Conservation Services Programme
DRAFT
Annual Research Summary
2020-21

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1. Introduction

1.1 Purpose

This report outlines the research carried out through the Conservation Services Programme Annual Plan 2020/21 and provides updates on multi-year projects started in previous years.

The Conservation Services Programme is one component of the Department of Conservation (DOC)'s wider bycatch programme and describes those services delivered as 'conservation services'. DOC has recently established a more extensive fisheries bycatch programme as a result of the availability of additional funding through the Biodiversity Budget 2018[1].

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

1.2 Background

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

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

1.3. CSP Vision and Objectives

The Conservation Services Programme (CSP) vision is that:

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

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

1. Understanding the nature and extent of adverse effects on protected species from commercial fishing activities in New Zealand fisheries waters.

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

2. Developing effective solutions to mitigate adverse effects of commercial fishing on protected species in New Zealand fisheries waters.
3. Developing population management plans, where appropriate.

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

1.4 Development of the Annual Plan

The Conservation Services Programme Annual Plan 2020/21[3] described the conservation services to be delivered as the Conservation Services Programme, and subject to cost recovery from the commercial fishing industry. As such, this Annual Plan formed the basis for levying the commercial fishing industry under the Fisheries Act 1996. For further background information on CSP, including extracts of relevant legislation, refer to the Conservation Services Programme Strategic Statement.

In the development of this Annual Plan a series of discussions were held with Fisheries New Zealand (FNZ) staff to harmonise the CSP and FNZ research programmes for 2020/21 and to ensure there was no duplication. A formal consultation process was also used as described below.

1.5 Consultation process

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

The collaborative processes used to develop the 2020/21 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 2020/21. This process was developed jointly by the CSP team at DOC and the Inshore Fisheries team at FNZ.
- Deepwater and Highly Migratory Species (HMS) observer coverage was developed jointly by the CSP team at DOC and the deepwater and HMS fisheries team at FNZ.

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

8 December 2019	Initial CSP Research Advisory Group (RAG) meeting – review and gap analysis.
February 2020	Updated medium-term research plans, initial list of research proposals and draft CSP RAG prioritisation framework circulated to CSP RAG.
6 March 2020	Second CSP RAG meeting to discuss and prioritise initial research proposals.
27 March 2020	Additional feedback received from CSP RAG on research proposals and their prioritisation.
8 May 2020	Draft CSP Annual Plan 2020/21 released for public consultation.
8 June 2020	Public consultation period closed.

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

[3] Available to download from: https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/plans-and-submissions/202021/final-csp-annual-plan-2020-21.pdf

1 July 2020	Summary of public submissions and response to comments completed.
9 July 2020	Director-General of Conservation conveyed the Conservation Services Programme Annual Plan 2020/21, amended in accordance with public submissions, to the Minister of Conservation for agreement.

1.6 Report structure

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

Conservation Services Programme activities in 2020/21 were divided into three main areas:

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

1.7 COVID-19

DOC is very cognisant that COVID-19 has had an impact and will continue to have an impact, including fishing activities, observer coverage and the delivery of research. This was accounted for in the CSP 2020/21 work programme. DOC remains committed to working with Fisheries NZ, Treaty partners, industry contacts and fishers, and with all interested stakeholders to respond to future changes.

2. Interaction Projects

2.1 INT2020-01 Observing commercial fisheries

Overall objective

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

Specific objectives

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

Rationale

Understanding the nature and extent of interactions between commercial fisheries and protected species can help to identify where the most significant interactions are occurring. The information can also be used to inform development of ways to mitigate those interactions and adverse effects. Such data 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 continued to purchase baseline services for "offshore" fisheries from FNZ Observer Services, given the scale of their operation, which allowed observers to be placed strategically across New Zealand Fisheries. For the purposes of providing costings, the rate provided by FNZ Observer Services has been used.

Project status

Complete.

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 on board 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 FNZ 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.

Reporting of protected species interactions in New Zealand commercial fisheries relies on observer data and commercial fishing effort data. The following analysis covers all fishing events that ended between **1 July 2020 - 30 June 2021**.

The preparation of data for this report generally follows the same procedure as previous years and any future changes will be documented within this report. Fisheries New Zealand also report on protected species captures using observer-recorded captures and fisher-reported captures to inform protected species capture estimation at a fishery wide scale. These are reported by fishing year (1 October 2020-30 September 2021).

Where possible, data grooming protocols align with FNZ, though some differences do occur, notably:

- This summary includes vessel impacts/deck strikes where it is possible to link the interaction with a fishing event.
- For protected species that were neither photographed or necropsied, the observer identification is considered correct (unless a DOC species expert is very confident a misidentification has occurred, e.g. a species being identified well beyond its known range).
- All protected species groups are included in this summary.

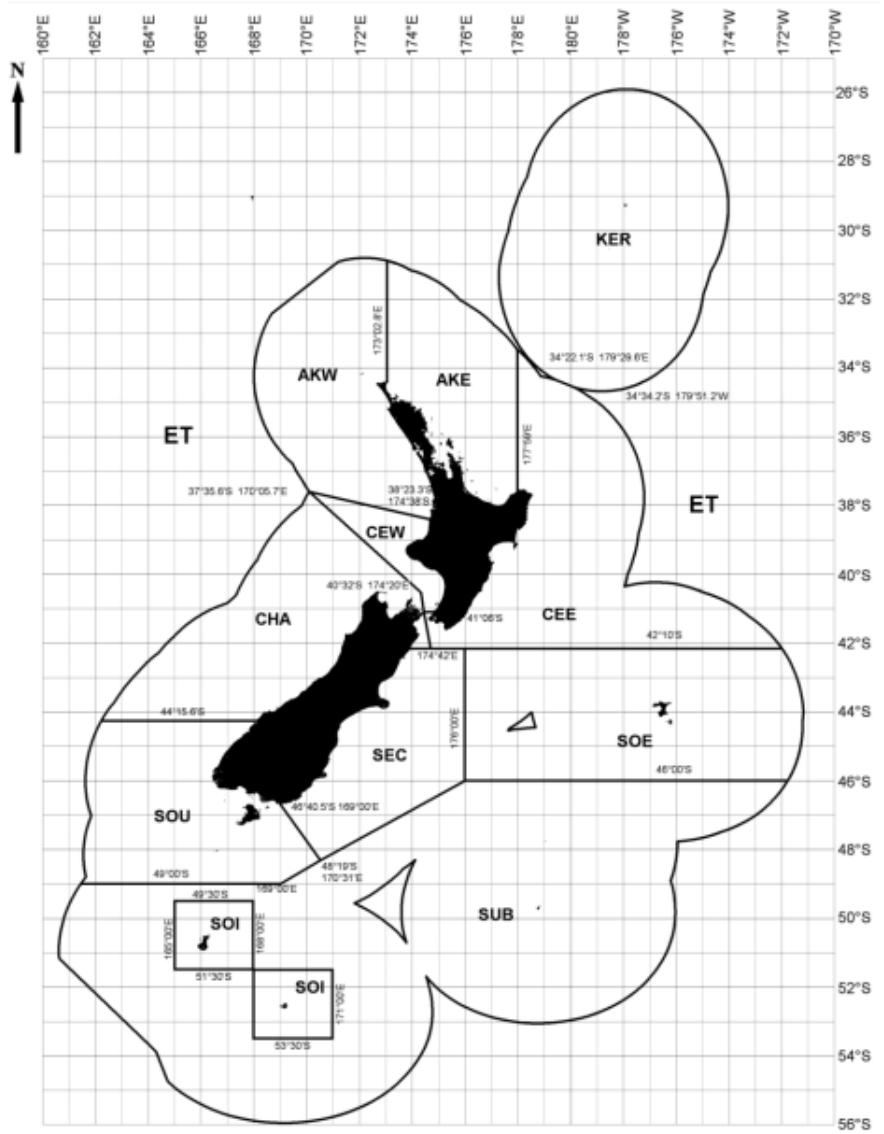
A total of 823 observed protected species interactions occurred during the July 2020-June 2021 reporting period. Of these, there were 636 seabirds, 113 marine mammals, 52 protected fish, 22 turtles and 4,752 kgs of protected coral. White-chinned petrels were the most frequently observed protected species interaction during this year (n=138). This summary 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 location of capture.

Table 1 presents a summary of commercial fishing effort, observer effort and observer coverage, in addition to protected species captures (including seabirds, marine mammals, protected fish and reptiles) and protected coral catch, in each fishery with observer coverage during the 2020/21 observer year.

Table 1. Summary of commercial effort, observed effort and protected species interactions in fisheries with observer coverage > 0% during the 2020/21 observer year.

Fishery	Effort tows /lines /nets	Observed tows/lines /nets	Coverage (%)	Protected species captures	Coral catch (kg)
Middle Depth Trawl - Hoki, Hake, Ling and Warehou	11,834	5,154	42.6	164	75.5
Middle Depth Trawl - Southern Blue Whiting	339	339	100	19	-
Middle Depth Trawl - Scampi	5,061	549	10.8	25	0.4
Middle Depth Trawl - Squid	3,777	3,085	81.7	257	3,203.2
Pelagic Trawl - Mackerel and Barracouta	5,406	1,713	31.7	45	5
Deepwater Bottom Trawl	4,706	1,363	29	10	1,425.5
Inshore Trawl	34,229	2,309	6.8	36	19.6
Inshore Setnet	18,903	914	4.8	44	18
Surface Longline	1,899	214	11.3	75	-
Deepwater Bottom Longline	6,294	393	6.2	34	3
Inshore Bottom Longline	7,605	392	5.2	37	3.4
Bottom Longline - Snapper	5,453	233	4.2	36	3.1
Purse Seine - Skipjack	260	70	26.9	35	-
Purse Seine - Other	531	72	13.6	6	-

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

Middle Depth Trawl Fisheries

Hoki, Hake, Ling and Warehou species

The hoki, hake, ling and warehou trawl activity spans all months, FMAs and vessel sizes. Within the fishery complex there is a distinct subset targeting the hoki spawn in the Cook Strait. This occurs between June and September and is fished only by vessels under 42m, in an area straddling the CHA and CEE FMAs. The remaining fishing effort occurs during the other months with hoki, hake, ling and warehou targeted largely in SEC, SUB, SOE and partly SOU areas. All vessels over 28m in this fishery are required to used one of the three permissible forms of regulated bird scaring equipment and offal management. Industry defined codes of practice can also apply.

Table 2 presents a summary of commercial fishing effort, observer effort and protected species captures in the fishery during the 2020/21 observer year. In the 2020/21 observer year the commercial effort increased by 1% from the previous year and the amount of overall observed coverage increased by 21%.

The number of seabird interactions increased by 16%, with 137 seabird captures in comparison to 118 in the previous observer year (Weaver 2021). Marine mammal captures decreased by 33% and three protected fish captures occurred, compared with the four in 2019/20 (Weaver 2021). A total of 75.5 kg of coral bycatch was observed this year, in comparison to the 22.2 kg of coral bycatch observed in 2019/20.

In summary, 119 observed trips were conducted aboard 41 vessels, with protected species captures occurring on 57 trips aboard 25 vessels (48% of observed trips, and 61% of vessels, involved protected species captures).

Table 2. Summary of commercial effort, observer effort and protected species interactions in the hoki, hake, ling and warehou middle depth trawl fisheries during the 2020/21 observer year.

FMA	Effort Tows	Observed Tows	Coverage (%)	Seabird interactions	Seabirds /100 tows	Mammal captures	Mammals /100 tows	Protected fish captures	Protected fish/100 tows	Coral catch (kg)	Coral catch /100 tows
1. AKE	431	32	7.4	3	9.4	-	-	-	-	-	-
2. CEE	1,163	195	16.8	2	1.0	7	3.6	-	-	-	-
3. SEC	2,717	961	35.4	28	2.9	2	0.2	-	-	41	4.3
4. SOE	1,730	990	57.2	24	2.4	-	-	1	0.1	21.5	2.2
5. SOU	1,132	415	36.7	30	7.2	2	0.5	-	-	12.6	3
6. SUB	952	639	67.1	41	6.4	1	0.2	1	0.2	-	-
7. CHA	3,956	1,907	48.2	9	0.5	12	0.6	1	0.1	-	-
8. CEW	10	-	-	-	-	-	-	-	-	-	-
9. AKW	22	15	68.2	-	-	-	-	-	-	-	-
Total	**11,834**	**5,154**	**42.6**	**137**	**2.7**	**24**	**0.5**	**3**	**0.1**	**75.5**	**1.5**

Table 3 reports on the numbers of interactions by species and fate immediately post interaction for the 2020/21 observer year. 73% of protected species interactions resulted in mortalities. White-chinned petrels were the most commonly bycaught seabird species and species overall.

Table 3. Protected species interactions in the hake, hoki, ling and warehou middle depth trawl fisheries during the 2020/21 observer year.

Species	Alive	Dead	Grand Total
Seabirds			
Albatrosses (Unidentified)	4	1	5
Black-browed albatross (Unidentified)	1	-	1
Buller's albatross	4	6	10
Campbell albatross	-	1	1
Cape petrels	3	-	3
Common diving petrel	-	1	1
Fairy prion	-	1	1
Flesh-footed shearwater	-	1	1
Gibson's albatross	1	-	1
Great albatrosses	2	-	2
Northern giant petrel	-	1	1
Petrels, Prions and Shearwaters	2	-	2
Prions (Unidentified)	1	-	1
Procellaria petrels	2	-	2
Salvin's albatross	3	22	25
Seabird (unspecified)	1	-	1
Shearwaters	1	-	1
Smaller albatrosses	-	1	1
Snares Cape petrel	-	1	1
Sooty shearwater	2	13	15
Southern royal albatross	1	-	1
Storm petrels	-	1	1
Westland petrel	-	1	1
White-capped albatross	12	7	19
White-chinned petrel	1	38	39
Seabirds Total	**42**	**95**	**137**
Marine Mammals			
Dusky dolphin	-	1	1
New Zealand fur seal	-	22	22
Pilot whale	-	1	1
Marine Mammals Total	**-**	**24**	**24**
Protected Fish			
Basking shark	2	-	2
Smalltooth sandtiger shark	1	-	1
Protected Fish Total	**3**	**-**	**3**
Grand Total	**45**	**119**	**164**

Tables 4a and b detail the method of interaction for each species. Capture in fishing gear was the most prevalent form of interaction overall, with 69% of these resulting in mortalities.

Table 4. Method of interaction for a) protected species released alive and b) dead protected species observed in the hake, hoki, ling and warehou middle depth trawl fisheries during the 2020/21 observer year.

a) Protected species released alive

Species	Brought on board	Caught in fishing gear	Impact against vessel	Grand Total
Seabirds				
Albatrosses (Unidentified)	-	2	2	4
Black-browed albatross (Unidentified)	-	1	-	1
Buller's albatross	3	1	-	4
Cape petrels	-	-	3	3
Gibson's albatross	1	-	-	1
Great albatrosses	-	2	-	2
Petrels, Prions and Shearwaters	-	-	2	2
Prions (Unidentified)	-	-	1	1
Procellaria petrels	-	1	1	2
Salvin's albatross	-	3	-	3
Seabird (unspecified)	-	-	1	1
Shearwaters	-	-	1	1
Smaller albatrosses	-	1	-	1
Sooty shearwater	-	1	1	2
Southern royal albatross	-	1	-	1
White-capped albatross	5	5	2	12
White-chinned petrel	-	1	-	1
Seabird Total	**9**	**19**	**14**	**42**
Protected Fish				
Basking shark	-	2	-	2
Smalltooth sandtiger shark	-	1	-	1
Protected Fish Total	**-**	**3**	**-**	**3**
Grand Total	**9**	**22**	**14**	**45**

b) Dead protected species

Species	Caught in fishing gear	Caught in mitigation device	Impact against vessel	Grand Total
Seabirds				
Albatrosses (Unidentified)	1	-	-	1
Buller's albatross	6	-	-	6
Campbell albatross	1	-	-	1
Common diving petrel	1	-	-	1
Fairy prion	-	-	1	1
Flesh-footed shearwater	1	-	-	1
Northern giant petrel	-	1	-	1
Salvin's albatross	21	1	-	22
Snares Cape petrel	1	-	-	1
Sooty shearwater	11	-	2	13
Storm petrels	1	-	-	1
Westland petrel	1	-	-	1
White-capped albatross	7	-	-	7
White-chinned petrel	36	2	-	38
Seabird Total	**88**	**4**	**3**	**95**
Marine Mammals				
New Zealand fur seal	22	-	-	22
Dusky dolphin	1	-	-	1
Pilot whale	1	-	-	1
Marine Mammal Total	**24**	**-**	**-**	**24**
Grand Total	**111**	**4**	**3**	**119**

Southern Blue Whiting

The southern blue whiting fishery is both spatially and temporally distinct from other middle depth trawl fisheries. The location of fishing effort is variable and dependent on the presence of spawning aggregations of southern blue whiting. Most effort occurs in the waters around Campbell Island in the subantarctic region. Unlike other middle depth trawl fisheries, protected species interactions tend to be dominated by marine mammal captures, specifically fur seals. Sea lion captures have also occurred in most previous fishing years at variable levels (up to 14) (Rowe 2009, Rowe 2010, Ramm 2010, Ramm 2012a, Ramm 2012b, Clemens-Seely et al. 2014., Clemens-Seely & Hjorvarsdottir 2016, Hjorvarsdottir 2016, Hjorvarsdottir 2017, Hjorvarsdottir & Isaacs 2018).

Table 5 presents a summary of commercial fishing effort, observer effort and protected species captures in the fishery during the 2020/21 observer year. There was a 55% decrease in fishing effort in this fishery in this observer year. The fishery received full observer coverage this year; the year prior received almost full coverage (Weaver 2021). The number of seabird interactions in the 2020/21 observer year has decreased from the previous year by 73% (there were 37 seabird interactions in 2019/20 compared to 10 seabird interactions in 2020/21) (Weaver 2021). Marine mammal captures decreased this year by 9% from the previous observer year.

In summary, nine observed trips were conducted aboard nine vessels, with protected species captures occurring on seven trips aboard seven vessels (78% of observed trips involved protected species captures and 78% of these vessels had protected species interactions in 2020/21).

Table 5. Summary of commercial effort, observer effort and protected species interactions in the southern blue whiting fishery during the 2020/21 observer year.

FMA	Effort Tows	Observed Tows	Coverage (%)	Seabird interactions	Seabirds /100 tows	Mammal captures	Mammals /100 tows
1. AKE	-	-	-	-	-	-	-
2. CEE	-	-	-	-	-	-	-
3. SEC	-	-	-	-	-	-	-
4. SOE	-	-	-	-	-	-	-
5. SOU	-	-	-	-	-	-	-
6. SUB	339	339	100	10	3.0	9	2.7
7. CHA	-	-	-	-	-	-	-
8. CEW	-	-	-	-	-	-	-
9. AKW	-	-	-	-	-	-	-
Total	**339**	**339**	**100**	**10**	**3.0**	**9**	**2.7**

Table 6 reports the numbers of interactions by species and fate immediately post interaction for the 2020/21 observer year. 58% of the observed interactions resulted in mortalities.

Table 6. Protected species interactions in the southern blue whiting fishery during the 2020/21 observer year.

Species	Alive	Dead	Grand Total
Seabirds			
Cape petrels	2	-	2
Grey petrel	1	3	4
Petrel (Unidentified)	1	-	1
Petrels, Prions and Shearwaters	1	-	1
Salvin's albatross	1	-	1
Storm petrels	1	-	1
Seabird Total	**7**	**3**	**10**
Marine Mammals			
New Zealand fur seal	-	8	8
New Zealand sea lion	1	-	1
Marine Mammal Total	1	**8**	**9**
Grand Total	**8**	**11**	**19**

Tables 7a and b detail the method of interaction by species. 42% of the protected species interactions that resulted in mortalities involved marine mammals. Three fur seals were found caught in the SLED on different trips.

Table 7. Method of interaction for a) protected species released alive and b) dead protected species observed in the southern blue whiting fishery during the 2020/21 observer year.

a) Protected species released alive

Species	External net capture	Impact against vessel	Grand Total
Seabirds			
Cape petrels	-	2	2
Grey petrel	-	1	1
Petrel (Unidentified)	-	1	1
Petrels, Prions and Shearwaters	-	1	1
Salvin's albatross	-	1	1
Storm petrels	-	1	1
Seabird Total	**-**	**7**	**7**
Marine Mammals			
New Zealand sea lion	1	-	1
Marine Mammal Total	**1**	**-**	**1**
Total	**1**	**7**	**8**

b) Dead protected species

Species	Caught in net	Caught in mitigation device	External net capture	Grand Total
Grey petrel	1	-	2	3
New Zealand fur seal	5	3		8
Grand Total	**6**	**3**	**2**	**11**

Scampi

Observations in the scampi fishery are undertaken primarily to monitor interactions with seabirds and New Zealand sea lions. Historically, captures of seabirds by this fishery have been recorded in most areas, with known captures of black petrels in AKE, along with captures of New Zealand sea lions in the SUB FMA.

Table 8 presents a summary of commercial fishing effort, observer effort and protected species captures in the fishery during the 2020/21 observer year. Commercial effort increased by 11% in comparison to the year prior (2019/20). Overall observer coverage of the fishery in 2020/21 increased by 15% from the previous observer year (2019/20). Observed tows were distributed between AKE, CEE, SOE and SUB FMAs, with the greatest number of tows observed in the SOE FMA.

The number of seabird interactions in the 2020/21 observer year has increased from the previous year by 118% (there were 11 seabird interactions in 2019/20 compared to 24 in 2020/21). One marine mammal capture occurred, whereas none were caught the year prior (Weaver 2021). There was 0.4kg of coral bycatch in this fishery in 2020/21, whereas there was no coral bycaught in 2019/20 (Weaver 2021).

In summary, nine observed trips were conducted aboard nine vessels, with protected species captures occurring on eight trips aboard eight vessels (89% of trips involved protected species captures and 89% of vessels that operated within this fishery during the 2020/21 year had protected species captures).

Table 8. Summary of commercial effort, observer effort and protected species interactions in the scampi fishery during the 2020/21 observer year.

FMA	Effort Tows	Observed Tows	Coverage (%)	Seabird interactions	Seabirds /100 tows	Mammal captures	Mammals /100 tows	Coral catch (kg)	Coral catch /100 tows
1. AKE	418	158	37.8	5	3.2	-	-	-	-
2. CEE	621	32	5.2	3	9.4	-	-	-	-
3. SEC	13	-	-	-	-	-	-	-	-
4. SOE	2,403	75	3.1	8	10.7	-	-	-	-
5. SOU	-	-	-	-	-	-	-	-	-
6. SUB	1,606	284	17.7	8	2.8	1	0.4	0.4	0.1
7. CHA	-	-	-	-	-	-	-	-	-
8. CEW	-	-	-	-	-	-	-	-	-
9. AKW	-	-	-	-	-	-	-	-	-
Total	**5,061**	**549**	**10.8**	**24**	**4.4**	**1**	**0.2**	**0.4**	**0.1**

Table 9 reports the number of interactions by species and fate immediately post interaction.

Table 9. Protected species interactions in the scampi fishery during the 2020/21 observer year.

Species	Alive	Dead	Grand total
Buller's albatross	-	1	1
Buller's and Pacific albatross	-	1	1
Common diving petrel	2	-	2
Flesh-footed shearwater	6	1	7
Salvin's albatross	4	2	6
Shearwaters	-	1	1
Smaller albatrosses	-	1	1
Sooty shearwater	1	-	1
White-capped albatross	3	-	3
White-chinned petrel	1	-	1
Seabird Total	**17**	**7**	**24**
Marine Mammals			
New Zealand fur seal	-	1	1
Marine Mammal Total	**-**	**1**	**1**
Total	**17**	**8**	**25**

Tables 10 a and b detail the method of interaction for each species.

Table 10. Method of interaction for a) observed protected species released alive and b) dead protected species observed in the scampi fishery during the 2020/21 observer year.

a) Protected species released alive

Species	External net capture	Caught on warp or door	Internal net capture	Impact against vessel	Caught in mitigation device	Grand Total
Common diving petrel	-	-	-	2	-	2
Flesh-footed shearwater	2	-	-	4	-	4
Salvin's albatross	3	-	1	-	-	4
Sooty shearwater	-	-	1	-	-	1
White-capped albatross	-	1	-	1	1	3
White-chinned petrel	-	-	1	-	-	1
Total	**5**	**1**	**3**	**7**	**1**	**17**

b) Dead protected species

Species	Caught on warp or door	Internal net capture	Grand Total
Seabirds			
Buller's albatross	-	1	1
Buller's and Pacific albatross	-	1	1
Flesh-footed shearwater	-	1	1
Salvin's albatross	-	2	2
Shearwaters	1	-	1
Smaller albatrosses	1	-	1
Seabird Total	**2**	**5**	**7**
Marine mammals			
New Zealand fur seal	-	1	1
Marine Mammal Total	**-**	**1**	**1**
Total	**2**	**6**	**8**

Squid

Observer coverage in the squid fishery is often higher than other trawl fisheries due to previous high rates of bycatch of New Zealand sea lions and seabirds. Being over 28 m in length, all vessels in this fishery are required to deploy one of the three permitted types of seabird mitigation devices (tori line, warp scarer, or bird baffler), industry defined codes of practice also apply and are monitored against by observers. Offal discarding has been identified as a key issue leading to warp captures in this fishery. Vessel Management Plans have been developed to ensure each vessel has a specific plan to manage discharge of offal during fishing activity.

Particularly in the SQU6T area around the Auckland Islands (within the SUB FMA), the observer coverage is focused on recording New Zealand sea lion captures. Sea Lion Exclusion Devices (SLEDs) are used by all vessels operating in the SQU6T fishery. The majority of observer coverage in the squid fishery has been targeted at the SQU6T area, with high levels of coverage also being achieved in SOU as the vessels trawl en route to and from SQU6T.

Seabird captures in this fishery tend to vary between years dependent upon the spatial and temporal activity of vessels and its overlap with breeding seabirds, in particular, white-chinned petrels and sooty shearwaters. Commonly, the bulk of the seabird captures have included white-capped albatrosses, sooty shearwaters and white-chinned petrels and this trend continues into the current year.

Table 11 presents a summary of commercial fishing effort, observer effort and protected species captures in the fishery during the 2020/21 observer year. Commercial fishing effort decreased by 29% and overall observer coverage decreased by 3% from the year prior (2019/20). Seabird interactions decreased by 46% in comparison to 2019/20. As with previous years, the majority of observed seabird interactions occurred in the SOU and SUB FMAs. Marine mammal captures increased by 30% and protected fish captures decreased by 79% from the previous observer year (2019/20). Coral bycatch increased by 46% from the year prior (2,190.7 kgs in 2019/20 compared to 3,203.2 in 2020/21) (Weaver 2021). The majority of the coral bycatch occurred in the SOU FMA.

In summary, 71 observed trips were conducted aboard 23 vessels, with protected species captures occurring on 54 trips aboard 20 vessels (76% of trips involved protected species captures and 87% of vessels that operated within this fishery during the 2020/21 year had protected species captures).

Table 11. Summary of commercial effort, observer effort and protected species interactions in the squid fishery during the 2020/21 observer year.

FMA	Effort Tows	Observed Tows	Coverage (%)	Seabird interactions	Seabirds /100 tows	Mammal captures	Mammals /100 tows	Protected fish captures	Protected fish /100 tows	Coral catch (kg)	Coral catch /100 tows
1. AKE	-	-	-	-	-	-	-	-	-	-	-
2. CEE	-	-	-	-	-	-	-	-	-	-	-
3. SEC	1,050	632	60.2	7	1.1	15	2.4	-	-	-	-
4. SOE	208	131	63.0	1	0.8	3	2.3	-	-	53	40.5
5. SOU	1,506	1,325	88.0	133	10.0	4	0.3	-	-	2,986.2	225.4
6. SUB	1,013	997	98.4	83	8.3	8	0.8	3	0.3	164	16.4
7. CHA	-	-	-	-	-	-	-	-	-	-	-
8. CEW	-	-	-	-	-	-	-	-	-	-	-
9. AKW	-	-	-	-	-	-	-	-	-	-	-
Total	**3,777**	**3,085**	**81.7**	**224**	**7.3**	**30**	**1.0**	**3**	**0.1**	**3,203.2**	**103.8**

Table 12 reports the numbers of interactions by species and fate immediately post interactions.

Table 12. Protected species interactions in the squid fishery during the 2020/21 observer year.

Species	Alive	Dead	Grand total
Seabirds			
Albatrosses (Unidentified)	3	2	5
Buller's albatross	4	15	19
Buller's and Pacific albatross	1	-	1
Common diving petrel	1	2	3
Fairy prion	1	1	2
Great-winged (Grey-faced) petrel	1	-	1
Petrel (Unidentified)	4	-	4
Petrels, Prions and Shearwaters	4	2	6
Procellaria petrels	3	-	3
Pterodroma petrels	1	-	1
Salvin's albatross	1	3	4
Seabird - Small	-	1	1
Smaller albatrosses	2	1	3
Snares Cape petrel	-	1	1
Sooty shearwater	6	22	28
White-capped albatross	31	38	69
White-chinned petrel	18	55	73
Seabird Total	**81**	**143**	**224**
Marine Mammals			
New Zealand fur seal	-	25	25
New Zealand sea lion	-	5	5
Marine Mammal Total	**-**	**30**	**30**
Protected Fish			
Basking shark	1	-	1
White pointer shark	2	-	2
Protected Fish Total	**3**	**-**	**3**
Grand Total	**84**	**173**	**257**

Table 13 lists the protected coral species bycaught in 2020/21, with *Dendrobathpathyes* spp. (black corals) being the most commonly bycaught species. Tables 13a and b detail the method of interaction for each species. External net capture was the most prevalent form of interaction overall and was responsible for 32% of the interactions that resulted in mortalities.

Table 13. Protected species of coral bycaught in the squid trawl fishery during the 2020/21 observer year.

Species	Weight (kg)
Sea fans	2
Bamboo corals	1
Black corals	1
Bottlebrush coral	7.3
Bushy hard coral	1
Coral (Unidentified)	53.2
Coral rubble	614
Coral rubble-dead	93.8
Dendrobathypathes spp.	2,428.8
Gorgonian coral	0
Spiny white hydrocorals	1
Stichopathes spp.	0.1
Grand Total	**3,203.2**

Table 14. Method of interaction for a) protected species released alive and b) dead protected species in the squid fishery during the 2020/21 observer year.

a) Protected species released alive

Species	Brought on board	Caught in net	External net capture	Caught in mitigation device	Impact against vessel	Other	Grand Total
Albatrosses (Unidentified)	-	-	2	-	1	-	3
Buller's albatross	-	-	3	-	-	1	4
Buller's and Pacific albatross	-	-	1	-	-	-	1
Common diving petrel	-	-	0	-	1	-	1
Fairy prion	-	-	0	-	1	-	1
Great-winged (Grey-faced) petrel	-	-	0	-	1	-	1
Petrel (Unidentified)	-	-	4	-	-	-	4
Petrels, Prions and Shearwaters	-	2	1	-	1	-	4
Procellaria petrels	-	-	3	-	-	-	3
Pterodroma petrels	-	-	0	-	1	-	1
Salvin's albatross	-	-	0	-	1	-	1
Smaller albatrosses	-	-	2	-	-	-	2
Sooty shearwater	-	2	1	-	2	1	6
White-capped albatross	8	3	15	-	4	1	31
White-chinned petrel	1	5	7	1	1	3	18
Seabird Total	**9**	**12**	**39**	**1**	**14**	**6**	**81**
Protected Fish							
Basking shark	-	1	-	-	-	-	1
White pointer shark	-		-	2	-	-	2
Protected Fish Total	**-**	**1**	**-**	**2**	**-**	**-**	**3**
Grand Total	**9**	**13**	**39**	**3**	**14**	**6**	**84**

b) Dead protected species

Species	Caught in warp or door	Caught in net	External net capture	Impact against vessel	Tangled in line	Caught in mitigation device	Other/ Unknown	Grand Total
Albatrosses (Unidentified)	2	-	-	-	-	-	-	2
Buller's albatross	2	7	3	2	-	-	1	15
Common diving petrel	-	-	-	2	-	-	-	2
Fairy prion	-	-	-	1	-	-	-	1
Petrels, Prions and Shearwaters	-	1	-	-	-	-	1	2
Salvin's albatross	1	-	1	1	-	-	-	3
Seabird - Small	-	-	-	1	-	-	-	1
Smaller albatrosses	1	-	-	-	-	-	-	1
Snares Cape petrel	-	-	-	-	1	-	-	1
Sooty shearwater	-	7	12	-	-	-	3	22
White-capped albatross	14	12	11	-	-	-	1	38
White-chinned petrel	-	25	28	-	-	-	2	55
Seabird Total	**20**	**52**	**55**	**7**	**1**	**-**	**8**	**143**
Marine Mammals								
New Zealand fur seal		23	1			1		25
New Zealand sea lion		2				3		5
Marine Mammal Total		**25**	**1**			**4**		**30**
Grand Total	**20**	**77**	**56**	**7**	**1**	**4**	**8**	**173**

Pelagic Trawl Fisheries

Mackerel and Barracouta

In previous years, common dolphins have been captured in the pelagic trawl fishery and in some instances multiple capture events have occurred. A Marine Mammal Operating Procedure (MMOP) has been developed by industry to reduce dolphin captures. These practices include: not setting or hauling at certain times of the day in certain areas, a watch being kept for dolphins in the vicinity of fishing operations, trawl doors being hauled partially on deck whilst turning (in order to close off the mouth of the net), not setting while dolphins are present close to the vessel and using dolphin dissuasive devices (DDDs) on all JMA7 night tows. All the vessels in this fishery are larger than 28 m and are required by law to deploy a seabird scaring device.

Table 15 presents a summary of commercial fishing effort, observer effort and protected species captures in the fishery during the 2020/21 observer year. Commercial effort in this fishery increased 3% from the previous year (2019/20). Overall observer coverage in this fishery decreased by 27% from the previous observer year (2019/20).

The number of seabird captures decreased by 8% in the 2020/21 observer year in comparison to the previous year (2019/20). Marine mammal captures increased from two captures in 2019/20 to nine captures in 2020/21. Coral bycatch in 2019/20 decreased by 80% in comparison to the year prior (25.5 kgs in 2019/20) (Weaver 2021).

In summary, 56 observed trips were conducted aboard 20 vessels, with protected species captures occurring on 20 trips aboard 13 vessels (36% of trips involved protected species captures and 65% of vessels that operated within this fishery during the 2020/21 year had protected species captures).

Table 15. Summary of commercial effort, observer effort and protected species interactions in the jack mackerel and barracouta pelagic trawl fishery during the 2020/21 observer year.

FMA	Effort Tows	Observed Tows	Coverage (%)	Seabird captures	Seabirds /100 tows	Marine mammal captures	Mammals /100 tows	Protected fish captures	Protected fish /100 tows	Coral catch (kg)	Coral catch /100 tows
1. AKE	1	-	-	-	-	-	-	-	-	-	-
2. CEE	27	-	-	-	-	-	-	-	-	-	-
3. SEC	2,126	510	24.0	12	2.4	5	1	-	-	-	-
4. SOE	160	55	34.4	1	1.8	-	-	-	-	5	9.1
5. SOU	539	293	54.4	20	6.8	2	0.7	-	-	-	-
6. SUB	-	-	-	-	-	-	-	-	-	-	-
7. CHA	1,668	377	22.6	2	0.5	1	0.3	1	0.3	-	-
8. CEW	763	412	54.0	-	-	1	0.2	-	-	-	-
9. AKW	122	66	54.1	-	-	-	-	-	-	-	-
Total	**5,406**	**1,713**	**31.7**	**35**	**2.0**	**9**	**0.5**	**1**	**0.1**	**5**	**0.3**

Table 16 reports the number of interactions by species and fate immediately post interaction. Sooty shearwaters and white-capped albatrosses were the most commonly bycaught seabird species.

Table 16. Protected species interactions in the jack mackerel and barracouta pelagic trawl fisheries during the 2020/21 observer year.

Species	Alive	Dead	Grand Total
Seabirds			
Albatrosses (Unidentified)	1	-	1
Buller's albatross	-	1	1
Buller's shearwater	1	-	1
Common diving petrel	6	-	6
Fairy prion	1	1	2
Pterodroma petrels	2	-	2
Salvin's albatross	-	1	1
Smaller albatrosses	1	-	1
Sooty shearwater	3	5	8
Southern royal albatross	1	2	3
Storm petrels	1	-	1
White-capped albatross	2	5	7
White-chinned petrel	1	-	1
Seabird Total	**20**	**15**	**35**
Marine mammals			
New Zealand fur seal	-	9	9
Marine Mammals Total	**-**	**9**	**9**
Protected fish			
White pointer shark	1	-	1
Protected fish Total	**1**	**-**	**1**
Grand Total	**21**	**24**	**45**

Tables 17a and b detail the method of interaction for each species. Net capture was the most prevalent form of interaction overall and was responsible for 46% of the interactions that resulted in mortalities.

Table 17. Method of interaction for a) protected species released alive and b) dead protected species observed in the jack mackerel and barracouta pelagic trawl fisheries during the 2020/21 observer year.

a) Protected species released alive

Species	Caught in net	Caught on warp door	External net capture	Impact against vessel	Unknown	Grand Total
Seabirds						
Albatrosses (Unidentified)	-	-	1	-	-	1
Buller's shearwater	-	-	-	1	-	1
Common diving petrel	-	-	-	6	-	6
Fairy prion	-	-	-	1	-	1
Pterodroma petrels	1	-	-	1	-	2
Smaller albatrosses	1	-	-	-	-	1
Sooty shearwater	-	-	-	3	-	3
Southern royal albatross	-	-	-	-	1	1
Storm petrels	-	-	-	1	-	1
White-capped albatross	-	1	1	-	-	2
White-chinned petrel	-	-	-	1	-	1
Seabird Total	**2**	**1**	**2**	**14**	**1**	**20**
Protected fish						
White pointer shark	1	-	-	-	-	1
Protected fish Total	**1**	**-**	**-**	**-**	**-**	**1**
Total	**3**	**1**	**2**	**14**	**1**	**21**

b) Dead protected species

Species	Caught in net	External net capture	Caught on warp or door	Grand Total
Seabirds				
Buller's albatross	-	1	-	1
Fairy prion	1	-	-	1
Salvin's albatross	-	-	1	1
Sooty shearwater	-	5	-	5
Southern royal albatross	-	-	2	2
White-capped albatross	1	2	2	5
Seabird Total	**2**	**8**	**5**	**15**
Marine mammals				
New Zealand fur seal	9	-	-	9
Marine Mammals Total	**9**	**-**	**-**	**9**
Grand Total	**11**	**8**	**5**	**24**

Deep Water Bottom Trawl Fisheries

Orange Roughy, Cardinal and Oreo Species

This trawl fishery spans all FMAs and also takes place in areas outside of the NZ EEZ. In deep water bottom trawl fisheries, one of the main focuses of observer coverage is to describe the impact of the trawls on benthic communities, more specifically protected corals. Seabird behaviour and abundance are also monitored around the vessels in this fishery. Discards and offal management, as well as the mandatory use of bird scaring devices, are employed by the fleet to mitigate seabird interactions.

Table 18 presents a summary of commercial fishing effort, observer effort and protected species captures in the deep water trawl fishery during the 2020/21 observer year. There was a slight increase (5%) in commercial fishing effort over 2020/21 and a 5.8% increase in overall observer coverage in comparison to the previous observer year (2019/20).

The rate of seabird captures increased by 40% in 2020/21, with 10 observed captures in comparison to four captures in the 2019/20 observer year (Weaver 2021). Coral bycatch for this observer year increased from 546.5 kgs in 2019/20 to 1,425.5 kgs in 2020/21 (Weaver 2021). The majority of the coral bycatch occurred in the SOE FMA.

In summary, 25 observed trips were conducted aboard nine vessels, with protected species captures occurring on 16 trips aboard eight vessels (64% of trips involved protected species captures and 89% of vessels that operated within this fishery during the 2020/21 year had protected species captures).

Table 18. Summary of commercial effort, observer effort and protected species interactions in the orange roughy, cardinal and oreo deep water bottom trawl fisheries during the 2020/21 observer year.

FMA	Effort Tows	Observed Tows	Coverage (%)	Seabird interactions	Seabirds /100 tows	Coral catch (kg)	Coral catch /100 tows
1. AKE	46	1	2.2	-	-	-	-
2. CEE	943	74	7.8	-	-	1.3	1.8
3. SEC	573	82	14.3	-	-	10	12.2
4. SOE	1,996	693	34.7	8	1.1	814.5	117.5
5. SOU	54	54	100	1	1.9	567	1,050
6. SUB	293	179	61.1	-	-	23.1	12.9
7. CHA	543	220	40.5	-	-	1.6	-
8. CEW	-	-	-	-	-	-	-
9. AKW	258	60	23.3	1	1.7	8	13.3
Total	**4,706**	**1,363**	**29**	**10**	**0.7**	**1,425.5**	**104.6**

Table 19 reports the number of interactions by species and fate immediately post interaction.

Table 19. Protected species interactions in the orange roughy, cardinal and oreo deep water bottom trawl fisheries during the 2020/21 observer year.

Species	Alive	Dead	Grand Total
Albatrosses (Unidentified)	2	-	2
Fairy prion	1	-	1
Grey-backed storm petrel	-	1	1
Smaller albatrosses	-	1	1
Snares Cape petrel	1	-	1
Sooty shearwater	1	2	3
White-chinned petrel	-	1	1
Grand Total	**5**	**5**	**10**

Table 20 lists the protected coral species bycaught in 2020/21. Tables 20a and b detail the method of interaction for each species.

Table 20. Protected species of coral bycaught in the orange roughy, cardinal and oreo deep water bottom trawl fisheries during the 2020/21 observer year.

Species	Weight (kg)
Sea fans	2.5
Bamboo coral	11.7
Bathypathes spp.	8
Black corals	5.8
Bubblegum coral	122.6
Bushy hard coral	499
Callogorgia spp.	0.1
Coral (Unidentified)	128
Coral rubble	1.6
Crested cup coral	2
Deepwater branching coral	121
Dendrobathypathes spp.	1
Golden corals	4.1
Gorgonian coral	5.4
Leiopathes spp.	2
Parantipathes spp.	1.1
Precious corals	11
Primnoa spp.	15
Solitary bowl coral	4.3
Stony branching corals	0.3
Stony corals	478
Trissopathes spp.	1
Grand Total	**1425.5**

Table 21. Method of interaction for a) observed protected species released alive and b) dead protected species in the orange roughy, cardinal and oreo deep water bottom trawl fisheries during the 2020/21 observer year.

a) Protected species released alive

Species	Impact against vessel	Grand Total
Albatrosses (Unidentified)	2	2
Fairy prion	1	1
Snares Cape petrel	1	1
Sooty shearwater	1	1
Grand Total	**5**	**5**

b) Dead protected species

Species	Caught on warp or door	Impact against vessel	Caught in net	Grand Total
Grey-backed storm petrel	-	1	-	1
Smaller albatrosses	1	-	-	1
Sooty shearwater	-	2	-	2
White-chinned petrel	-	-	1	1
Total	**1**	**3**	**1**	**5**

Inshore Fisheries

Inshore Trawl

Inshore fishing within the New Zealand EEZ is an immensely diverse activity, with large amounts of variation in individual practice and effort. In the case of trawl and bottom longline, it becomes difficult to draw a simple distinction between the inshore and offshore sectors, as a number of vessels make seasonal shifts across this artificial boundary. Individual vessels can range in size from just two metres in length to over 30 m. Equally, activity can range from 20 days per year to over 300 for each vessel. Overly simplified characterisation of the inshore sector is problematic and may lead to false conclusions about the fishery. Therefore, it is critical when gathering information on the inshore fishing sector to get as broad and representative coverage as possible.

Observer coverage of inshore fisheries has historically been low due to the inherent difficulties of placing observers on small vessels in remote ports. Additionally, many of the fishers only operate part time, either seasonally or sporadically. As a result, observers often spend much of their time on shore or travelling between ports.

Table 22 presents a summary of commercial fishing effort, observer effort and protected species captures in the inshore trawl fishery during the 2020/21 observer year. Commercial effort increased by 9% over 2020/21; coverage increased in the 2020/21 observer year, with an overall coverage of 7%, in comparison to 5% in the 2019/20 observer year (Weaver 2021).

Seabird interactions increased from 10 captures observed in 2019/20 to 31 captures in 2020/21 (Weaver 2021). Three marine mammal captures occurred in 2020/21 in comparison to four captures in 2019/20 (Weaver 2021). Two protected fish captures occurred, whereas none were caught the year prior (Weaver 2021). Coral bycatch decreased by 87% from 147.2 kgs in 2019/20 to 19.6 kgs in 2020/21 (Weaver 2021).

In summary, 64 observed trips were conducted aboard 40 vessels, with protected species captures occurring on 16 trips on board 12 vessels (25% of trips involved protected species captures and 30% of vessels that operated within this fishery during the 2020/21 year had protected species captures).

Table 22. Summary of the commercial effort, observer effort and protected species interactions in the inshore trawl fisheries during the 2020/21 observer year.

FMA	Effort Tows	Observed Tows	Coverage (%)	Seabird interactions	Seabirds /100 tows	Mammal captures	Mammals /100 tows	Protected fish captures	Protected fish /100 tows	Coral catch (kg)	Coral catch / 100 tows
1. AKE	4,377	458	10.5	16	3.5	-	-	-	-	17.1	3.7
2. CEE	5,244	320	6.1	1	0.3	1	0.3	-	-	-	-
3. SEC	9,091	673	7.4	10	1.5	1	0.1	-	-	1.4	0.2
4. SOE	67	-	0	-	-	-	-	-	-	-	-
5. SOU	2,900	196	6.8	3	1.5	-	-	-	-	-	-
6. SUB	-	-	-	-	-	-	-	-	-	-	-
7. CHA	8,541	1	0.01	-	-	-	-	-	-	-	-
8. CEW	1,617	-	0	-	-	-	-	-	-	-	-
9. AKW	2,392	661	27.6	1	0.2	1	0.2	2	0.3	1.1	0.2
Total	**34,229**	**2,309**	**6.8**	**31**	**1.3**	**3**	**0.1**	**2**	**0.1**	**19.6**	**0.8**

Table 23 reports the number of interactions by species and fate immediately post interaction.

Table 23. Protected species interactions in the inshore trawl fisheries during the 2020/21 observer year.

Species	Alive	Dead	Grand Total
Seabirds			
Australasian gannet	1	-	1
Black (Parkinson's) petrel	1	1	2
Common diving petrel	4	-	4
Flesh-footed shearwater	3	-	3
Grey petrel	2	-	2
Procellaria petrels	2	1	3
Salvin's albatross	2	-	2
Shearwaters	4	-	4
Sooty shearwater	4	5	9
White-capped albatross	-	1	1
Seabird Total	**23**	**8**	**31**
Marine Mammals			
New Zealand fur seal	-	2	2
Common dolphin	-	1	1
Marine Mammals Total	**-**	**3**	**3**
Protected fish			
White pointer shark	1	1	2
Protected fish Total	**1**	**1**	**2**
Grand Total	**24**	**12**	**36**

Tables 24a and b detail the method of interaction for each species. Capture in fishing gear accounted for 100% of mortalities.

Table 24. Method of interaction for a) protected species released alive and b) dead protected species observed in the inshore trawl fisheries during the 2020/21 observer year.

a) Protected species released alive

Species	Caught in fishing gear	Impact against vessel	Grand Total
Seabirds			
Australasian gannet	1	-	1
Black (Parkinson's) petrel	1	-	1
Common diving petrel	1	3	4
Flesh-footed shearwater	2	1	3
Grey petrel	-	2	2
Procellaria petrels	1	1	2
Salvin's albatross	1	1	2
Shearwaters	-	4	4
Sooty shearwater	4	-	4
Seabirds Total	**11**	**12**	**23**
Protected fish			
White pointer shark	1	-	1
Protected fish Total	1	**-**	1
Grand Total	**12**	**12**	**24**

b) Dead protected species

Species	Caught in fishing gear
Seabirds	
Black (Parkinson's) petrel	1
Procellaria petrels	1
Sooty shearwater	5
White-capped albatross	1
Seabirds Total	**8**
Marine mammals	
Common dolphin	1
New Zealand fur seal	2
Marine Mammals Total	**3**
Protected fish	
White pointer shark	1
Protected Fish Total	**1**
Grand Total	**12**

Inshore Setnet

Setnet fisheries have received low levels of observer coverage due to the difficulty of placing observers on board these generally very small vessels. However, in recent years increased monitoring has occurred in some areas, driven by Threat Management Plans for Hector's and Māui dolphins. Captures of a number of protected species have been reported in the past, including Hector's dolphins, yellow-eyed penguins, shags, sooty shearwaters and Westland petrels. Setnet is one of the few fisheries, like inshore trawl, dominated by vessels under 28 m, which do not have any regulated mitigation device requirements. As with inshore trawl, spatial closures have been put in place to reduce the risk of interaction with Hector's and Māui dolphins.

Observer coverage was initially low in this fishery but increased in 2008/09 due to concerns about Hector's dolphin bycatch. However, in recent years, the coverage has dropped again due to other priorities, such as observer coverage of inshore trawling on the west coast of the North Island and black petrel interactions in the Hauraki gulf.

Table 25 presents a summary of commercial fishing effort, observer effort and protected species captures in the fishery during the 2020/21 observer year. Fishing effort in 2020/21 increased by 18% from the 2019/20 fishing year, and overall observer coverage increased by 50% (Weaver 2021). The rate of seabird captures increased substaintially from seven interactions in 2019/20 to 27 observed seabird interactions in 2020/21 (Weaver 2021). The number of marine mammal captures increased from six in 2019/20 to 13 in 2020/21. Two protected fish were caught in observed sets in 2020/21 whereas none were observed by caught in 2019/20. The amount of coral bycaught in 2020/21 increased to 18 kg, compared to 3 kgs of corals bycaught in 2019/20 (Weaver 2021).

In summary, 19 observed trips were conducted aboard 12 vessels, with protected species captures occurring on 10 trips aboard eight vessels (53% of trips involved protected species captures and 67% of vessels that operated within this fishery during the 2020/21 year had protected species captures).

Table 25. Summary of commercial effort, observer effort and protected species interactions in the inshore setnet fishery during the 2020/21 observer year.

FMA	Effort Sets	Observed Sets	Coverage (%)	Seabird interactions	Seabirds /100 sets	Mammal captures	Mammals /100 sets	Protected fish captures	Protected fish /100 sets	Coral catch (kg)	Coral catch / 100 sets
1. AKE	5,416	-	-	-	-	-	-	-	-	-	-
2. CEE	866	-	-	-	-	-	-	-	-	-	-
3. SEC	4,105	580	14.1	23	4.0	3	0.5	-	c		-
4. SOE	1	-	-	-	-	-	-	-	-	-	-
5. SOU	1,314	229	17.4	4	1.7	8	3.5	2	0.9	18	7.9
6. SUB	-	-	-	-	-	-	-	-	-	-	-
7. CHA	317	-	-	-	-	-	-	-	-	-	-
8. CEW	545	105	19.3	-	-	2	1.9	2	1.9	-	-
9. AKW	6,339	-	-	-	-	-	-	-	-	-	-
Total	**18,903**	**914**	**4.8**	**27**	**3.1**	**13**	**1.4**	**4**	**0.4**	**18**	**2.0**

Table 26 reports the number of interactions with inshore setnet fishery by species and fate immediately post interaction. Fifty percent of the interactions in 2020/21 resulted in the mortalities.

Table 26. Protected species interactions in the inshore setnet fishery during the 2020/21 observer year.

Species	Alive	Dead	Grand Total
Cape petrels	2	-	2
Common diving petrel	1	-	1
Foveaux shag	-	2	2
Northern giant petrel	1	-	1
Otago shag	-	4	4
Pied shag	-	1	1
White-capped albatross	16	-	16
Seabird Total	**20**	**7**	**27**
Marine Mammals			
New Zealand fur seal	-	13	13
Marine Mammal Total	**-**	**13**	**13**
Protected Fish			
White pointer shark	**2**	2	4
Protected Fish Total	**2**	**2**	**4**
Grand Total	**22**	**22**	**44**

Tables 27a and b detail the method of interaction for each species. Net capture accounted for 100% of interactions.

Table 27. Method of interactions for a) protected species released alive and b) dead protected species observed in the setnet fishery during the 2020/21 observer year.

a) Protected species released alive

Species	Impact against vessel	Caught in net	Grand Total
Seabirds			
Cape petrels	-	2	2
Common diving petrel	1	-	1
Northern giant petrel	-	1	1
White-capped albatross	16	-	16
Seabird Total	**17**	**3**	**20**
Protected Fish			
White pointer shark	-	2	2
Protected Fish Total	**-**	**2**	**2**
Total	**17**	**5**	**22**

b) Dead protected species

Species	Caught in net
Seabirds	
Foveaux shag	2
Otago shag	4
Pied shag	1
Seabird Total	**7**
Marine Mammals	
New Zealand Fur Seal	13
Marine Mammals Total	**13**
Protected Fish	
White pointer shark	2
Protected Fish Total	**2**
Total	**22**

Surface Longline Fisheries

Domestic Tuna and Swordfish

The domestic tuna and swordfish fishery (targeting bigeye, southern bluefin and swordfish) has historically had low levels of observer coverage. This is primarily due to the inherent difficulties in placing observers on these small vessels, which generally work irregular patterns. Consequently, data on this fleet's interactions with protected species are poor. Southern bluefin tuna, bigeye tuna and swordfish were introduced into the quota system at the start of the 2004/05 fishing year. After a large capture event in November 2006, regulations were put in place requiring departure notices and seabird mitigation use (deployment of a streamer line and either line weighting or night setting). CSP has also distributed turtle de-hookers and line cutters to aid in the quick and efficient release of not only turtles, but also fur seals and a number of shark species.

Table 28 presents a summary of commercial fishing effort, observer effort and protected species captures in the fishery during the 2020/21 observer year. Commercial effort decreased by 15.8% in comparison to the previous year (2019/20). Overall observer coverage in domestic tuna and swordfish increased by 15.3% in 2020/21 in comparison to the previous observer year (2019/20).

There has been no increase in the number of seabird interactions in 2020/21 (there were 33 seabird interactions in 2019/20) (Weaver 2021). The number of marine mammal captures decreased by 49% from 33 observed interactions in the 2019/20 observer year to 19 in 2020/21 (Weaver 2021). The number of marine reptile captures increased substantially from three observed interactions in the 2019/20 observer year to 22 in 2020/21 (Weaver 2021). One protected fish capture was observed in 2020/21 in comparison to none the year prior.

In summary, 15 observed trips were conducted aboard 11 vessels, with protected species captures occurring on 11 trips aboard nine vessels (73% of trips involved protected species captures and 82% of vessels that were observed within this fishery during the 2020/21 year had protected species captures).

Table 28. Summary of commercial effort, observer effort and protected species interactions in the domestic tuna and swordfish fishery during the 2020/21 observer year.

FMA	Effort lines	Observed lines	Coverage (%)	Number of hooks observed	Seabird interactions	Seabirds /1000 hooks	Marine mammal captures	Marine mammals /1000 hooks	Reptile captures	Reptiles /1000 hooks	Protected fish captures	Protected fish / 1000 hooks
1. AKE	635	80	12.6	66,998	10	0.2	2	0.03	13	0.2	1	0.01
2. CEE	581	74	12.7	58,719	5	0.1	9	0.2	9	0.2	-	-
3. SEC	270	14	5.2	14,300	9	0.6	2	0.1	-	-	-	-
4. SOE	9	4	44.4	3,450	-	-	-	-	-	-	-	-
5. SOU	3	-	-	-	-	-	-	-	-	-	-	-
6. SUB	-	-	-	-	-	-	-	-	-	-	-	-
7. CHA	261	33	12.6	36,043	9	0.3	6	0.2	-	-	-	-
8. CEW	1	-	-	-	-	-	-	-	-	-	-	-
9. AKW	139	9	6.5	8,140	-	-	-	-	-	-	-	-
Total	**1,899**	**214**	**11.3**	**187,650**	**33**	**0.2**	**19**	**0.1**	**22**	**0.1**	**1**	**0.0**

Table 29 reports the number of interactions by species and fate immediately post interaction. Leatherback turtles were the most common protected species interaction in the 2020/21 observer year (27% of all interactions). Overall, 31% of protected species interactions resulted in mortalities.

Table 29. Protected species interactions in the domestic tuna and swordfish fishery during the 2020/21 observer year.

Species	Alive	Dead	Grand Total
Seabirds			
Australasian gannet	1	-	1
Black (Parkinson's) petrel	6	2	8
Buller's albatross	-	1	1
Buller's and Pacific albatross	1	-	1
Buller's shearwater	1	-	1
Flesh-footed shearwater	1	-	1
Smaller albatrosses	-	1	1
Storm petrels	1	-	1
Wandering albatross (Unidentified)	1	-	1
Westland petrel	-	1	1
White-capped albatross	3	8	11
White-chinned petrel	1	4	5
Seabird Total	**16**	**17**	**33**
Marine Mammals			
Common dolphin	1	-	**1**
New Zealand fur seal	15	2	**17**
Orca	1	-	**1**
Marine Mammal Total	**17**	**2**	**19**
Reptiles			
Green turtle	1	-	**1**
Leatherback turtle	18	2	**20**
Olive ridley turtle	-	1	**1**
Reptile Total	**19**	**3**	**22**
Protected Fish			
Manta ray	-	1	1
Protected Fish Total	**-**	**1**	**1**
Grand Total	**52**	**23**	**75**

Tables 30a and b detail the method of interaction for each species. Fishing gear capture accounted for 100% of mortalities.

Table 30. Method of interaction for a) protected species released alive, and b) dead protected species observed in the domestic tuna and swordfish fishery during the 2020/21 observer year.

a) Protected species released alive

Species	Caught in fishing gear	Caught in mitigation device	Impact against vessel	Grand Total
Seabirds				
Australasian gannet	1	-	-	**1**
Black (Parkinson's) petrel	6	-	-	**6**
Buller's and Pacific albatross	-	-	1	**1**
Buller's shearwater	-	-	1	**1**
Flesh-footed shearwater	1	-	-	**1**
Storm petrels	-	-	1	**1**
Wandering albatross (Unidentified)	1	-	-	**1**
White-capped albatross	3	-	-	**3**
White-chinned petrel	-	1	-	**1**
Seabird Total	**12**	**1**	**3**	**16**
Marine Mammals				
Common dolphin	1	-	-	**1**
New Zealand fur seal	14	1	-	**15**
Orca	1	-	-	**1**
Marine Mammal Total	**16**	**1**	**-**	**17**
Reptiles				
Green turtle	1	-	-	**1**
Leatherback turtle	18	-	-	**18**
Reptile total	**19**	**-**	**-**	**19**
Grand Total	**47**	**2**	**3**	**52**

b) Dead protected species

Species	Caught in fishing gear
Black (Parkinson's) petrel	2
Buller's albatross	1
Smaller albatrosses	1
Westland petrel	1
White-capped albatross	8
White-chinned petrel	4
Seabird Total	**17**
Marine Mammals	
New Zealand fur seal	2
Marine Mammal Total	**2**
Reptiles	
Green turtle	2
Olive ridley turtle	1
Reptile Total	**3**
Protected Fish	
Manta ray	1

Protected Fish Total	**1**
Total	**23**

Bottom Longline Fishery

Deepwater Bottom Longline

The offshore bottom longline fishery is observed to monitor seabird and marine mammal interactions. A relatively small fleet conducts a large amount of fishing effort in terms of the overall hook set. Regulations on this fishery require the use of tori lines and either night-setting or line weighting. Other industry applied mitigation techniques include gas cannons and offal and bait discard management.

Previously, the deepwater bottom longline fishery has been characterised as all bottom longline vessels over 34 m in length, and all vessels between 20-34 m that set over 5000 hooks/day. To align reporting with FNZ, the deepwater bottom longline fishery will now be defined as: Vessels 20 m in overall length and greater, and all autoliners.

Table 31 presents a summary of commercial fishing effort, observer effort and protected species captures in the deepwater bottom longline fishery during the 2020/21 observer year. Commercial effort increased by 5.5% and overall observer coverage decreased by 25% in 2020/21. The number of seabirds captured in this fishery decreased from 86 captures in 2019/20 (Weaver 2021) to 34 observed interactions in 2020/21. The total coral bycatch observed in 2020/21 increased to 3 kg, compared to 2.5 kg in 2019/20 (Weaver 2021).

In summary, six observed trips were conducted aboard six vessels, with protected species captures occurring on six trips aboard six vessels (100% of trips involved protected species captures on 100% of vessels that were observed within this fishery during the 2020/21 year).

Table 31. Summary of commercial effort, observer effort and protected species interactions in the offshore bottom longline fishery during the 2020/21 observer year.

FMA	Effort lines	Observed lines	Coverage (%)	Number of hooks observed	Seabird interactions	Seabirds /1000 hooks	Coral catch (kg)	Coral catch / 1000 hooks
1. AKE	293	-	-	-	-	-	-	-
2. CEE	213	-	-	-	-	-	-	-
3. SEC	593	66	11.1	513,994	1	0.002	-	-
4. SOE	1826	105	5.8	963,191	16	0.02	-	-
5. SOU	270	-	-	-	-	-	-	-
6. SUB	816	74	9.1	899,487	1	0.001	-	-
7. CHA	1774	148	8.3	214,646	16	0.07	3	0.01
8. CEW	91	-	-	-	-	-	-	-
9. AKW	418	-	-	-	-	-	-	-
Total	**6,294**	**393**	**6.2**	**2,591,318**	**34**	**0.01**	**3**	**0.01**

Table 32 reports the number of interactions in the offshore bottom longline fishery by species and fate immediately post interaction. White-chinned petrels were the most commonly bycaught protected species, comprising 65% of all captures.

Table 32. Protected species interactions in the offshore bottom longline fishery during the 2020/21 observer year.

Species	Alive	Dead	Grand Total
Buller's albatross	-	1	1
Fairy prion	2	-	2
Grey-backed storm petrel	-	1	1
Procellaria petrels	3	-	3
Sooty shearwater	-	1	1
Southern royal albatross	1	-	1
Wandering albatross (Unidentified)	1	-	1
Westland petrel	5	1	6
White-chinned petrel	-	18	18
Total	**12**	**22**	**34**

Table 33a details the method of interaction for each species.

Table 33. Method of interaction for a) protected species released alive, and b) dead protected species observed in the offshore bottom longline fishery during the 2020/21 observer year.

a) Protected species released alive

Species	Caught in fishing gear	Deck impact/strike	Grand Total
Fairy prion	-	2	2
Procellaria petrels	3	-	3
Southern royal albatross	-	1	1
Wandering albatross (Unidentified)	1	-	1
Westland petrel	1	4	5
Total	**5**	**7**	**12**

b) Dead protected species

Species	Caught in fishing gear	Deck impact/strike	Grand Total
Buller's albatross	1	-	1
Grey-backed storm petrel	-	1	1
Sooty shearwater	1	-	1
Westland petrel	1	-	1
White-chinned petrel	18	-	18
Total	**21**	**1**	**22**

Inshore Bottom Longline

As with other inshore fishing methods, observer coverage in the inshore bottom longline fishery has generally been limited. In the past, coverage has been focused on certain time periods in selected ports or regions. Mitigation techniques used and tested (to varying extents) in this fishery include: weighting regimes, night setting, use of tori lines and use of fish oil to deter birds. Since 2008, regulations on mitigation were introduced for all bottom longline vessels, requiring night setting or line weighting, tori line, and offal/discard management.

Bottom longline vessels tend to fish over wide areas with fishing activity occurring in all FMAs and ranging from 'inshore' to the Chatham rise. These fishing grounds overlap with a number of protected species' ranges, including a number of petrel and albatross species.

Previously, the inshore bottom longline fishery has been characterised as all bottom longline vessels under 20 m, and all vessels between 20-34 m in length that set 5000 hooks or less/day. To align reporting with FNZ, the inshore bottom longline fishery will now be defined as: Vessels under 20 m in overall length, excluding autoliners.

Table 34 presents a summary of commercial fishing effort, observer effort and protected species captures in the fishery during the 2020/21 observer year. In comparison to the previous observer year, commercial effort increased by 9% and overall observer coverage increased by 136% in 2020/21. The number of seabirds captured in this fishery increased substantially with 37 observed interactions in 2020/21 in comparison to five captures in 2019/20 (Weaver 2021). The total coral bycatch observed in 2020/21 was 3.4 kgs, compared to no coral bycatch observedin 2019/20 (Weaver 2021).

In summary, 16 observed trips were conducted aboard 14 vessels, with protected species captures occurring on eight trips aboard seven vessels (50% of these trips involved protected species captures and 50% of vessels that were observed within this fishery during the 2020/21 year had protected species captures).

Table 34. Summary of commercial effort, observer effort and protected species interactions in the inshore bottom longline fisheries during the 2020/21 observer year.

FMA	Effort lines	Observed lines	Coverage (%)	Number of hooks observed	Seabird interactions	Seabirds /1000 hooks	Coral catch (kg)	Coral catch / 1000 hooks
1. AKE	1,042	54	5.2	75,840	22	0.29	-	-
2. CEE	2,959	14	0.5	14,300	-	-	-	-
3. SEC	208	97	46.6	76,892	2	0.026	2.1	0.003
4. SOE	496	-	-	-	-	-	-	-
5. SOU	629	52	8.3	38,140	2	0.05	0.6	0.002
6. SUB	-	-	-	-	-	-	-	-
7. CHA	757	98	12.9	78,314	9	0.1	0.7	0.001
8. CEW	489	2	0.4	2,100	-	-	-	-
9. AKW	1,025	75	7.3	39,670	2	0.05	-	-
Total	**7,605**	**392**	**5.2**	**325,256**	**37**	**0.1**	**3.4**	**0.001**

Table 35 reports the number of interactions by species and fate immediately post interaction. Flesh-footed shearwaters were the most commonly bycaught protected species, comprising 51% of all captures.

Table 35. Protected species interactions in the inshore bottom longline fisheries during the 2020/21 observer year.

Species	Alive	Dead	Grand Total
Black (Parkinson's) petrel	3	1	4
Buller's and Pacific albatross	1	-	1
Flesh-footed shearwater	17	2	19
Grey petrel	-	1	1
Northern giant petrel	1	-	1
Sooty shearwater	3	-	3
Westland petrel	-	8	8
Total	**25**	**12**	**37**

Table 36 details the method of interaction for each species.

Table 36 Method of interaction for a) protected species released alive, and b) dead protected species observed in the inshore bottom longline fishery during the 2020/21 observer year.

a) Protected species released alive

Species	Caught in fishing gear	Deck impact/strike	Grand Total
Black (Parkinson's) petrel	2	1	3
Buller's and Pacific albatross	-	1	1
Flesh-footed shearwater	17	-	17
Northern giant petrel	-	1	1
Sooty shearwater	1	2	3
Total	**20**	**5**	**25**

b) Dead protected species

Species	Caught in fishing gear	Caught in mitigation device	Grand Total
Black (Parkinson's) petrel	1	-	1
Flesh-footed shearwater	2	-	2
Grey petrel	1	-	1
Westland petrel	7	1	8
Total	**11**	**1**	**12**

Bottom Longline - Snapper

Throughout the past ten years, observer coverage has been irregular in the snapper fishery, fluctuating between < 1% up to 8%. This fishery is predominantly conducted in the AKE FMA by vessels under 20 m in length.

Table 37 presents a summary of commercial fishing effort, observer effort and protected species captures in the fishery during the 2020/21 observer year. In comparison to 2019/20, there was a 25% increase in commercial fishing effort, and overall observer coverage of the fishery decreased by 33% in 2020/21. In the 2020/21 observer year, 31 seabird captures were observed, in comparison to 15 captures in 2019/20 (Weaver 2021). Protected fish captures increased from one in 2019/20 to four in 2020/21. One marine mammal capture occurred in 2020/21 with none the year prior. Coral bycatch increased from 1.6 kgs in 2019/20 to 3.1 kgs in 2020/21.

In summary, 20 observed trips were conducted aboard 16 vessels, with protected species captures occurring on nine trips aboard eight vessels (45% of these trips involved protected species captures and 50% of vessels that were observed within this fishery during the 2020/21 year had protected species captures).

Table 37. Summary of commercial effort, observer effort and protected species interactions in the snapper bottom longline fishery during the 2020/21 observer year.

FMA	Effort lines	Observed lines	Coverage (%)	Number of hooks observed	Seabird interactions	Seabirds /1000 hooks	Protected Fish captures	Protected Fish /1000 hooks	Marine mammal interactions	Marine mammals / 1000 hooks	Coral catch (kg)	Coral catch /1000 hooks
1. AKE	5,140	233	4.5	674,022	31	0.05	4	0.06	1	0.01	3.1	0.0005
2. CEE	15	-	-	-	-	-	-	-	-	-	-	-
3. SEC	-	-	-	-	-	-	-	-	-	-	-	-
4. SOE	-	-	-	-	-	-	-	-	-	-	-	-
5. SOU	-	-	-	-	-	-	-	-	-	-	-	-
6. SUB	-	-	-	-	-	-	-	-	-	-	-	-
7. CHA	20	-	-	-	-	-	-	-	-	-	-	-
8. CEW	11	-	-	-	-	-	-	-	-	-	-	-
9. AKW	267	-	-	-	-	-	-	-	-	-	-	-
Total	**5,453**	**233**	**4.2**	**674,022**	**31**	**0.05**	**4**	**0.06**	**1**	**0.01**	**3.1**	**0.0005**

Table 38 reports the number of interactions by species and fate immediately post interaction. Flesh-footed shearwaters were the most commonly bycaught protected species, comprising 67% of all captures.

Table 38. Protected species interactions in the snapper bottom longline fishery during the 2020/21 observer year.

Species	Alive	Dead	Grand Total
Black (Parkinson's) petrel	1	-	1
Common diving petrel	1	-	1
Flesh-footed shearwater	24	4	28
Red-billed gull	1	-	1
Seabird total	**27**	**4**	**31**
Marine mammals			
Common dolphin	-	1	1
Marine mammals total	**-**	**1**	**1**
Protected fish			
White pointer shark	4	-	4
Protected fish total	**4**	**-**	**4**
Grand Total	**31**	**5**	**36**

Table 39 details the method of interactions for each species. The four flesh-footed shearwaters and common dolphin that died due to the interaction were caught in fishing gear.

Table 39. Method of interaction for observed protected species released alive in the snapper bottom longline fishery during the 2020/21 observer year.

Species	Caught in fishing gear	Deck impact / strike	Grand Total
Black (Parkinson's) petrel	1	-	1
Flesh-footed shearwater	-	1	1
Red-billed gull	24	-	24
Sooty shearwater	1	-	1
Seabird total	**26**	**1**	**27**
Protected fish			
White pointer shark	4	-	4
Grand Total	**30**	**1**	**31**

Purse Seine Fisheries

Skipjack Tuna

In July 2011, the spine-tailed devil ray (*Mobula mobular*) and manta ray (*Manta birostris*) became fully protected under Schedule 7A of the Wildlife Act (1953). Since these two species of rays are caught in purse seine fisheries for tuna in New Zealand and worldwide, CSP observer coverage of the purse seine fishery began in the 2011/12 observer year.

Table 40 presents a summary of commercial fishing effort, observer effort and protected species captures in the skipjack tuna purse seine fisheries fishery during the 2020/21 observer year. Seabird and mammal captures are mostly non-existent or very low in this fishery (Clemens-Seely et al. 2014, Clemens-Seely & Hjorvarsdottir, 2016, Hjorvarsdottir 2017, Hjorvarsdottir & Isaacs 2018, Weaver 2019). Two seabird captures were observed in 2020/21, and 33 captures of spine-tailed devil rays were observed.

In summary, four observed trips were conducted aboard four vessels, with protected species captures occurring on two trips/vessels (50% of these trips involved protected species captures and 50% of vessels that were observed within this fishery during the 2020/21 year had protected species captures).

Table 40. Summary of commercial effort, observer effort and protected species interactions in the skipjack tuna purse seine fisheries during the 2020/21 observer year.

FMA	Effort tows	Observed tows	Coverage (%)	Seabird captures	Seabirds /100 tows	Protected fish captures	Protected fish /100 tows
1. AKE	211	61	28.9	2	3.3	15	24.6
2. CEE	-	-	-	-	-	-	-
3. SEC	-	-	-	-	-	-	-
4. SOE	-	-	-	-	-	-	-
5. SOU	-	-	-	-	-	-	-
6. SUB	-	-	-	-	-	-	-
7. CHA	16	-	-	-	-	-	-
8. CEW	4	-	-	-	-	-	-
9. AKW	29	9	31	-	-	18	200
Total	**260**	**70**	**26.9**	**2**	**2.9**	**33**	**47**

Table 41reports the number of interactions by species and fate immediately post interaction. No mortalities were observed in this fishery in mortalities in 2020/21.

Table 41. Protected species interactions in the skipjack tuna purse seine fisheries during the 2020/21 observer year.

Species	Alive	Grand Total
Common diving petrel	1	1
Fairy prion	1	1
Spine-tailed devil ray	33	33
Total	**35**	**35**

Mackerel & Other

The purse seine fishery targeting English mackerel, jack mackerel, kahawai, pilchard, snapper, trevally and other minor species is observed independently from the purse seine fishery targeting skipjack tuna because of temporal differences in fishing seasons as well as some differences in fishing practices and net construction.

Table 42 presents a summary of commercial fishing effort and observer effort in this fishery during the 2020/21 observer year. One seabird capture, one spine-tailed devil ray capture and four common dolphin captures were observed in 2020/21.

In summary, three observed trips were conducted aboard three vessels, with protected species captures occurring on three trips/vessels (100% of these trips involved protected species captures and 100% of vessels that were observed within this fishery during the 2020/21 year had protected species captures).

Table 42. Summary of commercial effort, observer effort and protected species interactions in the purse seine fisheries during the 2020/21 observer year.

FMA	Effort tows	Observed tows	Coverage (%)	Seabird captures	Seabirds /100 tows	Marine mammal captures	Marine mammals /100 tows	Protected fish captures	Protected fish /100 tows
1. AKE	492	72	14.6	1	1.4	4	1.4	1	1.4
2. CEE	24	-	-	-	-	-	-	-	-
3. SEC	-	-	-	-	-	-	-	-	-
4. SOE	-	-	-	-	-	-	-	-	-
5. SOU	-	-	-	-	-	-	-	-	-
6. SUB	-	-	-	-	-	-	-	-	-
7. CHA	7	-	-	-	-	-	-	-	-
8. CEW	8	-	-	-	-	-	-	-	-
9. AKW	-	-	-	-	-	-	-	-	-
Total	**531**	**72**	**13.6**	**1**	**1.4**	**4**	**5.6**	**1**	**1.4**

Table 43 reports the number of interactions in the purse seine fisheries by species and fate immediately post interaction. No mortalities were observed in this fishery in mortalities in 2020/21.

Table 43. Protected species interactions in the purse seine fisheries during the 2020/21 observer year.

Species	Alive	Grand Total
Common dolphin	4	4
Prions (Unidentified)	1	1
Spine-tailed devil ray	1	1
Total	**6**	**6**

Troll - Albacore

The troll fishery in New Zealand targets albacore tuna over the summer period (December – May), primarily on the west coasts of the North and South Islands. Roughly 90% of albacore tuna caught in New Zealand are caught using this method. Vessels in the fishery are typically 12-24 m in length, operating with crews of two to five. Being seasonal, albacore fishing usually forms one of several fishing activities for the vessels involved.

Commercial albacore trollers in New Zealand tow 12-18 lines simultaneously from the vessel's stern and from long outrigger poles mounted amidships. The line lengths or depths are adjusted to permit hauling of any one line without tangling or interfering with the others.

Observer coverage in this fishery has occurred opportunistically in the past.

In summary, three observed trips were conducted aboard three vessels with no protected species captures occurring.

Pot fisheries- Ling

Pot fishing can present many advantages to other fishing methods in its ability to reduce bycatch and impact on the seafloor. Whilst its use in fisheries such as rock lobster (and many other species) is well established, the potting method has also proven to be a viable harvesting method for the large bottom-dwelling fish ling. There is interest in this method being utilised for further target species also e.g., scampi, gurnard and rig.

Observer coverage in the pot fishery has occurred sporadically in the past alongside set net coverage. Interactions with seabirds and marine mammals are relatively low, though pot lines can create an entanglement risk. There are no current mitigation methods for this fishery.

In summary, four observed trips were conducted aboard three different vessels, with no protected species captures occurring.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $1,441,281. Services were provided by Fisheries New Zealand Observer Services.

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

Overall objective

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

Specific objectives

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

Rationale

Large numbers of seabirds frequent New Zealand waters. Seabirds with significant differences in conservation status can appear morphologically similar. The accurate determination of the taxon of seabirds captured in New Zealand fisheries is vital for examining the potential threat to population viability posed by incidental fisheries captures. Observers on commercial fishing vessels are not always able to identify seabirds at sea with high precision and the assessment of the age-class, sex and provenance of captured individuals requires necropsy in most cases. Historically all dead seabird specimens collected by observers have been returned for necropsy where possible. However, in many cases, the taxon can be confirmed through expert examination of photographs taken by observers, and this can be achieved at a lower cost than returning carcasses and performing necropsies. In order to maximise cost efficiencies, a new protocol has been developed to determine which specimens are returned for full necropsy. This protocol aims to strike a balance between returning birds for full necropsy (for rarer species and in less observed fisheries) and photographing birds for determination of taxon (for commonly caught species in well observed fisheries). A new addition to this protocol is the collection of feather samples from bycaught seabirds to allow genetic determination of identification for difficult species groups.

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

Information gained through this project will link into Fisheries New Zealand databases and will inform seabird bycatch estimates, ongoing risk assessments, research and modelling of the effects of fisheries bycatch on seabird populations. Furthermore, the mode of capture and associated information will

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

Project status

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

Summary of the methods and key findings

Between 1 July 2020 and 30 June 2021, a total of 651 seabirds were reported as incidental interactions with commercial fishing vessels by on-board New Zealand Government observers; of these 187 were returned for necropsy and 464 were interactions (photographed (n = 190) or non-photographed (n = 274)) as deceased or alive captures.

187 individual seabirds, grouped into 18 species, were incidentally killed as bycatch and returned for necropsy. Seabirds were returned from 52 individual vessels, comprised of 14 longline (n = 49 seabirds), 35 trawl (n = 133 seabirds), and three set net (n = 5 seabirds) vessels, and were dominated numerically by five bycatch species: white-chinned petrel (n = 48, 25.7%), New Zealand white-capped albatross (n = 34, 18.2%), sooty shearwater (n = 25, 13.4%), Salvin's albatross (n = 20, 10.7%) and Buller's albatross (n = 18, 9.6%). These five species accounted for 77.5% of all returns. All birds returned from longline fisheries had injuries consistent with being hooked in the bill, throat, or wing. Most birds returned from trawl fisheries were caught through entanglement in the net, cod-end, or pound (75.9%), with 16.5% likely to have specifically interacted with the warp. The cause of death for seven birds was deck strike on trawl vessels. Birds had a lower mean body fat score in comparison to birds from the previous two survey years. Discards, including offal, appear to continue to be an attractant for many seabirds.

In addition to the seabirds that were returned for necropsy, examination of the Ministry for Primary Industries (MPI) Central Observer Database (COD) and images provided by Government observers gave a total of a further 464 seabirds that were reported as interactions or photographed (as dead or alive captures) aboard 63 fishing vessels. The majority (64.9%) of the seabirds reported in these interactions and photographs were released alive. Out of these 464 records of seabird interactions, photographs were taken of 190 seabirds consisting of 18 species. Image quality varied widely, with poor images being particularly common for birds that were alive and seen on-board for short periods. Images of dead birds have improved with multiple images taken for each specimen.

Recommendations

- Wherever possible, all seabird interactions are photographed and recorded. If possible, haul and sample information should be included in the image.
- Images (with scale if possible) include the head and bill from the side and above, body (full body and side shots), wings (above and below) and shots of the feet whenever possible. This is particularly important for dead birds.
- Photo logs are completed for all images (which can be correlated to date and time stamps from the camera). Cameras are programmed to show correct date and time. Descriptions of the interaction would also help with the identification and matching of images.
- Photograph numbers are recorded on the observer non-fish bycatch form.
- Photographs (and extracts from the MPI observer logbooks) are provided regularly throughout the fishing year for photo-identification.
- Training and instruction on the use of the cameras and on how to take suitable photographs for identification use (i.e. number of images, type of images, date, and time stamps etc.) is provided for all observers.

Project logistics summary statement

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

Review milestones

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

Citation

Bell, E. & Larcombe, S. 2022. Identification of seabirds caught in New Zealand fisheries, 1 July 2020 to 30 June 2021. INT2019-02 final annual report prepared by WMIL for the Conservation Services Programme, Department of Conservation. 40 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/201920-annual-plan/int2019-02-seabird-id-1-july-2020-30-june-2021-final-report.pdf

2.3 INT2019-03 Characterisation of marine mammal interactions

Specific objectives

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

Rationale

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

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

Project status

Complete.

Summary of the methods and key findings

Marine mammals are incidentally caught in trawl, longline, set net, pots (and traps) and purse seine fisheries. The current study characterised marine mammal interactions with these fisheries from 1992–93 to 2017–18 and reviewed potential mitigation techniques.

Across fisheries, trawl had the highest number of observed captures when aggregated by species and gear, followed by surface longline. Trawl fisheries displayed high variability in observed capture rates amongst regions and target species. Post-capture survival was the highest for surface-longline fisheries, and almost all were recorded as live releases. In contrast, post-capture survival was lowest for trawl fisheries, where almost all were recorded as deceased.

The highest number of observed captures was pinnipeds, with New Zealand fur seal featuring the most frequently in observer records for trawl and surface longline. New Zealand sea lion was almost exclusively caught in trawl. Common dolphin was the most frequently recorded cetacean species in the observer data, followed by long-finned pilot whale and dusky dolphin. The current characterisation also identified four specific associations between species and fisheries that resulted in significant numbers of captures: common dolphin and large[1]vessel trawl fisheries targeting jack mackerel, Hector's and Māui dolphins and set-net fisheries, New Zealand sea lion and trawl fisheries targeting

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

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

squid, and New Zealand fur seal and trawl fisheries targeting southern blue whiting. Most of these fisheries have implemented mitigation measures over the study period, and reductions in observed and estimated captures were evident for all of these species in the time-series data.

Currently, the ability to assess and estimate the extent of captures relies on comprehensive observations of fishing effort via the fisheries observer programme. The current analysis revealed that observer coverage was low overall across gears, particularly inshore trawl, although there were increases in some fisheries with high marine mammal capture rates in recent years. Findings from this research highlight the challenges of finding suitable mitigation methods, testing the efficacy and effectiveness of different measures in use to reduce bycatch (e.g. exclusion, and acoustic deterrent devices), and documents the limitations of many approaches; they also show that successful mitigation techniques are often species- and fishery-specific.

Recommendations

This project aimed to analyse data on bycatch of marine mammals in commercial fisheries and identify and assess current mitigation technique. The recommendations on mitigation measures are tabled by fisheries type within the report.

Project logistics summary statement

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

Review milestones

- Draft final report made available on the CSP webpage in August 2020
- Final report made available on the CSP webpage in December 2022

Citation

Tremblay-Boyer, L; Berkenbusch, K. 2022. Characterisation of marine mammal interactions with fisheries & bycatch mitigation. INT2019-03 final report prepared by Dragonfly Data Science for the Department of Conservation, Wellington. 67 p.

Weblink

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

Overall objective

Identify coral bycatch that cannot be identified by fisheries observers to the finest taxonomic level (assign codes to coral specimens to the species level wherever possible, when this is not possible, identify specimens to genus or family level).

Specific objectives

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

Rationale

The 2010 amendment of Schedule 7A of the Wildlife Act 1953 protects all hard corals, including: black corals (all species in the order Antipatharia); gorgonian corals (all species in the order Alcyonacea (previously known as Order Gorgonacea)); stony corals (all species in the order Scleractinia); and hydrocorals (all species in the family Stylasteridae). Identifying coral bycatch that cannot be identified by fisheries observers to the finest taxonomic level provides vital baseline information that can help to better inform research and marine protection such as predictive modelling, benthic risk assessments and management of benthic marine protected species.

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

Project status

This is a multi-year project that is due for completion in May 2023. The reporting for 2020-21 is complete.

Summary of the methods and key findings

A total of 43 physical specimens in 32 samples were collected by Observers and returned for identification during the period 1 July 2020 to 30 June 2021. Sub-samples from each live specimen were taken for future genetic studies (n=29). Additionally, there were three historical physical samples collected by Observers with revised higher-level identifications made during the reporting period. A total of 19 research trawl-collected specimens in 15 samples are also reported here.

There were 251 specimens identified from digital images of catch reported as coral during the reporting period; 213 were protected coral taxa, and while Observers provided a label showing trip and tow number information for only 18 of the 257 processed images, all were able to be georeferenced. The remaining images were of non-protected corals.

The greatest number of protected coral specimen counts by images came from the SOU Southland (FMA5) and SOE South East (FMA4) regions. Most were taken by bottom trawl operations targeting the deep-sea species orange roughy, and set net operations targeting school shark. Similarly, most protected corals identified from physical specimens came from SOE South-East (FMA4) bottom trawl operations targeting orange roughy.

Recommendations

It is recommended that digital Images need to be taken with a label that includes trip and station data, and the coral specimen, or a sub-sample of the specimen, the MPI number, and a species code. This information helps experts verify the identification. The MPI sample number and the initial Observer three-letter identification code are crucial components in the data matching process used for updating the COD database with the expert ID of the physical specimens. For ease of database updates, it is recommend that the initial MPI sample number and three-letter code written on the specimen label corresponds to the sample number and code on the benthic form. If Observers decide to change their identification code at a later date while filling out electronic or paper catch forms, they should also amend the specimen labels to match the benthic forms.

Project logistics summary statement

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

Review milestones

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

Citation

Macpherson, D., Tracey, D. and Mills, S. (2022). Identification and storage of cold-water coral bycatch specimens 1 July 2020 - 30 June 2021. INT2019-04 final report prepared by NIWA for Department of Conservation. 49 pp.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/201920-annual-plan/int2019-04-identification-and-storage-of-cold-water-coral-bycatch-specimens-2020-21.pdf

2.5 INT2020-02 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 objective

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

Rationale

The accurate determination of the taxon of marine mammals, turtles and protected fish captured in New Zealand fisheries is vital for examining the potential threat to population viability posed by incidental fisheries captures. Observers on commercial vessels are not always able to identify marine mammals, turtles and protected fish at sea with high precision, and the assessment of the age-class may require expert knowledge. Information gained through this project will link to Fisheries New Zealand databases and will inform ongoing bycatch estimation, risk assessment, research and modelling of the effects of fisheries bycatch on marine mammals, turtles and protected fish populations. This project is designed to complement the existing seabird and coral identification projects. Observers routinely collect samples of genetic material from these taxa, these can be used to resolve uncertain identification determinations from photographs.

Project status

This is a multi-year project that is due for completion in December 2023. The reporting for 2020-21 is complete.

Summary of the methods and key findings

Marine mammals

There were 116 marine mammal bycatch events reported between 1 July 2020 to 30 June 2021. Of these events, 94 (81%) had either photos or videos that could be assessed to confirm taxa identification and other information. The remaining 22 (19%) events had no photos associated with them and were therefore not able to be assessed.

Taxa identification by observers was confirmed as correct in all events where reasonable quality photos were available.

Protected fish and reptiles

There were 74 protected fish and reptile bycatch events reported between 1 July 2020 to 30 June 2021. Of these events, 18 (24%) had either photos or videos that could be assessed to confirm taxa identification and other information. The remaining 56 (42%) events had either poor quality photos, or no photos at all associated with them, and were therefore not able to be assessed.

Taxa identification by observers was confirmed as correct in 94% of events where reasonable quality photos were available.

Recommendations

- Better photos should be taken to allow for more reliable age class determinations and if accurate ages are required, then tooth samples should be collected and processed.
- The instructions provided to observers should be reviewed and an increased effort should be made to collect a full range of good quality photos from all interaction events.
- Additional training and/or training materials should be made available to observers to help with sex determination. If an accurate sex determination is required, then consideration should be given to using DNA molecular methods from samples collected from each individual.

Project logistics summary statement

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

Review milestones

- Draft final report made available on the CSP webpage in April 2022
- Final report made available on the CSP webpage in October 2022

Citation

Johnston O, Childerhouse S (2022). Identification of marine mammals captured in New Zealand fisheries 2020-21. INT2020-02 final report prepared by Cawthron Institute for the Department of Conservation. 18 pp.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202021-annual-plan/int2020-02-identification-of-marine-mammals-captured-in-new-zealand-fisheries-2020-21.pdf

3. Population Projects

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

Specific objectives

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

Rationale

New Zealand sea lions are classified as Nationally Critical (Baker et al. 2010) and are incidentally killed each year in southern commercial trawl fishing operations targeting species including squid, scampi and southern blue whiting. The foraging areas of New Zealand sea lions at the Auckland Islands have been shown to overlap with commercial trawl fishing activity, particularly SQU6T and SCI6A. Approximately 70% of New Zealand sea lions breed at the Auckland Islands, where population data has been collected since the mid-1990s, including estimates of pup production and re-sighting of marked animals. Since 2001 there has been a considerable decline in pup production at the Auckland Islands. A literature review to identify potential indirect effects of commercial fishing on the Auckland Islands population as part of CSP project POP2010-01 highlighted a number of key information gaps that currently prevent a full understanding of any such potential indirect effects, including time series data of population dynamics as collected in this project. CSP project POP2012-02 analysed population data collected during previous years in order to determine the key demographic factors driving the observed population decline of New Zealand sea lions at the Auckland Islands. It found that low pupping rates, a declining trend in cohort survival to age 2 and low adult survival may explain declining pup counts in one studied population (Roberts et al. 2014).

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

Project status

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

Summary of the methods and key findings

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

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

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

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

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

Recommendations

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

- Trial mark-recapture at Shoal Point next year, marking pups at the edge of colony and letting them mix overnight.
- Optimise necropsies to get better data on causes of pup mortality at Campbell Island.
- Add to work plan structured and regular surveys at Paradise Point, Campbell Island and a designed survey for other areas.

Project logistics summary statement

This project was 90% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $100,000 over four years. Services were provided by internally recruited staff.

Review milestones

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

Citation

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

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

Weblink

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

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

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

Specific objectives

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

Rationale

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

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

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

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

Project status

Complete.

Summary of the methods and key findings

During the 2020/21 season 270 and 290 study burrows were monitored on Ohinau and Lady Alice Islands respectively. The breeding success (burrows with an egg that produce a chick that is likely to survive to fledging) on Ohinau Island was 58%, similar to the 62% measured in the 2018/19 season. Breeding success on Lady Alice Island was 48%, which was also similar to the 52% measured in 2018/19. There were no detectable differences in breeding success between study and burrowscope (control) burrows indicating no impact of handler disturbance. We were able to identify 80% of the birds in breeding study burrows on Ohinau Island and 75% in burrows on Lady Alice Island. An additional 315 and 148 flesh-footed shearwaters were banded on Ohinau and Lady Alice Islands respectively.

Burrow transects were carried out on Coppermine and Whatupuke Islands to gather data for an updated population estimate each island. Taranga island was also surveyed to confirm the presence/absence of flesh-footed shearwaters. We estimate that there are a total of 2,869 (2,142 – 3,597, 95% CI) occupied burrows on Coppermine Island and 1125 (647 – 1,603, 95% CI) occupied burrows on Whatupuke Island. No flesh-footed shearwaters were detected on Taranga and this confirms they are absent from the island.

Recommendations

In regards to the established monitoring locations, we recommend that:

- Population monitoring on Ohinau and Lady Alice Islands be continued with 200 breeding study burrows monitored annually.
- The number of burrowscope only burrows monitored annually be increased from 30 to 50 on each island.
- A survival analysis be undertaken to estimate adult survival on each island.
- There is continued, focussed effort to band and recapture as many flesh-footed shearwaters on the surface and in burrows on both islands.

Additionally, most of the population estimates conducted over the past five years have shown substantial changes to previous estimates. With this in mind, surveys of other flesh-footed shearwater breeding colonies to update population estimates are warranted. We recommend that the following islands be considered for surveys to update population estimates:

- Titi Island, Marlborough Sounds
- Green Island, Mercury Islands
- Mauitaha, Hen and Chicken Islands
- Wareware and Muriwhenua Islands, Hen and Chicken Islands

In regards to tracking, we recommend that a simultaneous sample of 10 juvenile and 10 adult flesh-footed shearwaters be tracked using PTTs in April/May to determine migration routes, and any differences between adult and juvenile mortality during this period.

Project logistics summary statement

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

Review milestones

- Final results for 2018/19 presented at the CSP TWG meeting on 17 July 2019
- Final 2018/19 report published on the CSP website in August 2019
- Final results for 2019/20 presented at the CSP TWG meeting on 25 June 2020
- Final 2019/20 report published on the CSP website in August 2020
- Final results for 2020/21 presented at the CSP TWG meeting on 10 June 2021
- Final 2020/21 report published on the CSP website in August 2021

Citation

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

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

Crowe, P. and Burgin, D. 2021. Flesh-footed shearwater population monitoring and estimates: 2020/21 season. POP2018-04 final report prepared by Wildlife Management International Limited for the New Zealand Department of Conservation, Wellington. 47 p.

Weblink

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

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

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/pre-2019-annual-plans/pop2018-04-flesh-footed-shearwater-population-monitoring-and-estimates-2020-21-final-report.pdf

3.3. POP2019-03 Antipodes Island seabirds research

Specific objectives

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

Rationale

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

Project status

Complete.

Summary of the methods and key findings

White-chinned petrels

During the summers of 2020-21 and 2021-22 the area of land occupied by white-chinned petrels on Antipodes Island was assessed along with burrow density and burrow occupancy which were combined to produce an estimate of the total size of the white-chinned petrel population there. This was compared with similar estimates made in 2008–2011, and the potential impact of landslides in 2014 and the eradication of mice from Antipodes I in 2016 on the current size of the white-chinned population was assessed. The most recent population estimate is larger than that made in 2008-2011, but the confidence intervals about both estimates are so large that it is not reasonable to conclude there has been any population change. The 2008–2011 and 2021–2022 estimates in combination suggest the population comprises ~46,000 breeding pairs.

The landslides in 2014 destroyed 5.6% of the white-chinned petrel burrows and as birds were incubating at the time of the landslides, up to 2.6% of the breeding population was killed. Subsequently the land on which the landslides occurred has been unsuitable for white-chinned petrel burrows and the birds that used these places have either died, moved, or stopped breeding. Although mice are known to prey on white-chinned petrels, any improvement in nesting success because of the mouse eradication has not had sufficient time to be reflected in the size of the breeding population.

The use of distance sampling for assessing burrow density, as well as the explicit assessment of the effectiveness of burrow occupancy measurement techniques are useful improvements in white-chinned petrel population size assessment techniques. With greater field effort and increased sample sizes these tools could provide more precise estimates of population size, though even with these improvements, estimates of population size are not precise enough to reliably detect population trends. Detection of population change is likely to be more easily achieved with an intensive mark-recapture study of birds in a representative study population.

Northern giant petrels

The number of northern giant petrel chicks on Antipodes Island were counted just before they fledged during the summers of 2020-21 and 2021-22. Counts were made on foot and through use of a drone. The number of chicks in the two years was similar (194, 188) and using nesting success measures from Macquarie Island, estimates of the number of breeding pairs of 304 and 295 were made. The number of northern giant petrels nesting on the island seems to have decreased and then increased since 1969 when they were first counted and this may be due to declines in the number of eastern rockhopper and erect-crested penguins nesting on the island, and an increase in the abundance of New Zealand fur seals.

Project logistics summary statement

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

Review milestones

- Final results for 2020/21 and 2021/22 presented at the CSP TWG meeting on 16 June 2022
- Final report published on the CSP website in July 2022

Citation

Elliot, G.; Walker K. Estimating the number of white-chinned petrels breeding on Antipodes Island. POP2019-03 Final Report for the Department of Conservation. Albatross Research, Nelson. 17 pp.

Elliot, G.; Walker K. Numbers of Northern Giant Petrel breeding on Antipodes Island in 2021 and 2022. POP2019-03 Final Report for the Department of Conservation. Albatross Research, Nelson. 15 pp.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/201920-annual-plan/pop2019-03--white-chinned-petrel-on-antipodes-final-report.pdf

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/201920-annual-plan/pop2019-03---giant-petrel-on-antipodes-final-report.pdf

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

Specific objectives

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

Rationale

The Conservation Services Programme Seabird medium term research plan (CSP seabird plan) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. This proposal delivers priority research components of the CSP seabird plan involving the estimation of key demographic parameters of Southern Buller's albatross at the Snares. An established study site for Southern Buller's albatross, with substantial historic mark-resight effort, exists at the Snares (Sagar 2014), one of the most accessible subantarctic island groups. Information involving demographic parameters have been collected at the three study sites annually since 1992.

Project status

Year one complete, year two delayed to 2021-22 due to COVID-19.

Summary of the methods and key findings

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

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

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

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

Recommendations

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

Project logistics summary statement

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

Review milestones

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

Citation

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

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https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/201920-annual-plan/pop2019-04-southern-bullers-snares-final-report-2019-20.pdf

3.5. POP2020-01 Auckland Islands seabird population research

Specific objectives

1. To determine adult survival and other demographic parameters for Gibson's albatross and estimate total population size, Adams Island.
2. To determine adult survival and other demographic parameters for white-capped albatross and population size of study colony at Disappointment Island.

Rationale

The Conservation Services Programme Seabird medium term research plan (CSP seabird plan) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and NPOA – Seabirds Objectives. It was developed at the request of the CSP Research Advisory Group. Key components of research described in the CSP seabird plan for delivery in 2020/21 were identified and prioritised by the CSP RAG. This project covers prioritised components involving field work at the Auckland Islands, which have been developed to maximise cost and logistical efficiencies between components. Supporting rationale for all the components is summarised in the CSP seabird plan.

Project status

Cancelled due to COVID-19 and funds returned to industry.

Project logistics summary statement

This project was 50% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $120,000 over one year.

3.6. POP2020-02 Protected coral identification and awareness

Overall objective

Update the coral identification guide for observers and fishers to accurately identify bycaught protected coral species at sea.

Rationale

The current CSP coral identification guide was last updated in 2014 and requires improvements for quick and accurate identification of bycaught protected coral species. Accurately identifying corals to the finest taxonomic level provides vital baseline information that can help to better inform research and marine protection such as predictive modelling, benthic risk assessments and management of benthic marine protected species. The identification guide will contain more information and imagery of species that are commonly misidentified or difficult to differentiate. The guide will also include information to increase the awareness of the importance and vulnerability of deep-water corals in New Zealand.

Project status

In progress.

Project logistics summary statement

This project was 100% Crown funded. The planned cost for the project was $30,000 over one year.

3.7. POP2020-03 Basking shark habitat suitability modelling

Overall objective

To model basking shark distribution in New Zealand waters and identify environmental variables that may be driving changes in habitat use.

Rationale

The waters around central and southern New Zealand, extending east to the Louisville Ridge are the Southern Hemisphere's hot spot for basking shark (*Cetorhinus maximus*). Up until the late 1990s large aggregations were commonly seen in coastal waters off the east coast of the South Island, less frequently off Southland and the lower North Island, during summer. Since then sightings in coastal waters have dropped to almost zero with the last confirmed sighting being of a single basking in Tory Channel, Marlborough Sounds, in 2012 (C. Duffy, unpublished data). Over the same period reported bycatch in mid-water trawl fisheries also fell to very low levels, although during the last two fishing years there have been clusters of bycatch events reported along the edge of the Southland shelf south and east of Snares Islands. Although it is not known if the disappearance of inshore aggregations and decline in bycatch is due to unsustainable incidental mortality of basking sharks, the very small estimated global effective population size (<100,000 individuals) and limited genetic differentiation of global stocks mean this a possibility.

Project status

Complete.

Summary of the methods and key findings

Habitat suitability models (HSMs) are capable of filling in knowledge gaps on spatial and temporal distributions and predict areas of suitable habitat for widely distributed species. Here, basking shark habitat suitability (measured as a habitat suitability index, HSI) around New Zealand was predicted by combining functionally relevant, high-resolution (1km2 grid resolution) environmental and biotic (zooplankton prey species) data and opportunistic basking shark occurrence data (n = 369).

The relationship between environment variables, biotic variables and basking shark records was explored using ensemble predictions (Ensemble HSM) from Boosted Regression Tree (BRT) and Random Forest (RF) models. BRT and RF models were bootstrapped 200 times and an ensemble model was produced by taking weighted averages of the predictions from each model type. BRT and RF models performed well for predicting basking shark occurrence (AUC and TSS > 0.7). Nine variables were retained for the model, eight environmental predictors and one biotic predictor. The relative importance of each predictor and their influence on basking shark HSI were consistent across BRT and RF models. Vertical flux (*POCFlux,* 26.0%), slope (*Slope*, 14.1%), and turbidity (*Turbidity*, 10.6%) were the three most important variables in predicting basking shark HSI. Bathymetry (*Bathy*, 9.7%) and broadscale bathymetric position index (*BPI broad*, 9.6%) were also moderately important variables. High HSI was predicted in gently sloping and less complex seafloor topographies with high turbidity and at two depth ranges – nearshore and at depths between 200 and 550 m. There was a weak relationship between HSI and copepod densities, with low HSI occurring with low levels of copepod densities, a peak in HSI at moderate copepod densities (10-20 counts per 5 nautical miles), and a plateau in HSI values at the highest levels of copepod densities (>25 counts per 5 nautical miles).

Areas of high habitat suitability exhibited a core area for basking shark in the New Zealand Exclusive Economic Zone (EEZ) occurred along the continental slope, particularly along the 250 m contour along the North and South Islands; Mernoo Bank, Pukaki Rise, Puysegur, and around New Zealand's offshore islands (Chatham Islands, Stewart Island, the Bounty Islands, and the Auckland Islands). Areas of high uncertainty (SD > 0.2) included most offshore waters north of 40°S, the deeper depths (>500 m) of the Hokitika Canyon, northern Chatham Rise, coastal waters off the East Coast South Island (Canterbury Bight), Foveaux Strait (between the South Island and Stewart Island) and Puysegur. High uncertainty beyond the core area was reported along deep sea features north of New Zealand, including the Kermadec Ridge and Trench, the Colville Ridge, the Norfolk Ridge, and the Lord Howe Rise.

Recommendations

By identifying areas of high habitat suitability, research efforts can be directed to specific areas of interest to increase the tagging success. For example, the Auckland Islands has been identified as an area of high habitat suitability for basking sharks where basking sharks were historically sighted at the surface. This area is also a known hotspot for other large filter-feeding vertebrates that feed along the Subtropical Front (STF), a continuous feature within the Southern Tropical Convergence at latitudes 39–42°S, characterised by elevated primary productivity.

Predictors found to positively influence basking shark HSI (vertical flux, often used as an index of phytoplankton abundance (primary production) could be further explored to better understand historic and future basking shark distribution. Similar models used in this project could be explored to predict basking shark distribution response to future climate change forecasting and events such as ENSOs.

Differences in habitat suitability among sexes or size classes, a common observation among sharks, were not examined at this time due to the relatively small sample size of basking sharks across the region and low availability of size and sex data for most records. This information is becoming more readily available through fisheries observer data collection and should be explored further in the future. Continued collection of biological data on basking sharks is essential for understanding differences in habitat use across life history stages, particularly for juvenile basking shark as they are globally rare but are known to occur in and around New Zealand waters.

Project logistics summary statement

This project was 100% Crown funded. The planned cost for the project was $30,000 over one year. Services were provided by NIWA.

Review milestones

- Final results presented at the CSP TWG meeting on the 9 December 2020
- Final report published on the CSP website in January 2021

Citation

Finucci, B., Stephenson, F., Petersen, G., Francis, M. and Pinkerton, M. 2020. Exploring the drivers of spatial distributions of basking sharks in New Zealand waters. POP2020-03 final report for the Conservation Services Programme, Department of Conservation. Prepared by the National Institute of Water and Atmospheric Research (NIWA). 50 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202021-annual-plan/pop2020-03-basking-shark-habitat-suitability-modelling-final-report.pdf

3.8. POP2020-04 Grey petrel population estimate, Antipodes Island

Overall objective

To collate existing data and recommend a methodology to provide an updated population estimate and assessment of the population trend of grey petrels at Antipodes Island.

Rationale

The Conservation Services Programme Seabird medium term research plan (CSP seabird plan) outlines a five-year research programme to deliver on the seabird population research component of CSP. It is targeted at addressing relevant CSP Objectives (as described in the CSP Strategic Statement) and National Plan of Action – Seabirds Objectives. This proposal delivers an initial step towards the research objective of updating the population estimate for grey petrels at Antipodes Island. The Antipodes Island population is by far the largest population globally for the species, and the trend in population size over time remains highly uncertain.

Project status

Complete.

Summary of the methods and key findings

Antipodes Island is thought to have the largest population globally of grey petrels, *Procellaria cinerea*, but the trend in population size over time remains unknown. This work focuses on planning an updated estimate of population size and trend. We collate and assess resources from previous work, using these to develop recommendations for field work that will yield a robust population estimate.

We first collated resources, then compared and contrasted methods and findings from previous work. Requirements for a robust, repeatable population size estimate and best-practise approaches are discussed. Taken together, previous work and requirements inform a range of options for population size estimation, with key pros and cons noted for each field strategy.

Balancing effort, flexibility and precision of the population size estimate, the recommended field strategy is spatial coverage distance sampling. This approach uses distance sampling following a simple-random design that maximises spatial coverage. Several other good options suggest variations but with key things in common: timing (occupancy sampling should occur in second half April), accounting for habitat lost to landslips, and using true surface areas of grey petrel habitat in calculations. With broad sampling across the grey petrel range, an accurate, robust, repeatable population size estimate can be produced.

Recommendations

- Recommended field strategy is spatial coverage distance sampling.

Project logistics summary statement

This project was 100% Crown funded. The planned cost for the project was $20,000 over one year. Services were provided by Parker Conservation.

Review milestones

- Final results presented at the CSP TWG meeting on the 9 December 2020
- Final report published on the CSP website in January 2021

Citation

Rexer-Huber K., Parker G.C. 2021. Antipodes Island grey petrels: assess and develop population estimate methodology. POP2020-04 final report for the Conservation Services Programme, Department of Conservation. Parker Conservation, Dunedin. 34 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202021-annual-plan/pop2020-04-grey-petrel-methodology-final-report.pdf

3.9. POP2020-05 Utilisation of the marine habitat of yellow-eyed penguins from Stewart Island/ Rakiura

Overall objective

Determining overlap of foraging ranges with, and assessing effects of, inshore fisheries on an endangered species in a region that may serve as mainland stronghold.

Rationale

The proposed project aligns with the Strategic Priorities Six "Ensure Bycatch does not threaten hoiho" and Seven "Protect and support marine habitats and ecosystems that nourish hoiho" of *Te Mahere Rima Tau / Five-year Action Plan* that supports *Te Kaweka Takohaka mō te Hohio*. This project is an extension/continuation of the CSP project POP2018-02 which mapped the habitat utilisation of yellow-eyed penguin/hoiho around the NZ mainland (North Otago to Southland).

Hoiho have been experiencing dramatic declines in numbers on the New Zealand mainland over the past years. A great variety of factors have been identified that contribute to the ongoing negative trend, ranging from ocean warming and fisheries interactions (bycatch, degradation of benthic habitat) to pollution, disease outbreaks and predation (primarily uncontrolled dogs).

On Stewart Island/Rakiura, especially the latter problems are virtually absent. Moreover, foraging conditions appear to be advantageous as birds do not have to travel far, resulting in very short foraging trips and rapid chick growth. It furthermore appears as if the penguins show an affinity for aquaculture operations where mussel farms may act as artificial reefs increasing prey availability. Overall, it appears as if Stewart Island/Rakiura – especially the island's southern half – may represent a refugium for the specie's northern population. Hence, the island may be of great importance for the species, especially if the negative population trend on the mainland continues.

There is a considerable set netting effort around Stewart Island/Rakiura. Unlike around most of the mainland, there is no ban for inshore set netting and nets can be deployed very close inshore. This potentially renders set netting the single greatest threat for Yellow-eyed penguins/hoiho on Stewart Island/Rakiura. There is very little information about the utilisation of the marine habitat by yellow-eyed penguins/hoiho on Stewart Island/Rakiura that would allow robust assessment of the potential impacts of set net fisheries on the species.

Project status

Complete.

Summary of the methods and key findings

Between November 2020 and July 2021, foraging of hoiho/yellow-eyed penguins from three different breeding locations on and around Rakiura/Stewart Island was studied using GPS dive loggers, satellite trackers, and animal-borne cameras to establish the penguins' utilisation of their local marine habitats. The sites ranged from southern Rakiura (Port Pegasus/Pikihatiti), the Bravo Island Group in Paterson Inlet/Whaka a Te Wera, to Whenua Hou/Codfish Island where penguins have access to the Foveaux Strait.

With most of the terrestrial threats the species faces on the New Zealand mainland virtually absent on Rakiura, the impact of fisheries is likely the most important factor besides climate change contributing to population declines. Set net fisheries, which unlike on the mainland are allowed to operate directly inshore are the greatest threat for Rakiura hoiho.

This study provides decision makers with the information required to adequately address this issue and, thus, follow the strategies outlined in Te Kaweka Takohaka mō te Hoiho.

Project logistics summary statement

This project was 100% Crown funded. The planned cost for the project was $30,000 over one year.

Review milestones

- Final results presented at the CSP TWG meeting on the 1 April 2022
- Final report published on the CSP website in April 2022

Citation

Mattern, T. & Ellenberg, U. 2022. Utilisation of the marine habitat by hoiho/yellow-eyed penguins from Rakiura/Stewart Island. Final report for POP2020-05, prepared by Eudyptes Consulting for the Conservation Services Programme, Department of Conservation. 45 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202021-annual-plan/pop2020-05-hoiho-tracking-rakiura-final-report.pdf

4. Mitigation Projects

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

Project Objectives

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

Rationale

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

Project status

Complete.

Summary of the methods and key findings

Artificial light at night (ALAN) can negatively impact the behaviour of nocturnally active seabirds by causing disorientation, exhaustion, and injury or mortality from light-induced collisions. Procellariiformes (e.g., petrels, prions, shearwaters, diving petrels and storm petrels) are disproportionately attracted to ALAN compared to other seabird groups, fledglings on their maiden flight are most at risk. The Hauraki Gulf has one of the world's highest diversities of seabirds, including several threatened species. Many of the species in the region are vulnerable to light pollution. While most of these species breed on uninhabited offshore islands, the extensive shipping activity in this region puts seabirds at great risk of light-induced collisions with vessels as they pass or are anchored nearby. This includes fishing vessels working at night.

The first part of this study, undertaken on two seabird breeding islands, tested which light intensities and colours were least attractive to seabirds through behavioural experiments where we shone lights into the sky and recorded seabird attraction. We also modelled the lights into the visual system of seabirds to identify how seabirds perceive lights differently. Our land-based experiments showed an equal statistical attraction to the light types we tested but provided anecdotal observations where more research and larger sample sizes are required. The number of seabirds trapped in the light beam differed by island and moon phase. The number of seabirds observed in thermal imagery differed by island and moon phase when comparing small LED lights only. Fifteen birds were grounded, most on Pokohinu Burgess Island during the flood LED treatment. Differences between islands likely reflected the local seabird diversity at each island.

The second part of this study, undertaken on vessels either anchored near the Mokohinau Islands or drifting off the eastern Coromandel, tested which light intensities and colours were least attractive to

seabirds through behavioural experiments where we shone lights horizontal to the vessel and recorded seabird attraction. Significantly more birds were observed in thermal imagery and from near the Mokohinau Islands than the eastern Coromandel, possibly due to the species present on each of the island groups or the time of year or vessel used during the experiments. Additionally, statistically significant numbers of birds were observed in thermal imagery and in boat-based observations closer to sunset and sunrise than during the middle of the night. Boat-based experiments showed an equal statistical attraction to the light types tested. The logistical challenges and resource constraints were key limitations resulting in small sample sizes.

Recommendations

Further research into the effects of ALAN in the Hauraki Gulf, and globally, is urgently required to address the increasing threat of ALAN to seabirds, especially for those species listed as threatened. The recommendations for future boat-based behavioural experiments should attempt to target specific seabird species that are vulnerable to ALAN, time experiments to incorporate a greater range of moon phases and weather, augment experiments to obtain more data for each treatment (and preferably without confounding variables, such as time of year and location), increase the number of each light type to be more consistent with the level of deck lighting used on fishing vessels, and invest in automation of detection to reduce the labour involved in manually detecting birds in thermal videos.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $20,000 over year one and $40,000 in year two. Services were provided by the Northern New Zealand Seabird Trust.

Review milestones

- Final results presented at the CSP TWG meeting on the 26 August 2021
- Final report published on the CSP website in September 2021

Citation

Lukies, K., Gaskin, C., Gaskett, A., Heswall, A., Gulley, K. and Friesen, M. 2021. Lighting adjustments to mitigate against fishing vessel deck strikes/vessel impacts. MIT2019-03 final report prepared by Northern New Zealand Seabird Trust for the New Zealand Department of Conservation, Wellington. 37 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/201920-annual-plan/mit2019-03-lighting-adjustments-to-mitigate-against-deck-strikes-final-report.pdf

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

Project Objectives

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

Rationale

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

Project status

In progress.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $1100,000 over year one and $150,000 in year two (subject to review).

4.3 MIT2020-02 Protected species liaison project

Overall objective

Grow liaison capacity across inshore fleets around the country including trawl, set net, bottom longline and surface longline fisheries.

Rationale

In order to effectively reduce the risk of interactions with protected species, it is important for vessel operators to use best practice mitigation and take all necessary steps, whether they are regulatory or non-regulatory, to avoid interactions. To achieve ongoing reductions in bycatch towards zero, there needs to be consistent use of the most effective mitigation measures currently available, while still encouraging continual improvement through innovation.

It is proposed through the Draft National Plan of Action – Seabirds 2020 that a suite of best practice mitigation standards will be implemented for each fishing method and will be reviewed annually by the Seabird Advisory Group. It is envisaged that the Liaison Project will play a central role in the implementation of these standards through the development of Protected Species Risk Management Plans (PSRMPs) on each vessel.

The purpose of the PSRMPs will change within this next phase, using best practice mitigation measures that the vessel will be implementing to demonstrate their achievement of the relevant mitigation standard, rather than just outlining the vessel's current practices. Auditing of these plans by MPI Fisheries Observers and compliance checks will then verify the steps that the vessel is taking to meet the mitigation measures outlined in the plan and highlight where there is still work to be done. PSRMPs will also cover mitigation actions to reduce or eliminate other protected species taxa (e.g. marine mammals), as relevant to the fishery.

Within the coming years the capacity of the program is expected to grow substantially in size to provide full outreach to all relevant inshore fisheries. The role of the liaison officers will largely remain the same, supporting and educating fishers in best practice mitigation and providing a vital interface between skippers, government, and researchers. The growth of the program will consist of additional Liaison Officers to expand into more fisheries and areas, increased contact with high risk vessels and fleets and development of training plans for crew on protected species and bycatch mitigation. The project will also expand the role of the liaison coordinator to ensure the operational oversight of the program and improve reporting.

Measuring success and constraints in reporting capability have been identified as improvements required in the rollout of this next phase of the project. This will be addressed through database development and standardisation of processes. There will also be increased engagement with quota holders to support the uptake of the plans and mitigation measures.

Project status

Complete.

Summary of the methods and key findings

In the first half of 2020/21 (1 October 2020- 28 February 2021) the liaison programme updated 56 PSRMPS and created 11 new PSRMPs for inshore/ Highly Migratory Species (HMS) vessels.

Additionally, a total of 47 PSRMP audits were completed by Observer services during this period. These were comprised of two surface longline audits, 10 bottom longline, 26 trawl and nine set net. None of the surface longline vessels audited were using hook-shielding devices.

Sixty triggers were reported during this time period from 24 different vessels. These were largely comprised of black petrel and flesh-footed shearwater interactions. However, it is important to note the high level of turtle captures in the surface longline fishery during the summer months of this fishing year.

Recommendations

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

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $240,000 over one year.

Review milestones

- Mid-year progress report for 2020/21 published on the CSP website on 20 September 2021

Citation

Plencner, T. 2021. Liaison programme mid-year progress report 2020/21. Report for CSP project MIT 2020-02. Prepared by the Department of Conservation. 11 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202021-annual-plan/mit2020-02-protected-species-liaison-project-report-oct-2020-feb-2021.pdf

4.4 MIT2020-03 Mitigation gaps analysis towards reducing protected species bycatch

Project Objectives

1. To provide an assessment of the level of bycatch reduction that existing mitigation tools can achieve for protected marine species (i.e. seabirds, corals, marine mammals, fish, and reptiles).

2. To identify the most significant gaps in mitigation technology/practice that will need to be filled in order to achieve further reductions of protected species bycatch.

Rationale

To achieve reduced protected species bycatch it is vital to understand what current mitigation techniques can deliver for protected marine species bycatch reduction and to identify the most significant gaps. This will help identify priorities for innovation and help in the development of innovation roadmaps. Based on available information on the use of bycatch mitigation techniques across different fishing methods, information on the known effectiveness of these mitigation techniques and levels of residual bycatch (of protected marine species) across different fishing methods, the project will aim to assess the level of further bycatch reduction existing mitigation techniques could deliver if fully deployed across all relevant fisheries.

Based on this assessment, the gap analysis would develop a matrix looking at fishing methods and the bycatch reduction priorities for protected marine species (i.e. seabirds, corals, marine mammals, fish, and reptiles) and identify the largest gaps between what current mitigation techniques can deliver and where highest bycatch, or bycatch of most vulnerable protected species, occurs. The assessment and the gap analysis would then be peer reviewed by key stakeholders.

Project status

Complete. The scope of this project was altered during the course of research and the report differs to the original in the CSP Annual Plan 2020/21. This report summaries the outcomes from two workshops to be used in guiding future development of a mitigation framework.

Summary of the methods and key findings

This project was aimed at identifying gaps in current bycatch mitigation within the context of New Zealand's commercial fisheries. The initial goals of the project were an assessment of existing mitigation tools, the identification of significant gaps in mitigation techniques and practices, and an appraisal of potential new technologies that may be used to support reductions in protected species bycatch. Within these goals, the project was predominantly based on stakeholder engagement to capture knowledge and input through stakeholder participation in two workshops. The workshops had the overall aim to develop a matrix of protected species and mitigation gaps across different commercial fisheries.

Guided by stakeholder input, however, the project's direction changed to documenting the discussions, notes, and questions from the initial workshop. This documentation is provided here, with information pertaining to bycatch mitigation presented by protected group species and fishery. It is intended to help refine future research directions for the mitigation of protected species bycatch in New Zealand.

Recommendations

There are no recommendations included in the report as DOC intends to engage with MPI and industry to refine the next steps towards development of mitigation projects through CSP, taking into consideration the feedback received during these workshops.

Project logistics summary statement

This project was 100% funded via Conservation Service Levies on the fishing industry. The planned cost for the project was $30,000 over one year. Services were provided by Dragonfly Data Science.

Review milestones

- Draft final report published on the CSP website on 3 November 2021
- Final report published on the CSP website on 18 November 2021

Citation

Large, K, Berkenbusch, K., Neubauer, P. Tornquist, M. 2021. Mitigation of protected species bycatch in commercial fisheries- workshop summary report. MIT2020-03 final report prepared by Dragonfly Data Science for the Conservation Services Programme, Department of Conservation. 29 p.

Weblink

https://www.doc.govt.nz/globalassets/documents/conservation/marine-and-coastal/marine-conservation-services/reports/202021-annual-plan/mit2020-03-mitigation-gaps-analysis-final-report.pdf

Appendix

Biodiversity 2018 Projects

BCBC2020-05: Spatial and temporal patterns in the diet of New Zealand king shag

BCBC2020-09: Integrated population model of Antipodean albatross for simulating management scenarios

BCBC2020-11c: Longline sink rate verification

BCBC2020-24: Otago and Foveaux shags colony surveys

BCBC2020-27: Salvin's albatross breeding success and phenology assessment