylines - Issue 1, October 2012](#)

[Bycatch Bylines - Issue 2, November 2012](#)

[Bycatch Bylines - Issue 3, January 2013](#)

[Bycatch Bylines - Issue 4 March 2013](#)

[Bycatch Bylines - Issue 5 April 2013](#)

[Bycatch Bylines - Issue 6 June 2013](#)

[Bycatch Bylines - Issue 7 August 2013](#)

[Bycatch Bylines - Issue 8 October 2013](#)