

# INT2019-02: IDENTIFICATION OF SEABIRDS CAPTURED IN NEW ZEALAND FISHERIES



*Seabird Interactions between 1 July 2019 and 30 June 2020*



**WMIL**

Wildlife  
Management  
International

# INT2019-02: Identification of seabirds captured in New Zealand fisheries, 1 July 2019 to 30 June 2020

Elizabeth Bell

Wildlife Management International Ltd  
PO Box 607  
Blenheim 7240  
New Zealand  
[www.wmil.co.nz](http://www.wmil.co.nz)  
[biz@wmil.co.nz](mailto:biz@wmil.co.nz)

This report was prepared by Wildlife Management International Limited for the Department of Conservation as fulfilment of the contract variation INT2019-02 signed 13 June 2019.

## Version History:

VERSION	DATE	AUTHOR	REASON FOR CHANGE
1	10 June 2021	WMIL: Bell, E.A.	First complete version
2	15 July 2021	WMIL: Bell, E.A.	Second complete version following editing
3	10 September 2021	WMIL: Bell, E.A.	Third version following COD extract and edits from DOC

## Citation:

This report should be cited as:

Bell, E.A. 2021. INT2019-02: Identification of seabirds caught in New Zealand fisheries, 1 July 2019 to 30 June 2020. Annual Technical Report to the Conservation Services Programme, Department of Conservation. Wellington, New Zealand.

All photographs in this Report are copyright © WMIL unless otherwise credited, in which case the person or organisation credited is the copyright holder.

Cover image: Image of Buller's albatross interaction (deck landing) provided by Kelvin Osbourne (MPI/DOC Government Observer), 14 March 2020.

# INT2019-02: IDENTIFICATION OF SEABIRDS CAPTURED IN NEW ZEALAND FISHERIES, 1 JULY 2019 TO 30 JUNE 2020

## ABSTRACT

New Zealand waters support a diverse range of seabird species, but much of the commercial fishing activity in the region overlaps with their ranges. The accurate identification of seabirds captured in New Zealand fisheries is vital for determining the potential impact of fisheries on these populations. Between 1 July 2019 and 30 June 2020, a total of 844 seabirds were reported as incidental interactions with commercial fishing vessels by on-board New Zealand Government observers; of these 250 were returned for necropsy and 594 were interactions (298) or photographed (296) as dead or alive captures. There were 250 seabirds comprising 24 taxa incidentally killed as bycatch and returned for necropsy. Birds were returned from 16 longline (n = 82 seabirds), 35 trawl (n = 163 seabirds) and five set net (n = 5 seabirds) vessels and were dominated numerically by five species: white-chinned petrel (n = 80, 32%), New Zealand white-capped albatross (n = 43, 17.2%), sooty shearwater (n = 28, 11.2%), Salvin's albatross (n = 27, 10.8%) and Buller's albatross (n = 27, 10.8%). These five species accounted for 82% of all returns. All birds returned from longline fisheries had injuries consistent with being hooked in the bill, throat, or wing. In contrast, most birds (74.2%) returned from trawl fisheries were killed through entanglement in the net, cod-end, or pound, with 18.4% likely to have been killed by warp interaction or entanglement. Eight birds were killed by striking the deck of the trawl vessel. Birds had the same mean fat scores in comparison to birds from the last fishing year, and 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 Central Observer Database (COD) and images provided by Government observers gave a total of a further 594 seabirds that were reported as interactions or photographed (as dead or alive captures) aboard 51 fishing vessels (and may include some non-capture interactions). Almost half (47.3%) of the seabirds reported in these interactions were released alive. Out of these 594 records of seabird interactions, photographs were taken of 296 seabirds consisting of 15 taxa. 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 are made to improve photo-identifications in the future.

*Keywords:* commercial fishing, seabirds, necropsy, photo-identification, incidental mortality, longline, trawl.

## 1. INTRODUCTION

New Zealand waters support a large and diverse range of seabird species. However, much of the commercial fishing activity within New Zealand waters overlaps with the ranges of these seabirds (Robertson et al. 2003). Therefore, the accurate identification of seabirds captured in commercial fisheries operations is vital for determining the potential impact of fisheries on these seabird populations.

New Zealand Government observers have been placed on commercial vessels since 1998 to investigate interactions between fisheries and seabird species but are not always able to accurately identify seabirds at sea. Consequently, a necropsy programme has been in place since 1998 to

accurately determine the taxon (as well as age, sex, diet, and provenance) of specimens recovered dead by observers. Observers present on fishing trips within New Zealand's Exclusive Economic Zone (EEZ) are generally required to return all seabirds caught and killed as incidental bycatch during fishing operations for necropsy. Additional information such as vessel name, location of capture (latitude and longitude) and date of capture is also recorded. Specific catch locations and vessel names have not been provided in this report on the grounds of commercial sensitivity. All necropsies were performed for the Department of Conservation (DOC) as part of Conservation Services Programme (CSP) project INT2019-02.

In the past, identification of seabirds released alive were often of unknown accuracy and were not confirmed by an expert. Consequently, a photography programme was developed to enable observers to record and return images of birds interacting with vessels (whether alive or dead), enabling the identification to be checked and verified.

This report provides a summary of the species of seabird identified as being captured in New Zealand fisheries between 1 July 2019 and 30 June 2020. Identifications were based on dead birds caught and returned and/or photographs or videos of live or dead birds.

## 1.1 Objectives

The overall objective of the observer programme is to determine which seabird species are captured in New Zealand commercial fisheries and the mode of capture.

The specific objectives are to:

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

## 2. METHODS

### 2.1 Necropsy

The necropsy methods followed those described by Bartle (2000) and used in autopsies in subsequent fishing years (Robertson 2000, Robertson & Bell 2002a, Robertson & Bell 2002b, Robertson et al. 2003, Robertson et al. 2004, Conservation Services Programme 2008, Thompson 2009, Thompson 2010a, Thompson 2010b, Bell 2011, Bell 2012, Bell 2013, Bell & Mischler 2014, Bell & Mischler 2015, Bell & Bell 2016, Bell & Bell 2017, Bell & Bell 2018, Bell & Bell 2019). Common and scientific names of all species caught and returned are provided in Table 1. Nomenclature generally follows Marchant & Higgins (1990), but for the albatrosses for which current taxonomy and nomenclature is in a state of flux, it is based on a combination of Nunn et al. (1996) and Robertson & Nunn (1998), and is consistent with the taxonomy recognised by the Agreement on the Conservation of Albatrosses & Petrels (ACAP 2010).

During necropsy, all birds were sexed by internal examination, with the exception of birds that had been damaged by fishing gear, machinery, or sea lice. Feather moult and the condition of the brood

patch were also recorded. Birds were characterised as either adult, breeding adult, non-breeding adult, sub-adult (pre-breeder), immature or juvenile based on a combination of plumage, morphological (such as bill size and colour), gonadal and brood patch characteristics.

- *Adults* – adult morphology (e.g. body size, bill size, bill colour, plumage colour), but active breeding could not be confirmed
- *Breeding adults* - considered to be actively breeding at the time of capture (e.g. bare brood patch, swollen ovaries, or testes)
- *Non-breeding adults* - identified by feather moult (e.g. downy brood patch, body moult, wing moult) and gonadal evidence (i.e. regressed or small ovaries and testes)
- *Sub-adults (pre-breeders)* – non-adult or near-adult plumage and/or morphology (e.g. bill colour), but no gonadal evidence that they had obtained breeding condition
- *Juveniles* - juvenile plumage and/or morphology (e.g. bill colour, bill size, leg, and foot colour)

Body condition was determined by assigning a fat score based on the relative amount of subcutaneous fat and fat on and around organs: '1' = no fat, to '5' = extremely fat (where internal examination becomes difficult). In instances where the birds have been damaged by sea lice, the fat score was listed as unknown.

Stomach and gizzard contents were identified to broad dietary groupings (i.e. squid, fish, crustaceans, etc.) and any hard parts (squid beaks, otoliths) were retained for future identification where possible. In addition, any bait material, offal or discarded material, plastic, stones, algae, and goose barnacle plates were recorded. Photographs were taken of plastic debris in the gizzard or stomach.

For each bird, any injuries were recorded, and this information, together with observer comments on the necropsy label, was used to determine the likely cause of death.

**Table 1** Common and scientific names of seabirds captured and returned, photographed, or reported as an interaction from New Zealand fisheries between 1 July 2019 and 30 June 2020.

COMMON NAME	SCIENTIFIC NAME	TOTAL	NECROPSY	PHOTO	INTERACTION
Albatross (unidentified)		15			15
Antipodean albatross	<i>Diomedea antipodensis antipodensis</i>	4	4		
Black (Parkinson's) petrel	<i>Procellaria parkinsoni</i>	9	5	1	3
Black-browed albatross (unidentified)	<i>Thalassarche</i> sp.	2			2
Broad-billed prion	<i>Pachyptila vittata</i>	1	1		
Buller's albatross	<i>Thalassarche bulleri bulleri</i>	44	27	10	7
Buller's and Pacific albatross	<i>Thalassarche bulleri</i>	6			6
Cape petrel	<i>Daption capense</i>	2		2	
Cape petrels	<i>Daption</i> spp.	12			12
Common diving petrel	<i>Pelecanoides urinatrix</i>	7	4	1	2
Fairy prion	<i>Pachyptila turtur</i>	2	1		1
Flesh-footed shearwater	<i>Puffinus carneipes</i>	21	7		14
Fluttering shearwater	<i>Puffinus gavia</i>	1			1
Foveaux shag	<i>Phalacrocorax stewarti</i>	1	1		
Great albatross (unidentified)	<i>Diomedea</i> spp.	4			4
Great-winged (grey-faced) petrel	<i>Pterodroma macroptera</i>	2	1		1
Grey petrel	<i>Procellaria cinerea</i>	27	2	4	21

COMMON NAME	SCIENTIFIC NAME	TOTAL	NECROPSY	PHOTO	INTERACTION
Grey-backed storm petrel	<i>Garrodia nereis</i>	3	1	2	
Grey-headed albatross	<i>Thalassarche chrysostoma</i>	1			1
Little blue penguin	<i>Eudyptula minor</i>	1	1		
Mid-sized petrel & shearwater (unidentified)		8			8
Mottled petrel	<i>Pterodroma inexpectata</i>	1	1		
New Zealand white-capped albatross	<i>Thalassarche steadi</i>	138	43	52	43
Northern giant petrel	<i>Macronectes halli</i>	2	1		1
Northern royal albatross	<i>Diomedea sanfordi</i>	3	2	1	
Otago shag	<i>Phalacrocorax chalconotus</i>	1	1		
Petrel (unidentified)		3			3
Petrels, prions & shearwaters (unidentified)		2			2
Prion (unidentified)	<i>Pachyptila</i> spp.	2		1	2
Procellaria petrel (unidentified)	<i>Procellaria</i> spp.	18			18
Red-billed gull	<i>Larus scopulinus</i>	1			1
Salvin's albatross	<i>Thalassarche salvini</i>	54	27	15	12
Seabird (unidentified)		1			1
Small albatross (unidentified)	<i>Thalassarche</i> spp.	4			4
Snares crested penguin	<i>Eudyptes robustus</i>	1		1	
Sooty shearwater	<i>Puffinus griseus</i>	76	28	34	14
Southern giant petrel	<i>Macronectes giganteus</i>	2	2		
Southern royal albatross	<i>Diomedea epomophora</i>	8	1	1	6
Storm petrel (unidentified)		10			10
Wandering albatross (unidentified)	<i>Diomedea exulans</i> sp.	1			1
Westland petrel	<i>Procellaria westlandica</i>	14	8	4	2
White-chinned petrel	<i>Procellaria aequinoctialis</i>	327	80	167	80
Yellow-eyed penguin	<i>Megadytes antipodes</i>	1	1		
<b>TOTAL</b>		<b>844</b>	<b>250</b>	<b>296</b>	<b>298</b>

Each specimen was allocated a unique necropsy number and photographed. This number, along with the information on the observer specimen tag and all other information collected during necropsy was entered into an Access database. Details relating to each specimen are available on request from the Manager, Conservation Services Programme, DOC (email: [msp@doc.govt.nz](mailto:msp@doc.govt.nz)).

## 2.2 Photo-identification

The photographs used in this analysis were of seabird captures for which the records indicated that only observer identification had been made, rather than a confirmed identification following necropsy. This covered live captures, mortalities where a specimen was not returned for necropsy (for whatever reason), images of birds that had no associated observer data (i.e. missing from Ministry for Primary Industries (MPI) Central Observer Database ('COD') extracts) and reported interactions in the MPI COD extract with no corresponding image and may include non-capture interactions.

Each bird or interaction was separated as follows:

- *Photo (Photo and Extract)*: seabird photographed by observer, image provided, and interaction recorded in MPI COD
- *Photo (Image not received to date)*: seabird apparently photographed by observer but not received to date and interaction recorded in MPI COD

- *Photo (Not in extract to date)*: image of seabird received but interaction not listed in MPI COD to date
- *Interaction*: seabird interaction with vessel (i.e. live or dead capture, warp, or deck strike, etc.) listed in MPI COD, but no image taken by observer

Photographs were provided in electronic format with associated observer MPI COD extracted information (vessel name, type of fishery, date of capture, time of capture etc.) in an Excel spreadsheet. Common and scientific names of all species caught, photographed, or recorded in the COD extract are provided in Table 1.

Dead specimens were generally photographed with a label that bore the trip, station and sample number making it easy to correlate to the MPI COD extract. However, photographs of live captures often contained no information on station or sample number, making it difficult to match the specimen to the extract unless the time and date stamp on the camera had been set correctly.

All photographed seabirds were identified to the lowest possible taxon. Various seabird reference books (including Marchant & Higgins 1990, Bartle 2000, Shirihai 2002, Onley & Scofield 2007) were used to confirm identification when necessary.

Bill and head morphology and colour were usually sufficient to allow the identification of albatrosses and larger petrels to species, but other key features (such as size, shape, foot colour and wing markings) were needed to identify smaller species. If key features were not visible in the photograph or the image was out of focus, identification to species was not possible. Where possible, the age, sex and provenance of the photographed seabirds were also determined.

Each individual seabird was allocated a unique number. The photograph (or photographs), the information from the observers and any other information observed in the photograph or the MPI COD extract were entered into an Access database.

## 3. RESULTS

### 3.1 Necropsy

#### 3.1.1 Returned seabirds

A total of 250 seabirds comprising 24 taxa were returned from 55 vessels between 1 July 2019 and 30 June 2020 (Table 2, Figure 1).

Seabirds returned were dominated by five species: white-chinned petrel ( $n = 80$ , 32%), New Zealand white-capped albatross ( $n = 43$ , 17.2%), sooty shearwater ( $n = 28$ , 11.2%), Salvin's albatross ( $n = 27$ , 10.8%) and Buller's albatross ( $n = 27$ , 10.8%) (Table 2). These five species accounted for 82% of all returns. Of the remaining 19 taxa, eleven had only single captures, three had two captures, two had four captures, one had five captures, one had seven captures and one had eight captures (Table 2).

There were three banded birds with uniquely numbered metal band within those captured and returned between 1 July 2019 and 30 June 2020. One cape petrel (FL407770) had been banded as an adult non-breeder on Adelie Land, Pointe Geologie Archipelago, Mont Rose, Antarctica on 19 December 2017 by the French CEBC, one male flesh-footed shearwater (Z57149) had been banded on Lady Alice Island on 13 January 2019 as adult in study burrow by WMIL, and one male Buller's albatross (M70833) had been banded on North East Island, The Snares as a 1+ year old on 8 March 1997. Banded specimens provide valuable longevity and survival data.

**Table 2.** Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2019 and 30 June 2020, by month of capture.

SPECIES	MONTH												TOTAL	% TOTAL
	2019						2020							
	J	A	S	O	N	D	J	F	M	A	M	J		
Antipodean albatross									4				4	1.6%
Black (Parkinson's) petrel								4	1				5	2.0%
Broad-billed prion				1									1	0.4%
Buller's albatross	13	5	1					2	1	1	2	2	27	10.8%
Common diving petrel				1						2	1		4	1.6%
Fairy prion			1										1	0.4%
Flesh-footed shearwater				1	4		2						7	2.8%
Foveaux shag		1											1	0.4%
Great-winged (Grey-faced) petrel	1												1	0.4%
Grey petrel		1	1										2	0.8%
Grey-backed storm petrel				1									1	0.4%
Little blue penguin					1								1	0.4%
Mottled petrel											1		1	0.4%
NZ white-capped albatross	10		1	1	1	1	5	10	10	3		1	43	17.2%
Northern giant petrel	1												1	0.4%
Northern royal albatross									2				2	0.8%
Otago shag								1					1	0.4%
Salvin's albatross	1	3		9	6	2	5		1				27	10.8%
Sooty shearwater				12	1		1	6	6	1	1		28	11.2%
Southern giant petrel		2											2	0.8%
Southern royal albatross											1		1	0.4%
Westland petrel				3	2					1	1	1	8	3.2%
White-chinned petrel				3	12	2	7	18	34	4			80	32.0%
Yellow-eyed penguin					1								1	0.4%
<b>TOTAL</b>	<b>26</b>	<b>12</b>	<b>4</b>	<b>32</b>	<b>28</b>	<b>5</b>	<b>20</b>	<b>41</b>	<b>59</b>	<b>12</b>	<b>7</b>	<b>4</b>	<b>250</b>	
<b>% TOTAL</b>	<b>10.4%</b>	<b>4.8%</b>	<b>1.6%</b>	<b>12.8%</b>	<b>11.2%</b>	<b>2.0%</b>	<b>8.0%</b>	<b>16.4%</b>	<b>23.6%</b>	<b>4.8%</b>	<b>2.8%</b>	<b>1.6%</b>		



**Table 3** Species and numbers of seabirds killed and returned from observed fishing vessels between 1 July 2019 and 30 June 2020, by sex (M = male, F = female, U = unknown) and age (A = adult, BA = breeding adult, N = non-breeding adult, SA = sub-adult, I = immature and J = juvenile, U = unknown).

SPECIES	SEX			AGE							TOTAL	% TOTAL
	M	F	U	A	BA	N	SA	I	J	U		
Antipodean albatross	4								4		4	1.6%
Black (Parkinson's) petrel	5			5	4						5	2.0%
Broad-billed prion	1			1	1						1	0.4%
Buller's albatross	20	6	1	27	6						27	10.8%
Common diving petrel	4			4							4	1.6%
Fairy prion		1		1							1	0.4%
Flesh-footed shearwater	4	3		7	2						7	2.8%
Foveaux shag		1		1							1	0.4%
Great-winged (Grey-faced) petrel		1		1							1	0.4%
Grey petrel	2			2							2	0.8%
Grey-backed storm petrel	1			1	1						1	0.4%
Little blue penguin		1		1							1	0.4%
Mottled petrel		1		1							1	0.4%
NZ white-capped albatross	25	13	5	38	17	1		3	1	1	43	17.2%
Northern giant petrel			1	1							1	0.4%
Northern royal albatross		2		2							2	0.8%
Otago shag	1							1			1	0.4%
Salvin's albatross	9	15	3	26	15		1				27	10.8%
Sooty shearwater	21	7		26	3				2		28	11.2%
Southern giant petrel		2		2							2	0.8%
Southern royal albatross		1		1							1	0.4%
Westland petrel	6	2		8							8	3.2%
White-chinned petrel	49	16	15	78	14	2	1			1	80	32.0%
Yellow-eyed penguin		1		1							1	0.4%
<b>TOTAL</b>	<b>152</b>	<b>73</b>	<b>25</b>	<b>235</b>	<b>63</b>	<b>3</b>	<b>2</b>	<b>4</b>	<b>7</b>	<b>2</b>	<b>250</b>	
<b>% TOTAL</b>	<b>60.8%</b>	<b>29.2%</b>	<b>10.0%</b>	<b>94.0%</b>	<b>25.2%</b>	<b>1.2%</b>	<b>0.8%</b>	<b>1.6%</b>	<b>2.8%</b>	<b>0.8%</b>		

The monthly distribution of returned specimens was not evenly spread across the fishing year with most birds returned being caught in March 2020 (n = 59, 23.6%), February 2020 (n = 41, 16.4%) and October 2019 (n = 32, 12.8%) (Table 2). This pattern reflects the timing of seabird breeding, presence within the New Zealand EEZ, timing and location of all observed fisheries, and observer coverage.

The majority of birds were males (n = 152, 60.8), with Antipodean albatross, black petrel, broad-billed prion, common diving petrel, grey petrel, grey-backed storm petrel and Otago shag returning only males (Table 3). However, fairy prion, Foveaux shag, great-winged (grey-faced) petrel, northern royal albatross, southern royal albatross, southern giant petrel, and yellow-eyed penguin had only females returned. Most birds were adults (n = 235, 94%) (Table 3). Of these adults, 63 (26.8%) were breeding and 3 (1.3%) were non-breeding (Table 3). Thirteen birds (5.2%) were pre-breeders (i.e. either sub-adult, immature, or juvenile birds) (Table 3).

### 3.1.2 Target vessel and fishery of necropsy seabirds

The seabirds killed and returned were caught in a range of Fishing Management Areas (FMA 1, 2, 3, 4, 5, 6, 7 and 9) and general positions are shown in Figures 1 and 2.

For the fishing period 1 July 2019 to 30 June 2020, there were 294 observed trips on 129 vessels (Observer data, unpublished). Fifty-six vessels (43.4%) returned birds during this period from 106 observed trips (36.1%); the average was 4.5 birds ( $\pm 0.6$ ) caught and returned from 1.9 observed trips ( $\pm 0.2$ ) per vessel. Over half of these 56 vessels returned relatively low numbers of birds (< 5 birds caught and returned; n = 36, 64.3%). Six vessels caught ten or more birds; one bottom longliner caught and returned 26 birds from one observed trip, one longliner caught and returned 14 birds over four observed trips, one trawl vessel returned ten birds over four observed trips and three trawl vessels returned 12 birds over three, four or seven observed trips. The remaining vessels caught and returned between five and nine birds from between one and five observed trips.

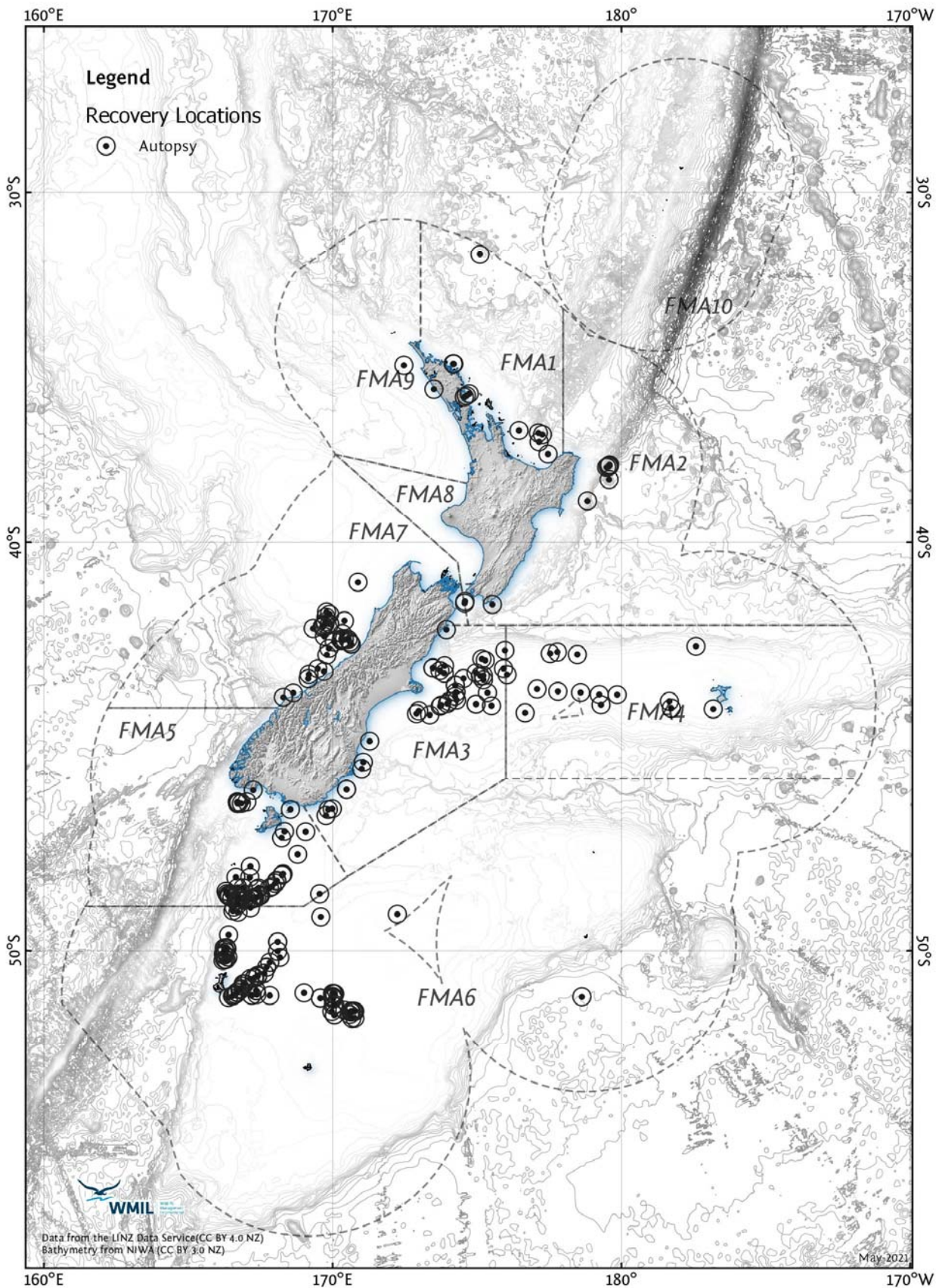
Of those vessels that caught and returned seabirds, 16 were longline vessels (28.6%; 11 bottom and 5 surface longline vessels), five were set-net vessels (8.9%) and 35 were trawlers (62.5%) (Table 4).

Longline vessels returned a total of 82 seabirds (32.8% of total returns; bottom longliner n = 58, 23.2% and surface longliner n = 24, 9.6%), with vessels targeting tuna *Thunnus* spp. accounting for 29.3% of longline specimens (n = 24), those targeting snapper *Centroberyx affinis* accounting for 6.1% of longline specimens (n = 5), those targeting ling *Genypterus blacodes* accounting for 58.5% of longline specimens (n = 48) and the remainder targeting 'other' species (mainly hoki *Macruronus novaezelandiae*, blue cod *Parapercis colias*, tarakihi *Nemadactylus macropterus* or hapuka *Polyprion oxygeneios*) accounting for 6.1% of longline specimens (n = 5) (Table 4).

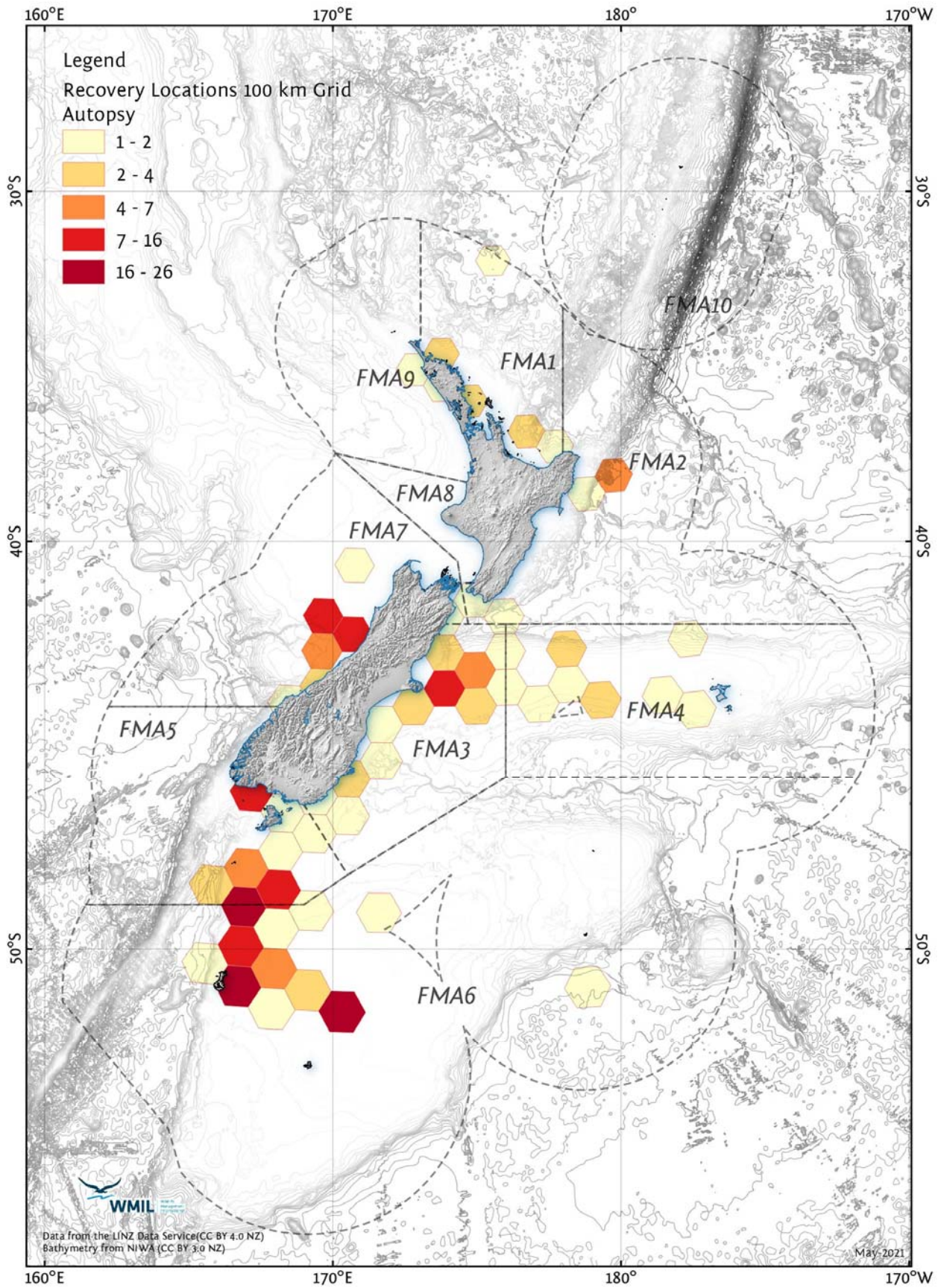
Bottom and midwater trawl fisheries combined returned 163 birds (65.2% of total returns), with trawlers targeting squid *Nototodarus* spp. accounting for 48.5% (n = 79) of all trawl returns, those targeting hoki *Macruronus novaezelandiae* accounting for 24.5% (n = 40), those targeting ling accounting for 6.1% (n = 10), those targeting scampi *Metanephrops challengerii* accounting for 4.9% (n = 8) and those targeting 'other' species (mainly barracouta *Thyrssites atun*, silver warehou *Seriola punctata*, gurnard *Chelidonichthys cuculus*, tarakihi, and southern blue whiting *Micromesistius australis*) accounting for 16% (n = 26) (Table 4).

Five seabirds were caught and killed on set net vessels (2% of total returns), with vessels targeting school sharks (*Galeorhinus galeus*) and other shark species accounting for 60% of all set-net returns and those targeting 'other' species (mainly butterfish *Odax pullus*) accounting for 40% of all set-net returns (Table 4).

**Figure 1** Individual catch locations of all seabirds killed and returned in New Zealand fisheries for necropsy between 1 July 2019 and 30 June 2020.  
 Note: catch location symbols may be obscured by overlying symbols (e.g. where several individuals were captured from the same tow or set, each bird will have the same catch location and appear on the maps as a single symbol).



**Figure 2** Grouped catch locations of all seabirds killed and returned in New Zealand fisheries for necropsy between 1 July 2019 and 30 June 2020.



**Table 4** Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2019 and 30 June 2020, by fisheries type.

Species	Trawl (Bottom/Midwater)					Longline (Surface/Bottom)				Setnet	Total
	Scampi	Squid	Hoki	Ling	Other	Tuna	Snapper	Ling	Other		
Antipodean albatross								4			4
Black (Parkinson's) petrel		1				4					5
Broad-billed prion				1							1
Buller's albatross	4	9	8		2	4					27
Common diving petrel		1		1	2						4
Fairy prion					1						1
Flesh-footed shearwater					1		5		1		7
Foveaux shag										1	1
Great-winged (Grey-faced) petrel						1					1
Grey petrel					2						2
Grey-backed storm petrel					1						1
Little blue penguin										1	1
Mottled petrel		1									1
NZ white-capped albatross	3	23	2	2	4	7		2			43
Northern giant petrel			1								1
Northern royal albatross								2			2
Otago shag										1	1
Salvin's albatross	1	3	13	2	7			1			27
Sooty shearwater		9	4	2	4			9			28
Southern giant petrel			2								2
Southern royal albatross		1									1
Westland petrel						1		7			8
White-chinned petrel		31	10	2	2			30	4	1	80
Yellow-eyed penguin										1	1
TOTAL	8	79	40	10	26	17	5	55	5	5	250
	3.2%	31.6%	16.0%	4.0%	10.4%	6.8%	2.0%	22.0%	2.0%		
% TOTAL	163					82				5	
	65.2%					32.8%				2.0%	

**Table 5** Number of seabirds of each species killed and returned from longline and trawl fisheries between 1 July 2019 and 30 June 2020, by likely cause of death. The proportion of albatross and non-albatross taxa returned is also presented.

Species	Trawl					Longline						Setnet	Total
	Warp	Net	Pound or Cod-end	Other	Vessel strike	Bill, neck, or throat	Wing	Legs or feet	Not obvious	Tangled	Vessel strike		
Antipodean albatross						3				1			4
Black (Parkinson's) petrel		1							4				5
Broad-billed prion		1											1
Buller's albatross	3	10	6	3		3	1		1				27
Common diving petrel		1			3								4
Fairy prion					1								1
Flesh-footed shearwater	1					3	2			1			7
Foveaux shag												1	1
Great-winged petrel						1							1
Grey petrel		1			1								2
Grey-backed storm petrel			1										1
Little blue penguin												1	1
Mottled petrel					1								1
NZ white-capped albatross	5	13	7	8	1	4			4	1			43
Northern giant petrel		1											1
Northern royal albatross						2							2
Otago shag												1	1
Salvin's albatross	8	14	4				1						27
Sooty shearwater		11	5	2	1	2	5		2				28
Southern giant petrel	1	1											2
Southern royal albatross		1											1
Westland petrel		1				3	3		1				8
White-chinned petrel		29	13	3		6	4		24			1	80
Yellow-eyed penguin												1	1
<b>Total</b>	<b>18</b>	<b>85</b>	<b>36</b>	<b>16</b>	<b>8</b>	<b>27</b>	<b>16</b>	<b>0</b>	<b>36</b>	<b>3</b>	<b>0</b>		
<b>Total (each type)</b>	<b>163</b>					<b>82</b>						<b>5</b>	
% of total longline or trawl	<b>11.0%</b>	<b>52.1%</b>	<b>22.1%</b>	<b>9.8%</b>	<b>4.9%</b>	<b>32.9%</b>	<b>19.5%</b>	<b>0.0%</b>	<b>43.9%</b>	<b>3.7%</b>	<b>0.0%</b>		<b>250</b>
Albatrosses (%)	<b>94.4%</b>	<b>47.1%</b>	<b>47.2%</b>	<b>68.8%</b>	<b>12.5%</b>	<b>33.3%</b>	<b>12.5%</b>		<b>13.9%</b>	<b>66.7%</b>			
Non-albatross (%)	<b>5.6%</b>	<b>52.9%</b>	<b>52.8%</b>	<b>31.3%</b>	<b>87.5%</b>	<b>66.7%</b>	<b>87.5%</b>		<b>86.1%</b>	<b>33.3%</b>		<b>100%</b>	

**Table 6** Types of injuries recorded on seabirds of each species killed and returned from longline and trawl fisheries between 1 July 2019 and 30 June 2020. The proportion of albatross and non-albatross taxa returned is also presented.

Note: Birds can have multiple injuries resulting in higher figures than the total number of seabirds killed and returned ( $n = 250$ ).

	No visible injuries	Waterlogged	Broken wing	Broken neck	Broken legs or feet	Broken bill	Hook in bill or throat (including swallowed hook)	Hook in wing	Hook in leg or feet	Open wound or severed body part	Crushed, or more than 3 injuries	Greased	Liced
Antipodean albatross							3			4			
Black (Parkinson's) petrel	5												
Broad-billed prion	1												
Buller's albatross	7	2	6		2	2	3	1		12	5	2	
Common diving petrel	3		2										
Fairy prion	1												
Flesh-footed shearwater	3						3	2		1	1		
Foveaux shag	1												
Great-winged petrel	1						1						
Grey petrel					1					2	1		
Grey-backed storm petrel	1												
Little blue penguin	1												
Mottled petrel											1	1	
NZ white-capped albatross	10	3	12		7		4			15	6	14	3
Northern giant petrel													1
Northern royal albatross							2			2			
Otago shag					1								
Salvin's albatross	5	4	13		4	2		1		8	6	6	1
Sooty shearwater	4	4	3		13	6	2	5		6	7		
Southern giant petrel	1									2			
Southern royal albatross		2	1							2			
Westland petrel	7				1		3	3					
White-chinned petrel	43	8	3	3	3	8	6	4		6	3		13
Yellow-eyed penguin	1												
<b>Total</b>	<b>95</b>	<b>23</b>	<b>40</b>	<b>3</b>	<b>32</b>	<b>18</b>	<b>27</b>	<b>16</b>	<b>0</b>	<b>60</b>	<b>30</b>	<b>23</b>	<b>18</b>
<b>% Total</b>	<b>38.0%</b>	<b>9.2%</b>	<b>16.0%</b>	<b>1.2%</b>	<b>12.8%</b>	<b>7.2%</b>	<b>10.8%</b>	<b>6.4%</b>	<b>0</b>	<b>24.0%</b>	<b>12.0%</b>	<b>9.2%</b>	<b>7.2%</b>
Albatrosses (%)	24.2%	47.8%	80.0%	0.0%	40.6%	22.2%	44.4%	12.5%		75.0%	56.7%	95.7%	27.8%
Non-albatross (%)	75.8%	52.2%	20.0%	100.0%	59.4%	77.8%	55.6%	87.5%		25.0%	43.3%	4.3%	72.2%

### 3.1.3 Injuries and likely cause of death of necropsied seabirds

The condition of the returned birds ranged from 'no obvious or visible injury', 'waterlogged', 'greased' or 'hook present' to 'crushed'. As in previous years, birds caught and returned from trawl fisheries had different injuries from those caught by longline vessels.

Of the 82 birds from longline vessels, most were waterlogged and had hook injuries and of these, 21 (25.6%) still had hooks present (13 in the bill/throat/neck and eight in the wing) (Tables 5 and 6).

Of the 163 birds from trawl vessels, most had been caught in the net or recovered in the pound or cod end (i.e. had drowned, n = 121, 74.2%) and were very wet and sandy with crush injuries (Tables 5 and 6). Other birds had injuries suggesting entanglement and crush injuries from the trawl warp and blocks (n = 30, 18.4%), many with grease covering part, or all, of the body and multiple fractures or missing body parts. Non-albatross taxa were mostly recovered from the net (52.9%) while almost only albatross taxa were affected by warp strikes (94.4%) exhibiting serious wing injuries or lacerations (Tables 5 and 6). There were eight seabirds returned that had been killed by impacting the trawl vessel (4.9%) (Tables 5 and 6).

All five setnet birds were caught in the net with occasional damage to legs or bills (Table 5).

### 3.1.4 Body condition of necropsy seabirds

Between 1 July 2019 and 30 June 2020, 59.6% of returned birds had fat scores of less than 3, 17.6% of birds had fat scores of 3 and 11.6% of birds had fat scores over 3 (Table 7). Twenty-eight birds (11.2%) could not have their fat scores confirmed due to damage (Table 7).

**Table 7** Fat scores of seabirds killed and returned from fishing vessels between 1 July 2019 and 30 June 2020 (1= no fat, to 5 = extremely fat; U = unknown).

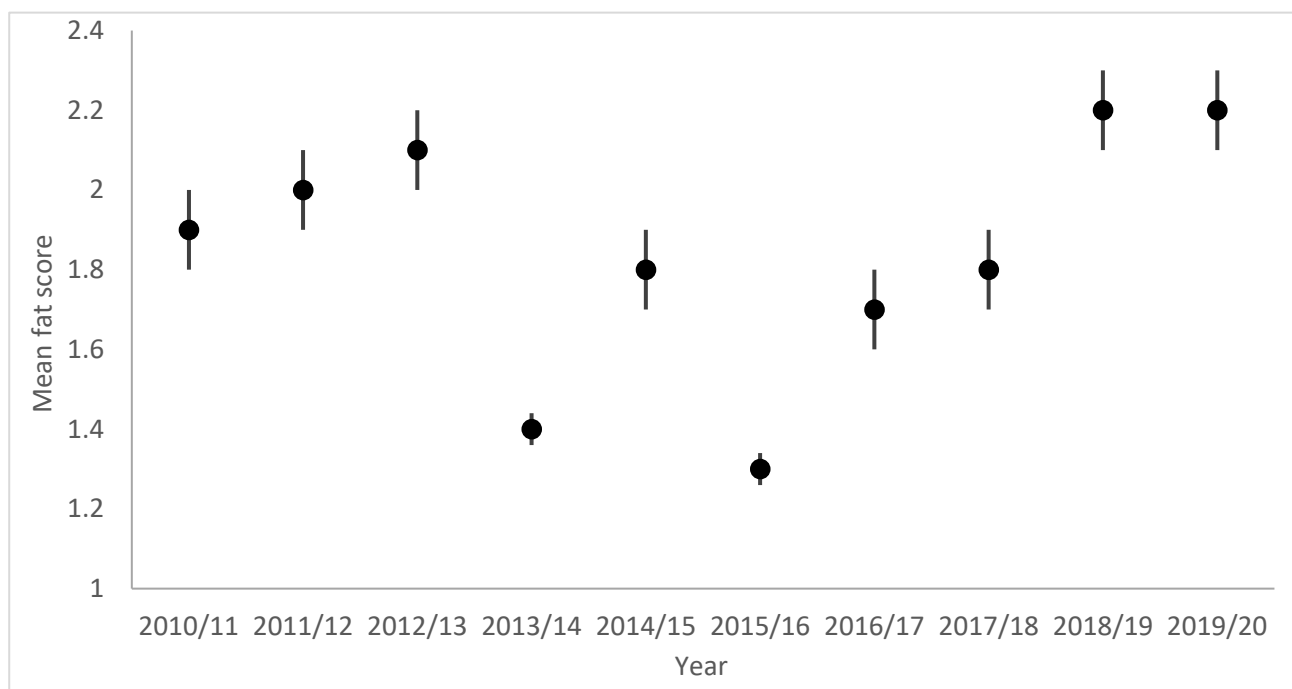
SPECIES	FAT SCORE						TOTAL	MEAN (±SE)
	1	2	3	4	5	U		
Antipodean albatross	1		3				4	2.5 ± 0.5
Black (Parkinson's) petrel	3	2					5	1.4 ± 0.2
Broad-billed prion		1					1	2.0 ± 0.0
Buller's albatross	14	8	3			2	27	1.6 ± 0.1
Common diving petrel	2		1		1		4	2.5 ± 1.0
Fairy prion				1			1	4.0 ± 0.0
Flesh-footed shearwater	2	3	2				7	3.0 ± 0.3
Foveaux shag			1				1	3.0 ± 0.0
Great-winged petrel		1					1	2.0 ± 0.0
Grey petrel		1		1			2	3.0 ± 1.0
Grey-backed storm petrel	1						1	1.0 ± 0.0
Little blue penguin		1					1	2.0 ± 0.0
Mottled petrel					1		1	5.0 ± 0.0
NZ white-capped albatross	11	8	9	5	4	6	43	2.5 ± 0.2
Northern giant petrel						1	1	-
Northern royal albatross	1	1					2	1.5 ± 0.5
Otago shag			1				1	3.0 ± 0.0
Salvin's albatross	4	6	6	7	1	3	27	2.8 ± 0.2
Sooty shearwater	5	11	8	2	2		28	2.5 ± 0.2
Southern giant petrel		2					2	2.0 ± 0.0
Southern royal albatross	1						1	1.0 ± 0.0
Westland petrel	3	4	1				8	1.8 ± 0.3
White-chinned petrel	16	35	9	3	1	16	80	2.0 ± 0.1
Yellow-eyed penguin		1					1	1.0 ± 0.0
<b>TOTAL</b>	<b>64</b>	<b>85</b>	<b>44</b>	<b>19</b>	<b>10</b>	<b>28</b>	<b>250</b>	<b>2.2 ± 0.1</b>
<b>% TOTAL</b>	<b>25.6%</b>	<b>34.0%</b>	<b>17.6%</b>	<b>7.6%</b>	<b>4.0%</b>	<b>11.2%</b>		



This suggests that the mean fat scores of returned birds between 1 July 2019 and 30 June 2020 (mean ( $\pm$  SE) =  $2.2 \pm 0.1$ ) was the same as last season (2018/19 =  $2.2 \pm 0.1$ ) and higher than the previous three fishing years (2017/18 ( $1.8 \pm 0.1$ ), 2016/17 ( $1.7 \pm 0.1$ ), 2015/16 ( $1.3 \pm 0.04$ )) (Bell 2013, Bell & Mischler 2014, Bell & Mischler 2015, Bell & Bell 2016, Bell & Bell 2017, Bell & Bell 2018, Bell & Bell 2019).

The mean fat score has fluctuated over the past ten years (Figure 3), with mean fat scores steadily increasing until 2012/13 and then alternating between lower and higher mean fat scores between 2013/14 and 2015/16 and steadily increasing over the past five fishing years since the lowest fat score of 1.3 in 2015/16 to a mean fat score of 2.2 in 2018/19 and 2019/20 fishing years (Bell 2013, Bell & Mischler 2014, Bell & Mischler 2015, Bell & Bell 2016, Bell & Bell 2017, Bell & Bell 2018, Bell & Bell 2019; Figure 3).

**Figure 3** The mean fat scores for all seabirds killed and returned in New Zealand fisheries, per fishing year, between 1 October 2010 and 30 June 2020.



### 3.1.5 Stomach and gizzard contents

Seventy-six birds (30.4%) had offal or discards in their stomachs and 54 birds (21.6%) had bait in their stomach (Table 8). In addition, 83 birds (33.2%) had empty stomachs. A further 25 birds (10%) had missing stomachs due to interaction with fishing gear or damage due to sea lice. No birds had plastic in their stomachs during this period (Table 8).

Most of the gizzard contents were natural food items (squid beaks 49.2%, fish bones and skin 26.8%, squid or fish eyeballs 9.2% and otoliths 14.8%), but 12% of the birds returned had also ingested plastic, metal, or string and 2% had ingested stones or seeds (Table 9). Photographs and samples of plastic content were taken.

In addition, 47 birds (18.8%) had empty gizzards and 27 birds (10.8%) had missing gizzards due to damage by fishing gear or sea lice. Samples (e.g. squid beaks and otoliths) have been collected for detailed identification to species if required.

**Table 8** Stomach contents of seabirds killed and returned from fishing vessels between 1 July 2019 and 30 June 2020.Note: Birds can have multiple items in the stomachs resulting in higher stomach content figures than the total number of seabirds killed and returned ( $n = 250$ ).

SPECIES	EMPTY	MISSING	BAIT	OFFAL (OR DISCARDS)	NATURAL	BARNACLES OR SEAWEED	PLASTIC	PROVENTRICULAR OIL	WORMS
Antipodean albatross	2			1	2				
Black (Parkinson's) petrel	1		3	1	1				
Broad-billed prion					1				
Buller's albatross	10	2	1	8	11				
Common diving petrel	4								
Fairy prion	1								
Flesh-footed shearwater	5		2						
Foveaux shag	1								
Great-winged petrel			1						
Grey petrel	1		1						
Grey-backed storm petrel	1								
Little blue penguin					1				
Mottled petrel	1								
NZ white-capped albatross	10	4	8	28	12			1	
Northern giant petrel		1							
Northern royal albatross	1			1					
Otago shag				1	1				
Salvin's albatross	6	2	8	12	6				
Sooty shearwater	11		8	6	7				
Southern giant petrel					2				
Southern royal albatross				1					
Westland petrel	1		3	3	2			2	
White-chinned petrel	26	12	19	14	15			1	
Yellow-eyed penguin	1								
<b>TOTAL</b>	<b>83</b>	<b>25</b>	<b>54</b>	<b>76</b>	<b>61</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>0</b>
<b>% TOTAL</b>	<b>33.2%</b>	<b>10.0%</b>	<b>21.6%</b>	<b>30.4%</b>	<b>24.4%</b>			<b>1.6%</b>	

**Table 9** Gizzard contents of seabirds killed and returned from fishing vessels between 1 July 2019 and 30 June 2020.

Note: Birds can have multiple items in the gizzard resulting in higher figures than the total number of seabirds killed and returned ( $n = 250$ ).

SPECIES	EMPTY	MISSING	SQUID BEAKS	OTOLITHS	FISH OR SQUID EYEBALLS	FISH BONES OR SKIN	PLASTIC, METAL OR STRING	SEEDS, STONES OR SHELL	WORMS	KRILL, FEATHERS, BARNACLES OR SEAWEED
Antipodean albatross	1		3			1				
Black (Parkinson's) petrel			4	2	1	2		1		
Broad-billed prion	1									
Buller's albatross	9	2	4	2	3	11		1		1
Common diving petrel	4									
Fairy prion	1									
Flesh-footed shearwater			6				7			
Foveaux shag	1									
Great-winged petrel			1							
Grey petrel			2							
Grey-backed storm petrel								1		
Little blue penguin	1									
Mottled petrel	1									
NZ white-capped albatross	16	5	12	3	5	17	1		2	3
Northern giant petrel		1								
Northern royal albatross			2	1	1		1			
Otago shag	1									
Salvin's albatross	7	3	3	9	7	13				1
Sooty shearwater	3		15	3	2	6	15		1	2
Southern giant petrel			2				1			1
Southern royal albatross			1	1	1	1				
Westland petrel			8	3	1	1		2	1	
White-chinned petrel		16	60	13	2	15	5		3	1
Yellow-eyed penguin	1									
<b>TOTAL</b>	<b>47</b>	<b>27</b>	<b>123</b>	<b>37</b>	<b>23</b>	<b>67</b>	<b>30</b>	<b>5</b>	<b>7</b>	<b>9</b>
<b>% TOTAL</b>	<b>18.8%</b>	<b>10.8%</b>	<b>49.2%</b>	<b>14.8%</b>	<b>9.2%</b>	<b>26.8%</b>	<b>12.0%</b>	<b>2.0%</b>	<b>2.8%</b>	<b>3.6%</b>

### 3.1.6 Identification of necropsy birds

Necropsy confirmed that the majority (75.6%) of the seabirds returned between 1 July 2019 and 30 June 2020 were identified correctly by the observers (based on the information provided by observers on the specimen tags) (Table 10).

**Table 10** Comparison of identifications (ID) recorded by on-board observers at sea compared with necropsy identification for seabirds killed and returned from observed fishing boats between 1 July 2019 and 30 June 2020.

Species	ID correct	ID wrong	ID to correct species group*	ID as seabird small, large or albatross*	ID not on label or code did not exist	Total
Antipodean albatross			4			4
Black (Parkinson's) petrel	5					5
Broad-billed prion		1				1
Buller's albatross	14		12		1	27
Common diving petrel	3	1				4
Fairy prion			1			1
Flesh-footed shearwater	7					7
Foveaux shag		1				1
Great-winged petrel		1				1
Grey petrel	1	1				2
Grey-backed storm petrel		1				1
Little blue penguin	1					1
Mottled petrel					1	1
NZ white-capped albatross	36	5		1	1	43
Northern giant petrel	1					1
Northern royal albatross		2				2
Otago shag			1			1
Salvin's albatross	25	2				27
Sooty shearwater	22	3	3			28
Southern giant petrel		2				2
Southern royal albatross				1		1
Westland petrel	8					8
White-chinned petrel	66	7	5		2	80
Yellow-eyed penguin					1	1
<b>Total</b>	<b>189</b>	<b>27</b>	<b>26</b>	<b>2</b>	<b>6</b>	<b>250</b>
<b>% Total</b>	<b>75.6%</b>	<b>10.8%</b>	<b>10.4%</b>	<b>0.8%</b>	<b>2.4%</b>	

\* Identified to correct group or size class but given the wrong species code.

Twenty-six seabirds (10.8%) were identified to the correct group or size class but were given the wrong species code (although this may relate to changes in the coding system). These included Antipodean albatross, Buller's albatross, fairy prion, Otago shag, sooty shearwater, and white-chinned petrel. A further 27 (10.8%) were identified incorrectly including the following species: broad-billed prion, common diving petrel, Foveaux shag, great winged (grey-faced) petrel, grey petrel, grey-backed storm petrel, New Zealand white-capped albatross, northern royal albatross, Salvin's albatross, sooty shearwater, southern giant petrel, and white-chinned petrel. Six birds (2.4%) did not have an observer identification code on the return label or had a code that did not exist (Table 10).

## 3.2 Photographs and Interactions

### 3.2.1 Numbers of photographed seabirds or those listed as interactions

In total 594 birds were either photographed and reported in the MPI COD extract as captured (both live and dead seabirds) or were recorded in the MPI COD interacting with fishing vessels (this number may include some non-capture interactions) but not photographed between 1 July 2019 and 30 June 2020 (Table 11).

**Table 11** Number of seabirds of each species reported as photographed or interacting with fishing vessels between 1 July 2019 and 30 June 2020.

Species	Photograph	Interaction	Total
	In COD extract & image	In COD extract with no image	
Albatross (unidentified)		15	15
Black (Parkinson's) petrel	1	3	4
Black-browed albatross (unidentified)		2	2
Buller's albatross	10	7	17
Buller's and Pacific albatross		6	6
Cape petrel	2		2
Cape petrels (unidentified)		12	12
Common diving petrel	1	2	3
Fairy prion		1	1
Flesh-footed shearwater		14	14
Fluttering shearwater		1	1
Great albatross (unidentified)		4	4
Great-winged (grey-faced) petrel		1	1
Grey petrel	4	21	25
Grey-backed storm petrel	1		1
Grey-headed albatross		1	1
Mid-sized petrel & shearwater (unidentified)		8	8
New Zealand white-capped albatross	52	43	95
Northern giant petrel		1	1
Northern royal albatross	1		1
Petrel (unidentified)		3	3
Petrels, prion, and shearwaters (unidentified)		2	2
Prion (unidentified)	1	2	3
Procellaria petrel (unidentified)		18	18
Red-billed gull		1	1
Salvin's albatross	15	11	26
Seabird (unidentified)		1	1
Small albatross (unidentified)		4	4
Snares crested penguin	1		1
Sooty shearwater	33	14	47
Southern royal albatross	1	8	9
Storm petrel (unidentified)		9	9
Wandering albatross (unidentified)		1	1
Westland petrel	4	2	6
White-chinned petrel	169	80	249
<b>Total</b>	<b>296</b>	<b>298</b>	<b>594</b>

**Table 12.** Number of photograph and interaction seabirds recorded from observed fishing vessels between 1 July 2019 and 30 June 2020, by month of capture.

SPECIES	MONTH												TOTAL	% TOTAL
	J	F	M	A	M	J	J	A	S	O	N	D		
Albatross (unidentified)		5	2	1	1	1		1	1	1		2	15	2.5%
Black (Parkinson's) petrel		1	1								2		4	0.7%
Black-browed albatross (unidentified)				2									2	0.3%
Buller's albatross		1	2	1	3	4	3	3					17	2.9%
Buller's and Pacific albatross					3		3						6	1.0%
Cape petrel							1		1				2	0.3%
Cape petrels (unidentified)		1	2				1		6		1	1	12	2.0%
Common diving petrel		1			1						1		3	0.5%
Fairy prion							1						1	0.2%
Flesh-footed shearwater	1	6	1					1		3	2		14	2.4%
Fluttering shearwater											1		1	0.2%
Great albatross (unidentified)		1	1				1					1	4	0.7%
Great winged (grey-faced) petrel					1								1	0.2%
Grey petrel		1					1		23				25	4.2%
Grey-backed storm petrel		1				1							1	0.3%
Grey-headed albatross										1			1	0.2%
Mid-sized petrel & shearwater (unidentified)		6	2										8	1.3%
New Zealand white-capped albatross	14	25	21	18	4	2	2		1	4	3	1	95	16.0%
Northern giant petrel									1				1	0.2%
Northern royal albatross											1		1	0.2%
Petrel (unidentified)			1	2									3	0.5%
Petrels, prion, and shearwaters (unidentified)		2											2	0.3%
Prion (unidentified)						1	1	1					3	0.5%
Procellaria petrel (unidentified)		13	1	1							1	2	18	3.0%
Red-billed gull												1	1	0.2%
Salvin's albatross	2	1	1		1				1	12	8	1	26	4.5%
Seabird (unidentified)							1						1	0.2%
Small albatross (unidentified)		1		1			2						4	0.7%
Snares crested penguin		1											1	0.2%
Sooty shearwater	1	1	20	7	2					9	8		47	8.1%

SPECIES	MONTH												TOTAL	% TOTAL
	J	F	M	A	M	J	J	A	S	O	N	D		
Southern royal albatross	3	1	1	1			1						9	1.2%
Storm petrel (unidentified)			3		1	4			1	1			9	1.7%
Wandering albatross (unidentified)	1												1	0.2%
Westland petrel							5			1			6	1.0%
White-chinned petrel	10	72	75	79						2	9		249	41.6%
<b>TOTAL</b>	<b>32</b>	<b>141</b>	<b>134</b>	<b>113</b>	<b>17</b>	<b>13</b>	<b>23</b>	<b>6</b>	<b>35</b>	<b>34</b>	<b>37</b>	<b>9</b>	<b>594</b>	
<b>% TOTAL</b>	<b>5.4%</b>	<b>23.7%</b>	<b>22.6%</b>	<b>19.0%</b>	<b>2.9%</b>	<b>2.2%</b>	<b>3.9%</b>	<b>1.0%</b>	<b>5.9%</b>	<b>5.7%</b>	<b>6.2%</b>	<b>1.5%</b>		

Of these, 298 had no photographs taken (a mixture of birds that were either released alive or discarded dead by the crew) and 296 seabird interactions that were photographed and had corresponding entries in the MPI COD extract (Table 11).

Similar to the seabirds caught and returned for necropsy, the photograph and interaction seabirds were dominated by three species: white-chinned petrel (n = 249, 41.6%), New Zealand white-capped albatross (n = 95, 16.0%), and sooty shearwater (n = 48, 8.1%) (Table 12). These three species accounted for 65.7% of all reported interaction or photograph birds.

Like the necropsied seabirds, the monthly distribution of photograph and interaction seabirds was also not evenly spread across the fishing year with most birds being reported in February 2020 (n = 142, 23.7%), March 2020 (n = 137, 23.7%), and April 2020 (n = 113, 19.0%) (Table 12). This pattern reflects the timing of seabird breeding, presence within the New Zealand EEZ, timing and location of all observed fisheries, and observer coverage.

### 3.2.2 Target fishery and vessels of photographed or interaction seabirds

The seabirds that were photographed and listed in the MPI COD extract and discarded dead or released alive were caught in a range of Fishing Management Areas (FMA 1, 3, 4, 5, 6, and 7) and general positions are show in Figures 4 and 5.

The seabirds that were reported as an interaction in the MPI COD extract but not photographed were caught in a range of Fishing Management Areas (FMA 1, 2, 3, 4, 5, 6, and 7) and general positions are show in Figures 6 and 7. One seabird that were reported as an interaction in the MPI COD extract were recorded outside the New Zealand EEZ (Figures 6 & 7).

The 594 seabirds that were either photographed or recorded as an interaction were from 51 different vessels: two birds (0.3%) from a potting vessel (2.0%), five birds (0.8%) on a set net vessel (2.0%), 62 birds (10.4%) on 14 longline vessels (27.5%) and 526 bird (88.6%) on 30 trawl vessels (58.8%) (Table 13).

**Table 13** Number of seabirds recorded as interactions or photographed from fisheries vessels between 1 July 2019 and 30 June 2020 (with the number of individual vessels in parentheses).

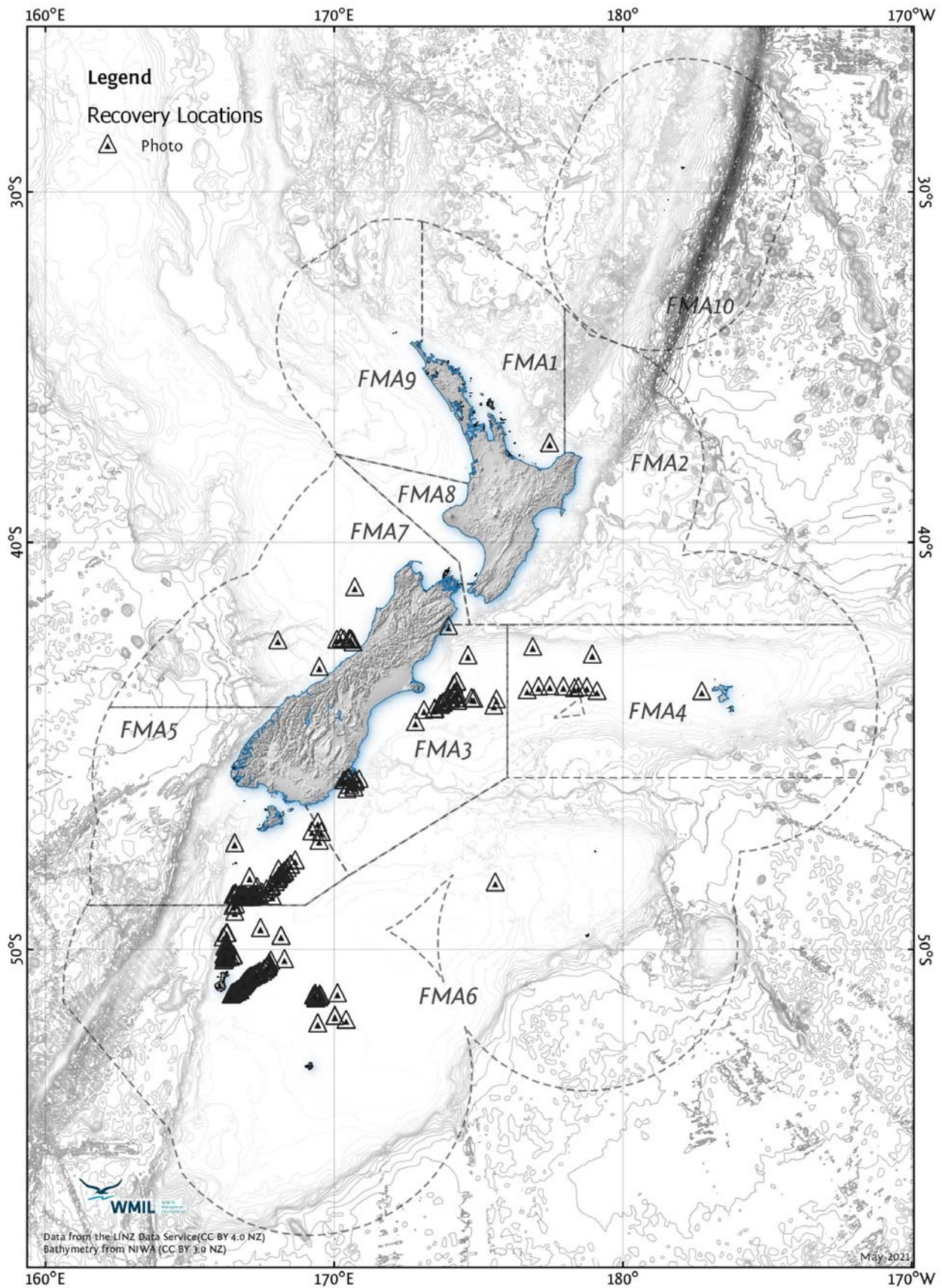
		Photograph seabirds	Interaction Seabirds	Total
Longline vessels	Bottom	25 (2)	27 (8)	52 (8)
	Surface	1 (1)	8 (2)	9 (2)
Trawl vessels		270 (27)	256 (30)	526 (30)
Set net vessels			5 (1)	5 (1)
Pot vessels			2 (1)	2 (1)
<b>Total</b>		<b>296 (30)</b>	<b>298 (49)</b>	<b>594 (51)</b>

For the fishing period 1 July 2019 to 30 June 2020, there were 294 observed trips on 129 vessels (Observer data, unpublished). Fifty-one vessels (39.5%) reported interactions (photographed and/or non-photographed) with seabirds (Table 13). Over half of these 51 vessels reported relatively low numbers of bird interactions (< 5 birds reported; n = 26, 50.9%). There were 20 vessels (39.2%) that had interactions with 10 or more birds.

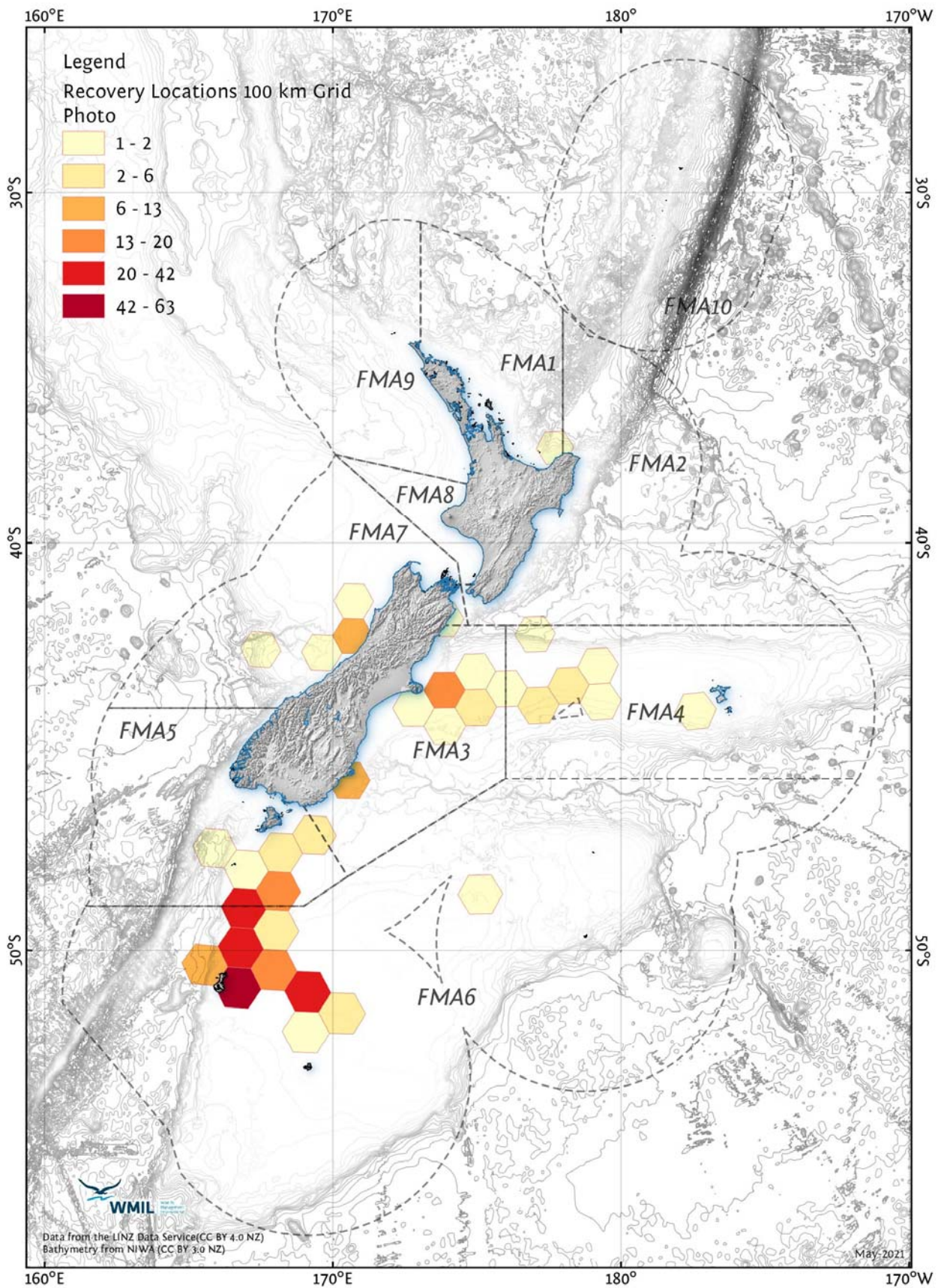
When combined with the seabirds that were caught and returned for necropsy, the number of vessels that had live and/or dead interactions with seabirds increased to 67 (51.9%). Over half of these vessels reported low numbers of interactions or returned low numbers of seabirds (<5 birds; n = 34, 50.7%). Twenty-six vessels (38.8%) had interactions with or returned more than 10 seabirds.



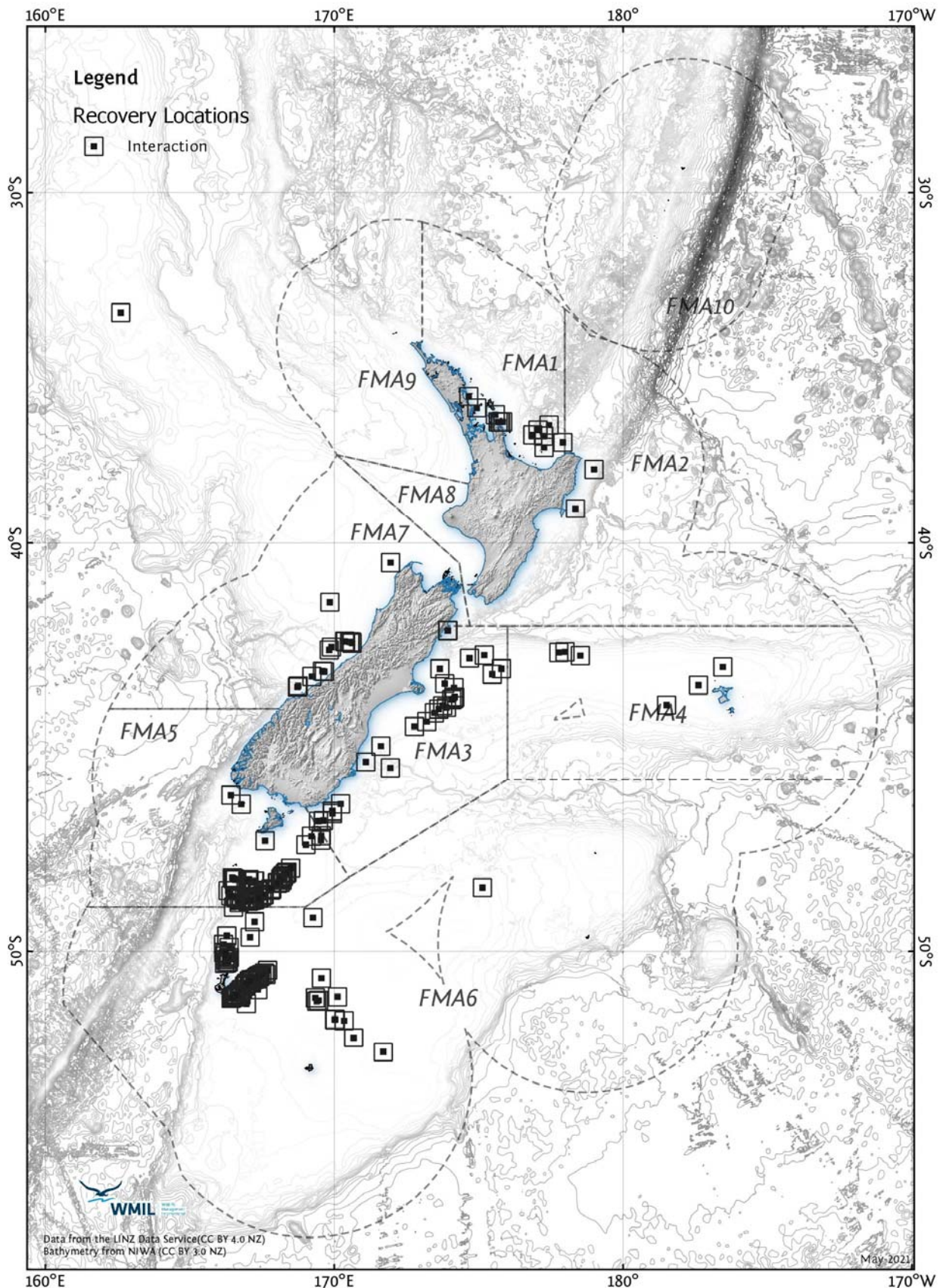
**Figure 4** Individual catch locations of all seabirds caught and photographed in New Zealand fisheries between 1 July 2019 and 30 June 2020.  
 Note: catch location symbols may be obscured by overlying symbols (e.g. where several individuals were captured from the same tow or set, each bird will have the same catch location and appear on the maps as a single symbol).



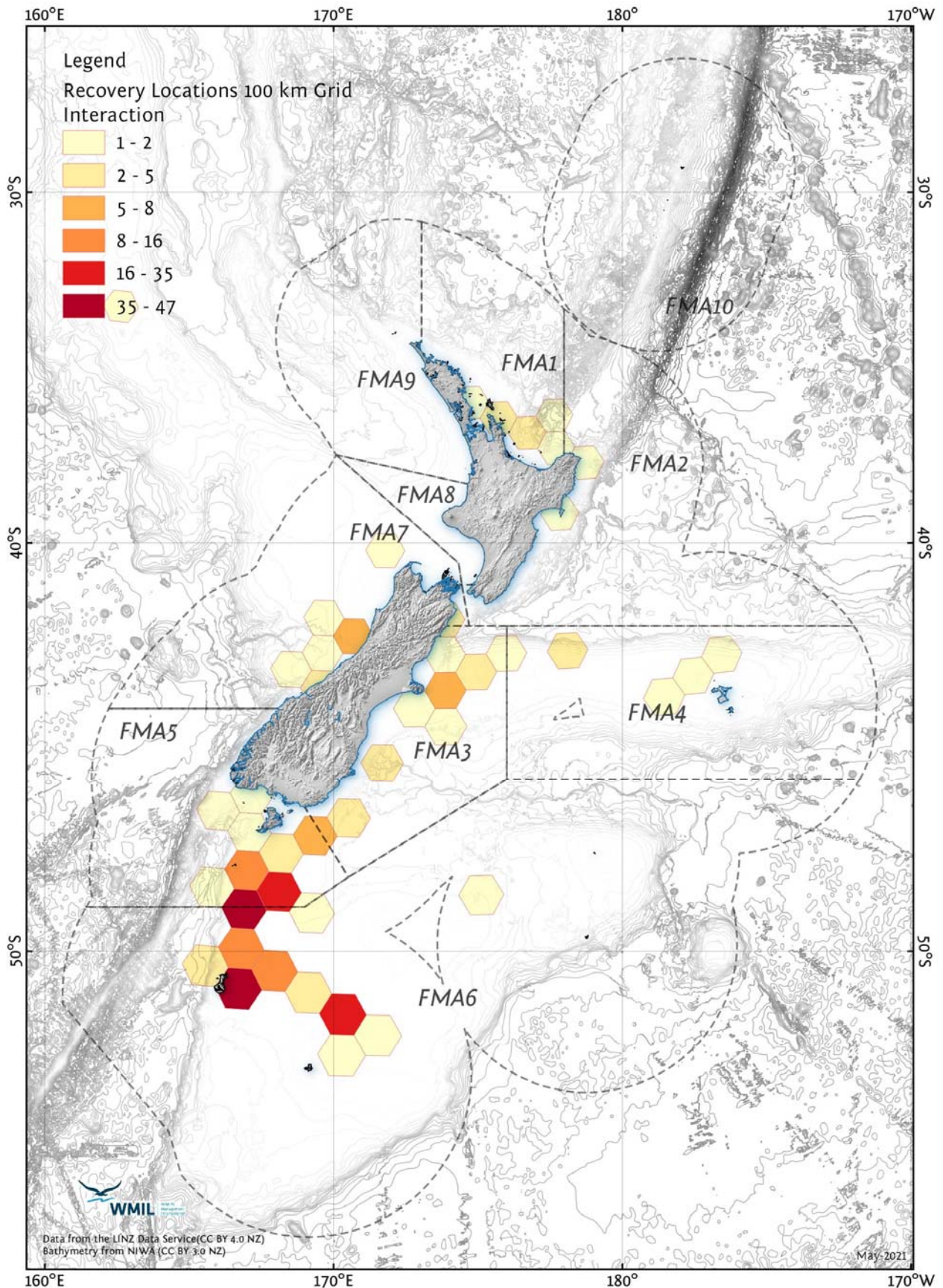
**Figure 5** Grouped catch locations of all seabirds caught and photographed in New Zealand fisheries between 1 July 2019 and 30 June 2020.



**Figure 6** Individual catch locations of all seabirds reported as an interaction (and not photographed) in New Zealand fisheries between 1 July 2019 and 30 June 2020.  
 Note: catch location symbols may be obscured by overlying symbols (e.g. where several individuals were captured from the same tow or set, each bird will have the same catch location and appear on the maps as a single symbol).



**Figure 7** Grouped catch locations of all seabirds reported as an interaction (and not photographed) in New Zealand fisheries between 1 July 2019 and 30 June 2020.



### 3.2.3 Injuries of photographed or interaction seabirds

Almost half of the 594 interaction or photographed birds represented live bird interactions (n = 292, 49.2%) (Table 14). Only 36 of the photographed birds were released alive (12.2%) compared to 256 interaction birds (85.9%) (Table 14). Most of these interaction birds were released by the crew prior to the Observer being able to photograph the birds (as reported by the observer in the notes provided in the MPI COD extract). Nine reported dead birds could not be recovered as they fell off the warp or hook prior to coming aboard (Table 14).

**Table 14** Number of seabirds recorded as interactions or photographed from fisheries vessels between 1 July 2019 and 30 June 2020.

	Photograph seabirds	Interaction Seabirds	Total	% Total
<b>Alive</b>	36	256	<b>292</b>	49.2%
<b>Dead</b>	260	33	<b>293</b>	49.3%
<b>Not recovered (dead)</b>		9	<b>9</b>	1.5%
<b>Total</b>	<b>296</b>	<b>298</b>	<b>594</b>	

For the 296 seabirds that were photographed, 36 were released alive (although some had injuries that are likely to cause death) and 260 died for a range of reasons (Table 15). Of the 260 dead photographed birds, 155 were drowned in the trawl nets (59.6%), 22 were drowned on longline hooks (8.55%), 11 died as results of warp strike (4.2%), 11 were drowned in the codend (of the trawl nets) (4.2%), 52 died on trawl vessels for other reasons (20%) and nine died by striking the vessel (3.5%) (Tables 15 & 16).

For the 43 seabirds that were recorded dead following an interaction (but not photographed) with the fishing vessel, 15 (34.1%) were drowned in the trawl nets, seven (15.9%) went through the warp, 11 (25%) could not be recovered after falling off the warp or net prior to coming aboard the vessel, and 11 (25%) were drowned on longline hooks but fell off before reaching the vessel or were discarded by crew (Table 15).

**Table 15** Types of injuries recorded on seabirds that were photographed or recorded as interactions from fisheries vessels between 1 July 2019 and 30 June 2020.

	Photograph		Interaction		Total			% Total
	Alive	Dead	Alive	Dead	Alive	Dead	All	
<b>No visible injuries</b>	29	74	221	10	<b>250</b>	<b>84</b>	<b>334</b>	56.2%
<b>Disorientated</b>	5	3	12		<b>17</b>	<b>3</b>	<b>20</b>	3.4%
<b>Waterlogged</b>		99	1	5	<b>1</b>	<b>109</b>	<b>110</b>	18.5%
<b>Broken wing</b>		27		4		<b>31</b>	<b>31</b>	5.2%
<b>Broken neck</b>		4				<b>4</b>	<b>4</b>	0.7%
<b>Broken leg</b>		1				<b>1</b>	<b>1</b>	0.2%
<b>Hook (unspecified)</b>		5				<b>5</b>	<b>5</b>	0.8%
<b>Hook in bill or throat</b>	1		1	5	<b>2</b>	<b>5</b>	<b>7</b>	1.2%
<b>Hook in wing</b>		1				<b>1</b>	<b>1</b>	0.2%
<b>Hook in foot</b>				1		<b>1</b>	<b>1</b>	0.2%
<b>Open wound</b>		7		1		<b>8</b>	<b>8</b>	1.3%
<b>Severed body part</b>		11				<b>11</b>	<b>11</b>	1.9%
<b>More than 3 injuries (crushed)</b>		1		7		<b>8</b>	<b>8</b>	1.3%
<b>Greased</b>		13				<b>13</b>	<b>13</b>	2.2%
<b>Liced</b>		5				<b>5</b>	<b>5</b>	0.8%
<b>Unknown (unable to assess)</b>	1	9	20	10	<b>21</b>	<b>19</b>	<b>40</b>	6.7%
<b>Total</b>	<b>36</b>	<b>260</b>	<b>255</b>	<b>43</b>	<b>281</b>	<b>295</b>	<b>576</b>	
	<b>296</b>		<b>298</b>		<b>594</b>			

**Table 16** Number of seabirds of each species that were photographed after vessel interaction from commercial fisheries between 1 July 2019 and 30 June 2020, by likely cause of death. The proportion of albatross and non-albatross taxa returned is also presented.

Species	Longline				Trawl								Total	
	Hook				Warp	Net		Codend	Other		Vessel strike			
	Bill	Wing	Location not reported	Location not reported		Dead	Alive		Dead	Alive	Dead	Alive		Dead
	Dead			Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead			
Black (Parkinson's) petrel				1										1
Buller's albatross					2	1	6				1			10
Cape petrel											2			2
Common diving petrel											1			1
Grey petrel												4		4
Grey-backed storm petrel											1			1
New Zealand white-capped albatross					7	2	25	4	1	9	4			52
Northern royal albatross									1					1
Prion (unidentified)							1							1
Salvin's albatross					2	1	9	1		1	1			15
Snares crested penguin						1								1
Sooty shearwater						1	21			8		3		33
Southern royal albatross											1			1
Westland petrel							3				1			4
White-chinned petrel	4	1	18			15	90	5		34		2		169
<b>Total</b>	<b>4</b>	<b>1</b>	<b>18</b>	<b>1</b>	<b>11</b>	<b>21</b>	<b>155</b>	<b>10</b>	<b>2</b>	<b>52</b>	<b>12</b>	<b>9</b>		
<b>% Total</b>	<b>1.4%</b>	<b>0.3%</b>	<b>6.1%</b>	<b>0.3%</b>	<b>3.7%</b>	<b>7.1%</b>	<b>52.4%</b>	<b>3.4%</b>	<b>0.7%</b>	<b>17.6%</b>	<b>4.1%</b>	<b>3.0%</b>		<b>296</b>
<b>Total (each type)</b>	<b>24</b>				<b>272</b>									
% of total longline or trawl	<b>16.6%</b>	<b>4.2%</b>	<b>75%</b>	<b>4.2%</b>	<b>4.0%</b>	<b>7.7%</b>	<b>56.9%</b>	<b>3.7%</b>	<b>0.7%</b>	<b>19.1%</b>	<b>4.4%</b>	<b>3.3%</b>		
Albatrosses (%)					100%	9.5%	25.8%	54.5%	100%	19.2%	58.3%			
Non-albatross (%)	100%	100%	100%	100%		90.5%	74.2%	45.5%		80.8%	41.7%	100%		

There were a range of injuries on the interaction and photographed birds as shown in Table 15. Most of the birds (n = 334, 56.2%) had no visible injuries and most of these birds were released alive (n = 250, 74.9%).

There were 30 interaction birds (5.1%) and ten photographed birds (1.7%) that could not have injuries assessed by the observer as these birds had been released or discarded by the crew or had fallen overboard before retrieval (Table 15).

### 3.2.4 Identification of photographed seabirds

There were 15 different seabird taxa that had been photographed by the Observers (Tables 11, 15 & 17).

Examination of 296 photographed seabird interactions received confirmed that observers had accurately identified 91.9% (n = 272) of seabirds (Table 17). Four New Zealand white-capped albatross, one sooty shearwater, two Westland petrels and two white-chinned petrels were incorrectly identified (n= 9, 3%; Table 17).

**Table 17** Comparison of 262 (of 300) observer identifications with expert identifications for observed and photographed captures listed in COD from fishing vessels between 1 July 2019 and 30 June 2020, by species.

Where: 'Confirmed' = photograph identification confirmed the observer identification; 'new, consistent' = photograph identification was to a lower taxonomic group, but consistent with the observer identification; and 'new, not consistent' = photograph identification was not consistent with the observer identification (i.e. observer identified the species incorrectly).

Species	Confirmed	New, consistent	New, not consistent	Total
Black (Parkinson's) petrel	1			1
Buller's albatross	5	5		10
Cape petrel		2		2
Common diving petrel	1			1
Grey petrel	4			4
Grey-backed storm petrel		2		2
NZ white-capped albatross	48		4	52
Northern royal albatross		1		1
Prion (unidentified)	1			1
Salvin's albatross	14	1		15
Snares crested penguin		1		1
Sooty shearwater	33		1	34
Southern royal albatross	1			1
Westland petrel	1	1	2	4
White-chinned petrel	163	2	2	167
<b>Total</b>	<b>272</b>	<b>15</b>	<b>9</b>	<b>296</b>
<b>% Total (all 295 seabirds)</b>	<b>91.9%</b>	<b>5.1%</b>	<b>3.0%</b>	

### 3.2.5 Quality and number of photographs

The quality of the images obtained by observers continued to vary widely, particularly for live birds. Video footage is now being received as well as still imagery.

Photography of dead birds continues to improve with a number of images being taken for most of the dead specimens.

Issues included only one photograph for some seabirds, not all key features being photographed, poor focus, and under- or over-exposure.

Poor images were particularly common for birds that were alive and seen on-board for short periods (particularly when photographs were taken from a long distance).

### 3.2.6 Recommendations for photograph identification

It is recommended that:

1. Wherever possible, all seabird interactions are photographed and recorded. If possible, haul and sample information should be included in the image.
2. 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.
3. Photo logs are completed for all images (which can be correlated to date and time stamps from the camera). Descriptions of the interaction would also help with the identification and matching of images.
4. Photograph numbers are recorded on the observer non-fish bycatch form.
5. Photographs (and extracts from the MPI observer logbooks) are provided regularly throughout the fishing year for photo-identification.
6. 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.

## 4. ACKNOWLEDGMENTS

This work was funded through the Conservation Services Programme (INT2019-02), Department of Conservation. This necropsy and photo-identification work would not have been possible without the dedication of Ministry for Primary Industries observers who retained the birds for necropsy, took the photographs, and completed logbooks (which contain important information on cause of death and other aspects of the interaction on-board). Shannon Weaver, Katie Clemens-Seely and Georgia Hardieboys provided the link between Wildlife Management International Ltd, the Department of Conservation and the Ministry for Primary Industries Observer Programme and helped provide clarification on any discrepancies with necropsy tag data and photograph records. Kelvin Floyd (WMIL) developed and maintained the WMIL necropsy and photo-identification database and produced all maps.

## 5. REFERENCES

- Agreement on the Conservation of Albatrosses and Petrels (ACAP). 2010: Taxonomy of albatrosses and larger petrels. Unpublished report prepared by the Taxonomic Working Group of the Agreement on the Conservation of Albatrosses and Petrels for the Convention on the Conservation of Migratory Species of Wild Animals 16th Meeting of the CMS Scientific Council. Bonn, Germany, 28-30 June 2010. 11p. [http://www.cms.int/bodies/ScC/16th\\_scientific\\_council/Eng/ScC16\\_Doc\\_17\\_Taxonomy\\_of\\_Albatrosses\\_&\\_Petrels\\_ACAP\\_E.pdf](http://www.cms.int/bodies/ScC/16th_scientific_council/Eng/ScC16_Doc_17_Taxonomy_of_Albatrosses_&_Petrels_ACAP_E.pdf)
- Bartle, J.A. 2000: Autopsy report for seabirds killed and returned from New Zealand fisheries 1 October 1996 to 31 December 1997. Conservation Advisory Science Notes 293. Department of Conservation, Wellington. 43 p.
- Bell, E.A. 2011. Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 October 2010 to 30 June 2011. Contract report to Conservation Service Programme. Department of Conservation, Wellington.



- Bell, E.A. 2012. Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 July 2011 to 30 June 2012. Contract report to Conservation Service Programme. Department of Conservation, Wellington.
- Bell, E.A. 2013. Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 July 2012 to 30 June 2013. Contract report to Conservation Service Programme. Department of Conservation, Wellington.
- Bell, E.A.; Mischler, C.P. 2014. Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 July 2013 to 30 June 2014. Contract report to Conservation Service Programme. Department of Conservation, Wellington.
- Bell, E.A.; Mischler, C.P. 2015. Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 July 2014 to 30 June 2015. Contract report to Conservation Service Programme. Department of Conservation, Wellington.
- Bell, E.A.; Bell, M.D. 2016. Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 July 2015 to 30 June 2016. Contract report to Conservation Service Programme. Department of Conservation, Wellington.
- Bell, E.A.; Bell, M.D. 2017. Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 July 2016 to 30 June 2017. Contract report to Conservation Service Programme. Department of Conservation, Wellington.
- Bell, E.A.; Bell, M.D. 2018. Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 July 2017 to 30 June 2018. Contract report to Conservation Service Programme. Department of Conservation, Wellington.
- Bell, E.A.; Bell, M.D. 2019. INT2016-02: Identification of seabirds caught in New Zealand fisheries 1 July 2018 to 30 June 2019. Annual Technical Report to the Conservation Services Programme, Department of Conservation. Wellington, New Zealand.
- CSP (Conservation Services Programme) 2008: Summary of autopsy reports for seabirds killed and returned from observed New Zealand fisheries: 1 October 1996 – 30 September 2005, with specific reference to 2002/03, 2003/04, 2004/05. DOC Research and Development Series 291. Department of Conservation, Wellington. 110 p.
- Marchant, S.; Higgins, P.J. 1990: Handbook of Australian, New Zealand and Antarctic birds. Vol. 1. Oxford University Press, Oxford. 735 p.
- Nunn, G.B.; Cooper, J.; Jouventin, P.; Robertson, C.J.R.; Robertson, G.G. 1996: Evolutionary relationships among extant albatrosses (Procellariiformes: Diomedidae) established from complete cytochrome-b gene sequences. *Auk* 113: 784–801.
- Onley, D.; Scofield, P. 2007: Albatrosses, petrels, and shearwaters of the world. Princeton University Press, Princeton. 240 p.
- Robertson, C.J.R. 2000: Autopsy report for seabirds killed and returned from New Zealand fisheries 1 January 1998 to 30 September 1998. Conservation Advisory Science Notes 294. Department of Conservation, Wellington. 36 p.
- Robertson, C.J.R.; Bell, E. 2002a: Autopsy report for seabirds killed and returned from New Zealand fisheries 1 October 1998 to 30 September 1999. DOC Science Internal Series 28. Department of Conservation, Wellington. 41 p.

- Robertson, C.J.R.; Bell, E. 2002b: Autopsy report for seabirds killed and returned from New Zealand fisheries 1 October 1999 to 30 September 2000. DOC Science Internal Series 29. Department of Conservation, Wellington. 41 p.
- Robertson, C.J.R.; Bell, E.; Scofield, P. 2003: Autopsy report for seabirds killed and returned from New Zealand fisheries, 1 October 2000 to 30 September 2001: birds returned by Ministry of Fisheries observers to the Department of Conservation. DOC Science Internal Series 96. Department of Conservation, Wellington. 36 p. plus data supplement.
- Robertson, C.J.R.; Bell, E.; Scofield, P. 2004: Autopsy report for seabirds killed and returned from New Zealand fisheries, 1 October 2001 to 30 September 2002: birds returned by Ministry of Fisheries observers to the Department of Conservation. DOC Science Internal Series 155. Department of Conservation, Wellington. 43 p. plus data supplement.
- Robertson, C.J.R.; Bell, E.A.; Sinclair, N.; Bell, B.D. 2003: Distribution of seabirds from New Zealand that overlap with fisheries worldwide. Science for Conservation 233. Department of Conservation, Wellington. 102 p.
- Robertson, C.J.R.; Nunn, G.B. 1998: Towards a new taxonomy for albatrosses. Pp. 13–19 in Robertson, G.; Gales, R. (Eds): Albatross biology and conservation. Surrey Beatty & Sons, Chipping Norton, Australia.
- Shirihaj, H. 2002: A complete guide to Antarctic wildlife: the birds and marine mammals of the Antarctic continent and Southern Ocean. Alula Press Oy, Finland. 510 p.
- Thompson, D.R. 2009: Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 October 2005 to 30 September 2006. DOC Marine Conservation Services Series 2. Department of Conservation, Wellington. 35 p.
- Thompson, D.R. 2010a: Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 October 2006 to 30 September 2007. DOC Marine Conservation Services Series 3. Department of Conservation, Wellington. 37 p.
- Thompson, D.R. 2010b: Autopsy report for seabirds killed and returned from observed New Zealand fisheries: 1 October 2007 to 30 September 2008. DOC Marine Conservation Services Series 5. Department of Conservation, Wellington. 33 p.