

**INT 2013-02 IDENTIFICATION OF SEABIRDS
CAPTURED IN NEW ZEALAND FISHERIES:
1 JULY 2015 TO 30 June 2016**



INT2013-02 Identification of seabirds captured in New Zealand fisheries: 1 July 2015 to 30 June 2016

Elizabeth Bell and Mike Bell

Wildlife Management International Ltd
PO Box 607
Blenheim 7240
New Zealand
www.wmil.co.nz
biz@wmil.co.nz

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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 2015 and 30 June 2016 a total of 328 seabirds comprising 25 taxa were incidentally killed as bycatch and returned for autopsy by on-board New Zealand Government observers. Birds were returned from longline (n = 157), trawl (n = 167) and set net (n = 4) vessels, and were dominated numerically by five species (white-chinned petrel *Procellaria aequinoctialis*, Buller's albatross *Thalassarche bulleri bulleri*, New Zealand white-capped albatross *Thalassarche steadi*, sooty shearwater *Puffinus griseus* and Salvin's albatross *Thalassarche salvini*). All birds returned from longline fisheries had injuries consistent with being hooked or entangled in the bill or throat. In contrast, most birds (74.0%) returned from trawl fisheries were killed through entanglement in the net or cod-end, with the remaining 18.7% likely to have been killed by warp interaction or entanglement. Seven birds were killed by striking the deck of the vessel. Birds had a lower mean fat scores as in the previous three fishing years, and discards, including offal, appear to continue to be an attractant for many seabirds. In addition to the seabirds that were returned for autopsy, examination of the Ministry for Primary Industries Central Observer Database and images provided by Government observers gave a total of a further 544 seabirds that were reported as interactions or photographed (as dead or alive captures) with 62 fishing vessels (and may include some non-capture interactions). Over half (54.2%) of the seabirds reported in these interactions were released alive. Out of these 544 extra records of seabird interactions on fishing vessels, photographs were taken of 270 seabirds consisting of 21 taxa. Image quality varied widely, with poor images being particularly common for birds that were alive and seen on-board for short periods. Images for dead birds have improved with a number of images taken for each specimen. Recommendations are made to improve photo-identifications in the future.

Keywords: commercial fishing, seabirds, autopsy, 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, an autopsy programme has been in place since 1998 to accurately determine the taxon (and 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 autopsy. 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 autopsies were performed for the Department of Conservation (DOC) as part of Conservation Services Programme (CSP) project INT2013-02.

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 2015 and 30 June 2016. Identifications were based on dead birds caught and returned and/or photographs 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 autopsy 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 Autopsy

The autopsy methods followed those described by Bartle (2000) and used in autopsies in subsequent fishing years (Robertson 2000; Robertson & Bell 2002a, b; Robertson et al. 2003, 2004; Conservation Services Programme 2008; Thompson 2009, 2010a, b; Bell 2011, 2012, 2013; Bell & Mischler 2014, 2015). 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 autopsy, 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 autopsy 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 2015 and 30 June 2016.

COMMON NAME	SCIENTIFIC NAME	AUTOPSY	PHOTO (P) OR EXTRACT REPORT (E)
Albatross (unidentified)			E
Antipodean albatross	<i>Diomedea antipodensis antipodensis</i>	✓	P
Australasian gannet	<i>Morus serrator</i>		E
Black (Parkinson's) petrel	<i>Procellaria parkinsoni</i>	✓	P & E
Broad-billed prion	<i>Pachyptila vittata</i>	✓	
Buller's albatross	<i>Thalassarche bulleri bulleri</i>	✓	P & E
Buller's or Pacific albatross (unidentified)	<i>Thalassarche spp.</i>		E
Buller's shearwater	<i>Puffinus bulleri</i>		P
Campbell albatross	<i>Thalassarche impavida</i>	✓	P
Cape petrels (unidentified)	<i>Daption spp.</i>		E
Chatham Island albatross	<i>Thalassarche eremita</i>	✓	
Common diving petrel	<i>Pelecanoides urinatrix</i>	✓	P & E
Cook's petrel	<i>Pterodroma cookii</i>	✓	P
Fairy prion	<i>Pachyptila turtur</i>		E
Flesh-footed shearwater	<i>Puffinus carneipes</i>	✓	P & E
Gibson's albatross	<i>Diomedea antipodensis gibsoni</i>	✓	P
Great albatross (unidentified)	<i>Diomedea spp.</i>		E
Great-winged (grey-faced) petrel	<i>Pterodroma macroptera</i>		P & E
Grey petrel	<i>Procellaria cinerea</i>	✓	P & E
Grey-backed storm petrel	<i>Garrodia nereis</i>	✓	P
Grey-headed albatross	<i>Thalassarche chrysostoma</i>	✓	
Light-mantled sooty albatross	<i>Phoebastria palpebrata</i>		E
Mid-sized petrel & shearwater (unidentified)			E
New Zealand white-capped albatross	<i>Thalassarche steadi</i>	✓	P & E
Northern giant petrel	<i>Macronectes halli</i>	✓	E
Petrel (unidentified)			E

COMMON NAME	SCIENTIFIC NAME	AUTOPSY	PHOTO (P) OR EXTRACT REPORT (E)
Petrels, prion and shearwaters (unidentified)			E
Prion (unidentified)	<i>Pachyptila spp.</i>		E
Procellaria petrel (unidentified)	<i>Procellaria spp.</i>		E
Salvin's albatross	<i>Thalassarche salvini</i>	✓	P & E
Seabird (unidentified)			E
Shearwater (unidentified)			E
Small albatross (unidentified)	<i>Thalassarche spp.</i>		E
Snares cape petrel	<i>Daption capense australe</i>	✓	
Sooty shearwater	<i>Puffinus griseus</i>	✓	P & E
Southern black-browed albatross	<i>Thalassarche melanophris</i>	✓	
Southern royal albatross	<i>Diomedea epomophora</i>		P
Stewart Island shag	<i>Phalacrocorax chalconotus</i>	✓	
Storm petrel (unidentified)			E
Wandering albatross (unidentified)	<i>Diomedea spp.</i>		P & E
Wandering (Snowy) albatross	<i>Diomedea exulans</i>	✓	P
Westland petrel	<i>Procellaria westlandica</i>	✓	E
White-chinned petrel	<i>Procellaria aequinoctialis</i>	✓	P & E
White-faced storm petrel	<i>Pelagodroma marina</i>	✓	P & E
White-headed petrel	<i>Pterodroma lessonii</i>		P & E
Wilson's storm petrel	<i>Oceanites oceanicus</i>		P
Yellow-eyed penguin	<i>Megadytes antipodes</i>	✓	

Each specimen was allocated a unique autopsy number and photographed. This number, along with the information on the observer specimen tag and all other information collected during autopsy was entered into an Access database. Details relating to each specimen are available on request from the Manager, Marine Conservation Services, DOC (email: csp@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 autopsy. This covered live captures, mortalities where a specimen was not returned for autopsy (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 Autopsy

3.1.1 Returned seabirds

A total of 328 seabirds comprising 25 taxa were returned from 44 vessels between 1 July 2015 and 30 June 2016 (Table 2, Figure 1).

Seabirds returned were dominated by five species: Salvin's albatross ($n = 23$, 7.0%), sooty shearwater ($n = 29$, 8.9%), NZ white-capped albatross ($n = 55$, 16.8%), Buller's albatross ($n = 63$, 19.2%) and white-chinned petrel ($n = 104$, 31.7%) (Table 2). These five species accounted for 83.6% of all returns (Table 2). Of the remaining 20 taxa, twelve had only single captures, northern giant petrels had two captures, southern black-browed albatross and yellow-eyed penguin had three captures, common diving petrel had four captures, black petrels had five captures, grey petrel had six captures, flesh-footed shearwaters had nine captures and Westland petrels had ten captures (Table 2).

There was one banded bird within those captured and returned between 1 July 2015 and 30 June 2016. One female Westland petrel had a uniquely numbered metal band (L-30410) and had been banded as a chick at Scotchman's Creek in Punakaiki on 15 April 1997. Banded specimens provide valuable longevity and survival data.

The monthly distribution of returned specimens was not evenly spread across the fishing year with most birds returned being caught in April ($n = 70$, 21.3%), October ($n = 64$, 19.5%) or May ($n = 43$, 13.1%) (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.

Table 2. Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2015 and 30 June 2016, by month of capture.

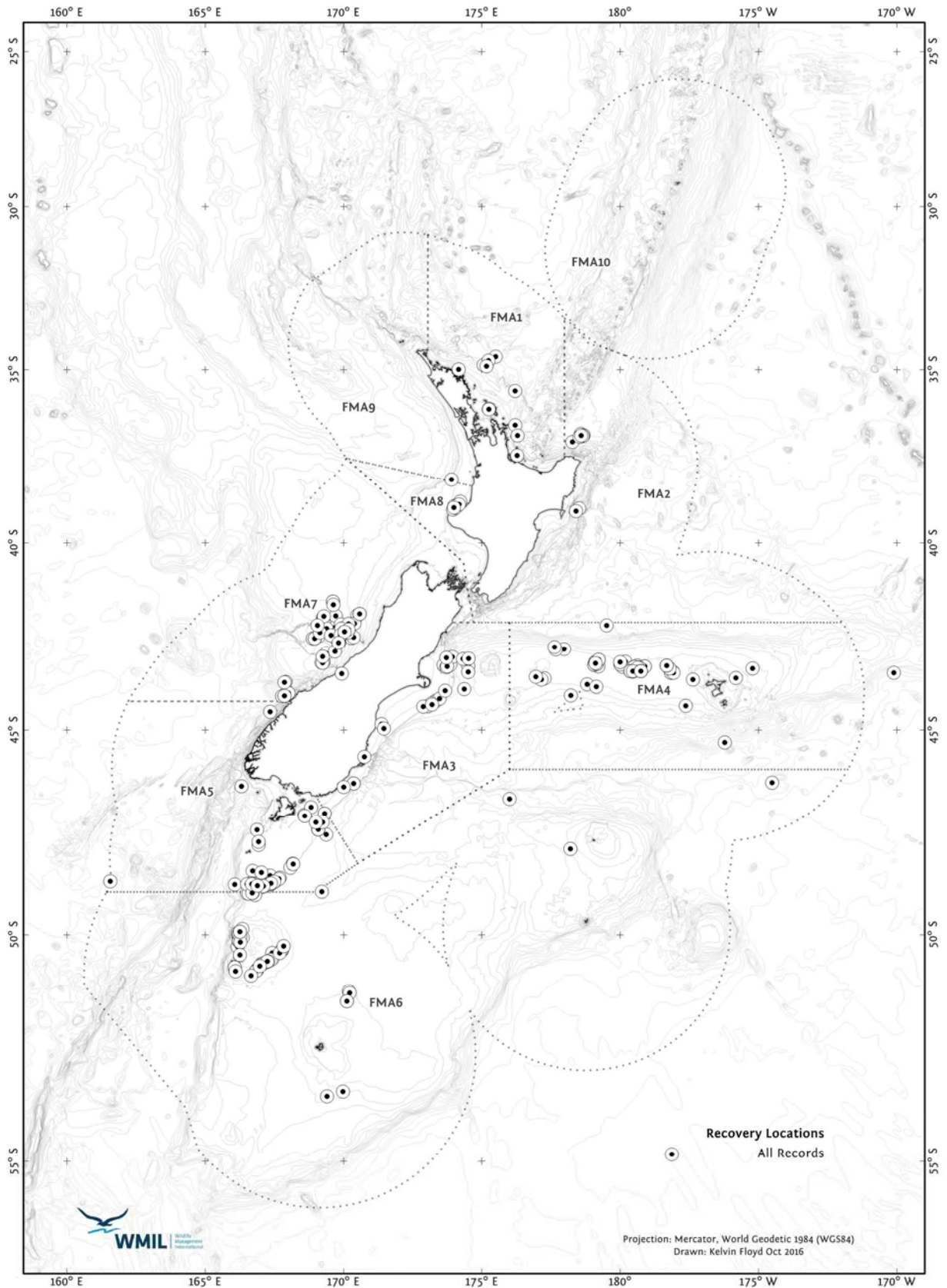
SPECIES	MONTH												TOTAL	% TOTAL
	J	F	M	A	M	J	J	A	S	O	N	D		
Antipodean albatross												1	1	0.3
Black (Parkinson's) petrel				1							3	1	5	1.5
Broad-billed prion												1	1	0.3
Buller's albatross	1	3	4	16	20	9	5	1	1	2	1		63	19.2
Campbell albatross					1								1	0.3
Chatham Island albatross												1	1	0.3
Common diving petrel			2							2			4	1.2
Cook's petrel							1						1	0.3
Flesh-footed shearwater	1	3	1	2					1			1	9	2.7
Gibson's albatross					1								1	0.3
Grey petrel									6				6	1.8
Grey-backed storm petrel		1											1	0.3
Grey-headed albatross					1								1	0.3
NZ white-capped albatross	3	7	7	13	13	5	3				1	3	55	16.8
Northern giant petrel						1						1	2	0.6
Salvin's albatross	2	2	1						2	9	2	5	23	7.0
Snares Cape petrel										1			1	0.3
Sooty shearwater		6	4	6	2					8	3		29	8.9
Southern black-browed albatross							3						3	0.9
Stewart Island shag												1	1	0.3
Wandering (Snowy) albatross				1									1	0.3
Westland petrel				4	4	2							10	3.0
White-chinned petrel	5	12	11	27	1					42	2	4	104	31.7
White-faced storm petrel			1										1	0.3
Yellow-eyed penguin			2			1							3	0.9
TOTAL	12	34	33	70	43	18	12	1	10	64	12	19	328	
% TOTAL	3.7	10.4	10.1	21.3	13.1	5.5	3.7	0.3	3.0	19.5	3.7	5.8		

Table 3 Species and numbers of seabirds killed and returned from observed fishing vessels between 1 July 2015 and 30 June 2016, 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		1		1	1						1	0.3
Black (Parkinson's) petrel	4	1		5	4						5	1.5
Broad-billed prion	1			1							1	0.3
Buller's albatross	32	27	4	63	45	2					63	19.2
Campbell albatross		1		1	1						1	0.3
Chatham Island albatross		1		1	1						1	0.3
Common diving petrel	4			4							4	1.2
Cook's petrel	1			1							1	0.3
Flesh-footed shearwater	6	3		9	6						9	2.7
Gibson's albatross	1			1							1	0.3
Grey petrel	5		1	4	2		1			1	6	1.8
Grey-backed storm petrel	1			1							1	0.3
Grey-headed albatross		1		1	1						1	0.3
NZ white-capped albatross	25	25	5	51	32		4				55	16.8
Northern giant petrel	1	1		1			1				2	0.6
Salvin's albatross	11	12		22	18		1				23	7.0
Snares Cape petrel	1			1							1	0.3
Sooty shearwater	27	2		29	20						29	8.9
Southern black-browed albatross	1	2		2	1	1	1				3	0.9
Stewart Island shag	1							1			1	0.3
Wandering (Snowy) albatross			1							1	1	0.3
Westland petrel	2	8		9	7		1				10	3.0
White-chinned petrel	69	32	3	103	65		1				104	31.7
White-faced storm petrel	1			1	1						1	0.3
Yellow-eyed penguin	3			3							3	0.9
TOTAL	197	117	14	315	205	3	10	1	0	2	328	
% TOTAL	60.1	35.7	4.3	96.0	62.5	0.9	3.0	0.3	0	0.6		

Figure 1 Catch locations of all seabirds killed and returned in New Zealand fisheries for necropsy between 1 July 2015 and 30 June 2016.

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).



The majority of birds were males ($n = 197$, 60.1%, Table 3). Broad-billed prion, common diving petrel, Cook's petrel, Gibson's albatross, grey petrel, grey-back storm petrel, Snares cape petrel, Stewart Island shag, white-faced storm petrel and yellow-eyed penguin only returned males. Buller's albatross, flesh-footed shearwater, sooty shearwater and white-chinned petrels returned mainly males. However Antipodean albatross, Campbell albatross, Chatham Island albatross, grey-headed albatross, NZ white-capped albatross, northern giant petrel, Salvin's albatross, southern black-browed albatross and Westland petrel had either equal numbers of each sex or only female returns. Most birds were adults ($n = 315$, 96.0%). Of these adults, 205 (62.5%) were breeding and 3 (0.9%) were non-breeding. Eleven birds (3.4%) were pre-breeders (i.e. either sub-adult, immature or juvenile birds).

3.1.2 Target vessel and fishery

The seabirds killed and returned were caught in a range of Fishing Management Areas (FMA 1, 2, 3, 4, 5, 6, 7, 8 and 9) as well as just outside FMA4 and general positions are show in Figure 1.

For the fishing period 1 July 2015 to 30 June 2016, there were 297 observed trips on 112 vessels (Kris Ramm, CSP DOC, pers. comm.) and 44 (39.3%) of these vessels returned birds during this period. Half the vessels returned relatively low numbers of birds (< 5 birds caught and returned; $n = 22$, 50%) (Figure 2). On average, there were 7.5 birds (± 1.7) caught and returned from 4.0 trips (± 0.5) per vessel. Eleven vessels caught 10 or more birds with one vessel catching 72 birds as shown in Figure 2.

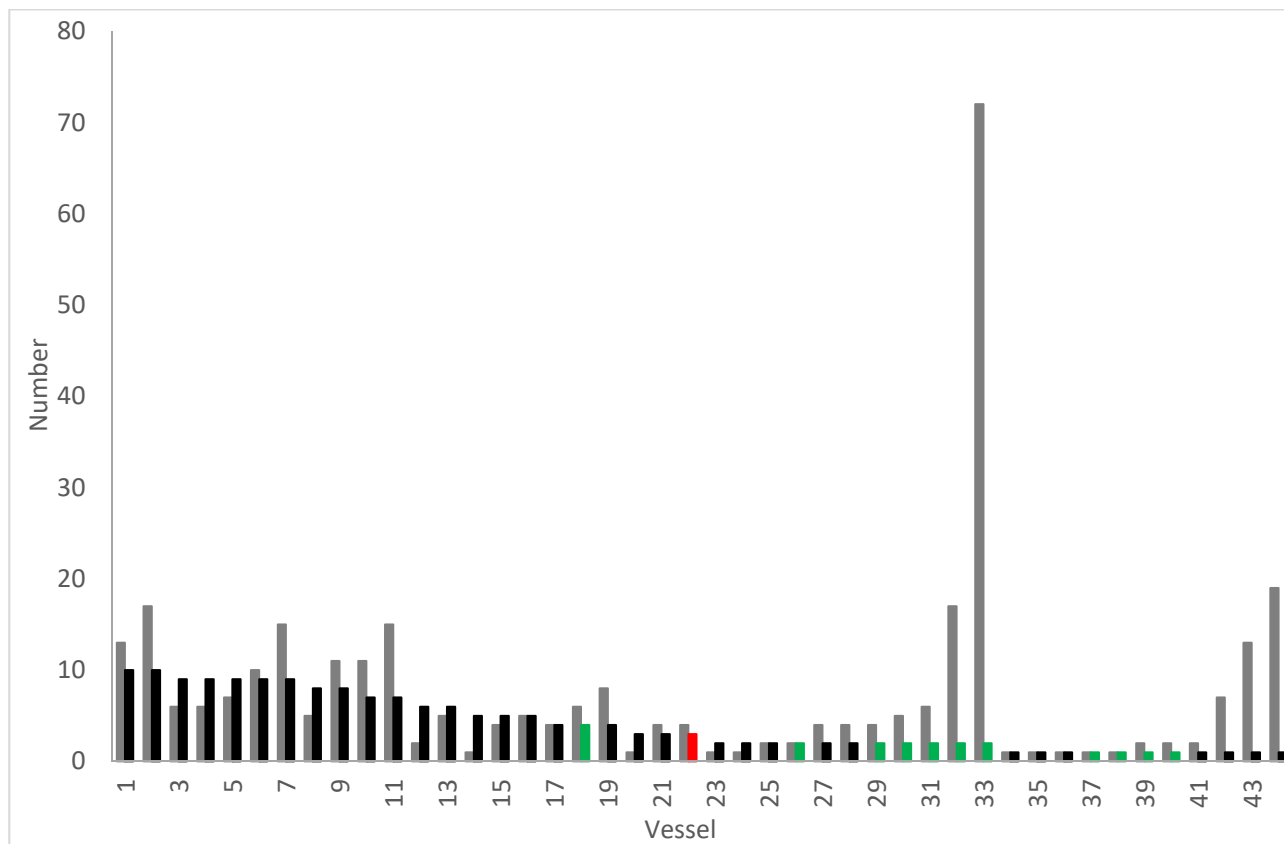
Of the vessels that caught and returned seabirds, 15 were either bottom or surface longliners (34.1%), one was a setnetter (2.3%) and the remaining were trawlers (63.6%) (Table 4).

Bottom and surface longline fisheries returned a total of 157 birds (47.9% of total returns), with vessels targeting tuna (*Thunnus* spp.) accounting for 39.5% of longline specimens ($n = 62$) and those targeting snapper *Centroberyx affinis* accounting for 1.9% of longline specimens ($n = 3$) and the remainder targeting 'other' species (mainly hoki *Macruronus novaezelandiae*, ling *Genypterus blacodes*, swordfish (*Xiphias gladius*) or warehou species *Seriolella* spp.) accounted for 58.6 % of longline specimens ($n = 92$) (Table 4).

Bottom and midwater trawl fisheries combined returned 167 birds (50.9% of total returns), with trawlers targeting squid (*Nototodarus* spp.) accounting for 37.1% ($n = 62$) of all trawl returns, trawlers targeting hoki (*Macruronus novaezelandiae*) accounting for 21.6% ($n = 36$), trawlers targeting ling accounting for 7.2% ($n = 12$), trawlers targeting scampi (*Metanephrops challengerii*) accounting for 1.2% ($n = 2$) and trawlers targeting 'other' species accounting for 32.9% ($n = 55$) (Table 4). The 'other' species included barracouta (*Thyrstites atun*), orange roughy (*Hoplostethus atlanticus*), hake (*Merluccius australis*), jack mackerel (*Trachurus* spp.), silver warehou (*Seriolella punctata*) and southern blue whiting (*Micromesistius australis*).

Four seabirds were caught and killed on set net vessels targeting school sharks *Galeorhinus galeus* (1.2% of total returns) (Table 4).

Figure 2 The number of seabirds killed and returned in New Zealand fisheries, and the number of trips for each observed vessel between 1 July 2015 and 30 June 2016.
Where ● is the number of observed trips by a trawl vessel, ● is the number of observed trips by a longline vessel and ● is the number of observed trips by a set net vessel and ● is the total number of seabirds caught and returned by that vessel in all observed trips.



3.1.3 Injuries and likely cause of death

The condition of the returned birds ranged from ‘no obvious injury’, ‘waterlogged’ or ‘hook present’ to ‘crushed’.

As in previous years (Robertson et al. 2004; Conservations Services Programme 2008; Thompson 2010 a, b; Bell 2011, 2012, 2013; Bell & Mischler 2014, 2015), birds caught and returned from trawl fisheries had different injuries from those caught by longline vessels.

Of the 157 birds caught and returned from longline vessels, most were waterlogged and had hook injuries (Table 5). Of these, 77 still had hooks still present (58 in the bill, throat or neck and 19 in the wing) (Table 5).

Of the 166 birds caught and returned from trawl vessels, most had been caught in the nets or recovered in the pound or cod ends (i.e. had drowned, n = 123, 74.1%) and were very wet and sandy with crush injuries (broken wings, broken chest, crushed organs etc.) (Table 5). Other birds had injuries suggesting entanglement and crush injuries from the trawl warp and blocks (n = 31, 18.7%), 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 (63.4%) while only albatross taxa were affected by warp strikes (100%) exhibiting serious wing injuries or lacerations.

There were 7 seabirds returned that had been killed by impacting the vessel (4.1%) (Table 5). All of these were reported from trawl vessels.

Table 4 Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2015 and 30 June 2016, by fisheries type.

Species	Trawl (Bottom/Midwater)					Longline (Surface/Bottom)			Setnet	Total
	Scampi	Squid	Hoki	Ling	Other	Tuna	Snapper	Other		
Antipodean albatross						1				1
Black (Parkinson's) petrel					1	4				5
Broad-billed prion					1					1
Buller's albatross		11	8		11	26		7		63
Campbell albatross						1				1
Chatham Island albatross					1					1
Common diving petrel				2	2					4
Cook's petrel		1								1
Flesh-footed shearwater	1						3	5		9
Gibson's albatross						1				1
Grey petrel			4		2					6
Grey-backed storm petrel					1					1
Grey-headed albatross						1				1
NZ white-capped albatross	1	17	3		12	17		5		55
Northern giant petrel			1					1		2
Salvin's albatross		1	9		7			6		23
Snares Cape petrel			1							1
Sooty shearwater		12	4	5	8					29
Southern black-browed albatross						3				3
Stewart Island shag									1	1
Wandering (Snowy) albatross						1				1
Westland petrel						7		3		10
White-chinned petrel		20	6	4	9			65		104
White-faced storm petrel				1						1
Yellow-eyed penguin									3	3
TOTAL	2	62	36	12	55	62	3	92	4	328
	167					157				
% TOTAL	50.9					47.9			1.2	

Table 5 Number of seabirds of each species killed and returned from longline and trawl fisheries between 1 July 2015 and 30 June 2016, by likely cause of death. The proportion of albatross and non-albatross taxa returned is also presented.

Species	Longline				Trawl				Setnet	Vessel strike	Total
	Bill or Throat	Wing	Legs or Feet	Not obvious	Warp	Net	Pound or Cod-end	Other			
Antipodean albatross		1									1
Black (Parkinson's) petrel				4		1					5
Broad-billed prion						1					1
Buller's albatross	28	1		4	9	13	2	6			63
Campbell albatross				1							1
Chatham Island albatross							1				1
Common diving petrel							2			2	4
Cook's petrel										1	1
Flesh-footed shearwater				8		1					9
Gibson's albatross	1										1
Grey petrel						5				1	6
Grey-backed storm petrel						1					1
Grey-headed albatross				1							1
NZ white-capped albatross	14	3		5	18	7	4	3		1	55
Northern giant petrel				1		1					2
Salvin's albatross	1			5	4	9	4				23
Snares Cape petrel						1					1
Sooty shearwater						20	8			1	29
Southern black-browed albatross	2	1									3
Stewart Island shag									1		1
Wandering (Snowy) albatross				1							1
Westland petrel	5	1		4							10
White-chinned petrel	7	12		46		23	8	3			104
White-faced storm petrel										1	1
Yellow-eyed penguin									3		3
Total	58	19	0	80	31	83	29	12	4	7	328
% of total longline or trawl	36.9	12.1	0	50.9	18.6	49.7	17.4	7.2			
Albatrosses (%)	77.6	31.6	0	27.5	100	36.4	37.9	75.0	0	14.3	
Non-albatross (%)	22.4	68.4	0	72.5	0	63.6	62.1	25.0	100	85.7	

3.1.4 Body condition

Between 1 July 2015 and 30 June 2016, 89.0% of returned birds had fat scores of less than 3, 4.0% of birds had fat scores of 3 and only 1.2% of birds had fat scores over 3 (Table 6). This suggests that the mean fat scores of returned birds between 1 July 2015 and 30 June 2016 (mean (\pm SE) = 1.3 ± 0.04) was lower than the past three fishing years (2014/15 = 1.8 ± 0.1 , 2013/14 = 1.4 ± 0.04 and 2013/13 = 2.1 ± 0.1) (Bell 2013; Bell & Mischler 2014, 2015). Only 19 birds (5.8%) could not have their fat scores confirmed due to damage.

Table 6 Fat scores of seabirds killed and returned from fishing vessels between 1 July 2015 and 30 June 2016 (1= no fat, to 5 = extremely fat; U = unknown).

SPECIES	FAT SCORE						TOTAL	MEAN (\pm SE)
	1	2	3	4	5	U		
Antipodean albatross	1						1	1.0 ± 0.0
Black (Parkinson's) petrel	5						5	1.0 ± 0.0
Broad-billed prion			1				1	3.0 ± 0.0
Buller's albatross	49	7	1			6	63	1.2 ± 0.1
Campbell albatross	1						1	1.0 ± 0.0
Chatham Island albatross	1						1	1.0 ± 0.0
Common diving petrel	3	1					4	1.3 ± 0.3
Cook's petrel					1		1	5.0 ± 0.0
Flesh-footed shearwater	7	2					9	1.2 ± 0.2
Gibson's albatross		1					1	2.0 ± 0.0
Grey petrel	4	1				1	6	1.2 ± 0.2
Grey-backed storm petrel	1						1	1.0 ± 0.0
Grey-headed albatross	1						1	1.0 ± 0.0
NZ white-capped albatross	39	9				7	55	1.2 ± 0.1
Northern giant petrel	1	1					2	1.5 ± 0.5
Salvin's albatross	16	5	1	1			23	1.4 ± 0.2
Snares Cape petrel	1						1	1.0 ± 0.0
Sooty shearwater	26	3					29	1.1 ± 0.6
Southern black-browed albatross		2	1				3	2.3 ± 0.3
Stewart Island shag	1						1	1.0 ± 0.0
Wandering (Snowy) albatross						1	1	
Westland petrel	6	4					10	1.5 ± 0.2
White-chinned petrel	79	13	6	2		4	104	1.3 ± 0.1
White-faced storm petrel		1					1	2.0 ± 0.0
Yellow-eyed penguin			3				3	3.0 ± 0.0
TOTAL	242	50	13	3	1	19	328	1.3 ± 0.04
% TOTAL	73.8	15.2	4.0	0.9	0.3	5.8		

3.1.5 Stomach and gizzard contents

Stomach contents were identified to main groups following a similar method to that used since 2009 (Thompson 2009, 2010a, b; Bell 2011, 2012, 2013; Bell & Mischler 2014, 2015). In total, 99 birds (30.4%) had offal or discards in their stomachs and 53 birds has bait in their stomach (16.3%) (Table 7). In addition, 106 birds (32.3%) had empty stomachs. A further 3 birds (0.9%) had missing stomachs due to interaction with fishing gear or damage due to sea lice.

Table 7 Stomach contents of seabirds killed and returned from fishing vessels between 1 July 2015 and 30 June 2016.

Note: Birds can have multiple items in the stomachs resulting in higher stomach content figures than the total number of seabirds killed and returned ($n = 328$).

SPECIES	EMPTY	GONE ¹	BAIT ²	OFFAL/DISCARDS ³	NATURAL ⁴	SLUDGE ⁵	PROVENTRICULAR OIL	OTHER ⁶
Antipodean albatross	1							
Black (Parkinson's) petrel				4	3			
Broad-billed prion	1							
Buller's albatross	22	1	1	20	6	5		2
Campbell albatross	1							
Chatham Island albatross	1							
Common diving petrel	3				1			
Cook's petrel	1							
Flesh-footed shearwater	4		1	4				1
Gibson's albatross	1							
Grey petrel	3				2			
Grey-backed storm petrel	1							
Grey-headed albatross				1				
NZ white-capped albatross	19	1	3	23	1	2		
Northern giant petrel				2		1		1
Salvin's albatross	7		3	10	3			3
Snares Cape petrel								1
Sooty shearwater	8		6	10	7	2		
Southern black-browed albatross	3							
Stewart Island shag								1
Wandering (Snowy) albatross		1						
Westland petrel	2			1				
White-chinned petrel	27		39	23	16	7		1
White-faced storm petrel	1							
Yellow-eyed penguin				1				2
TOTAL	106	3	53	99	39	17	1	11
% TOTAL	32.2	0.9	16.3	30.4	12.0	5.2	0.3	3.4

¹ Stomach missing or damaged by sea lice.

² Identifiable (regularly sized) pieces of fish or squid.

³ Whole fish (usually small bycatch fish); fish heads, fillets, vertebrae and skin; or squid tentacles, heads and beaks.

⁴ Identifiable prey fish or squid (whole or parts), salps and krill.

⁵ Usually fish sludge (minced fish or squid); could be offal or discards, or natural.

⁶ Seaweed, plastic, worms or nylon cord

Table 8 Gizzard contents of seabirds killed and returned from fishing vessels between 1 July 2015 and 30 June 2016.

Note: Birds can have multiple items in the gizzard resulting in higher figures than the total number of seabirds killed and returned ($n = 328$).

SPECIES	EMPTY	GONE	SQUID BEAKS	OTOLITHS	FISH OR SQUID EYEBALLS	FISH BONES OR SKIN	PLASTIC OR STRING	SEEDS, STONES OR SHELL	WORMS	KRILL, FEATHERS, BARNACLES OR SEAWEED
Antipodean albatross			1							
Black (Parkinson's) petrel			5		1	1				
Broad-billed prion				1						
Buller's albatross	12	2	15	9	12	13		3		1
Campbell albatross			1	1	1					
Chatham Island albatross	1									
Common diving petrel	3									1
Cook's petrel			1							
Flesh-footed shearwater			7	1			5	2		
Gibson's albatross						1				
Grey petrel			5	3		2			2	
Grey-backed storm petrel	1									
Grey-headed albatross			1							
NZ white-capped albatross	15	1	14	7	10	10		1		2
Northern giant petrel			1							
Salvin's albatross	3		19	2	7	1	13	2	7	1
Snares Cape petrel			1							
Sooty shearwater	3		19	2	7	1	13	2	7	1
Southern black-browed albatross	2		1							
Stewart Island shag	1									
Wandering (Snowy) albatross		1								
Westland petrel			3			1				
White-chinned petrel		1	104	30	7	8	5	4	19	
White-faced storm petrel								1		
Yellow-eyed penguin								3		
TOTAL	48	5	181	58	41	44	26	19	28	8
% TOTAL	14.6	1.5	55.5	17.8	12.6	13.5	8.0	5.8	8.6	2.5

Most of the gizzard contents were natural food items (squid beaks 55.5%, fish bones 13.5%, squid or fish eyeballs 12.6% and otoliths 17.8%), but 8.0% of the birds returned had also ingested plastic or string and 5.8% had ingested stones or seeds (Table 8). In addition, 48 birds (14.6%) had empty stomachs and five birds (1.5%) 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. Photographs and samples of plastic content were also taken.

3.1.6 Identification

Autopsy confirmed that the majority (80.8%) of the seabirds returned between 1 July 2015 and 30 June 2016 were identified correctly by the observers (based on the information provided by observers on the specimen tags) (Table 9).

Table 9 Comparison of identifications (ID) recorded by on-board observers at sea compared with autopsy identification for seabirds killed and returned from observed fishing boats between 1 July 2015 and 30 June 2016.

Species	ID correct	ID to correct species group*	ID as seabird large or albatross*	ID as petrel unidentified*	ID wrong	ID not on label or code didn't exist	Total
Antipodean albatross			1				1
Black (Parkinson's) petrel	3				2		5
Broad-billed prion					1		1
Buller's albatross	44	15			1	3	63
Campbell albatross		1					1
Chatham Island albatross						1	1
Common diving petrel	3				1		4
Cook's petrel		1					1
Flesh-footed shearwater	8	1					9
Gibson's albatross		1					1
Grey petrel	4			1	1		6
Grey-backed storm petrel		1					1
Grey-headed albatross					1		1
NZ white-capped albatross	52				1	2	55
Northern giant petrel	1	1					2
Salvin's albatross	21				2		23
Snares Cape petrel		1					1
Sooty shearwater	18	10			1		29
Southern black-browed albatross		3					3
Stewart Island shag	1						1
Wandering (Snowy) albatross		1					1
Westland petrel	9					1	10
White-chinned petrel	98	1		1	1	3	104
White-faced storm petrel		1					1
Yellow-eyed penguin	3						3
Total	265	38	1	2	12	10	327
% total	80.8	11.6	0.3	0.6	3.7	3.1	

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

Forty (12.2%) 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, Campbell albatross, Cook's petrel, flesh-footed shearwater, Gibson's albatross, grey petrel, grey-backed storm petrel, grey-headed albatross, northern giant petrel, Snares cape petrel, sooty shearwater, southern black-browed albatross, white-chinned petrel and white-faced storm petrel. A further 12 (3.7%) were identified incorrectly including the following species: black petrel, broad-billed prion, Buller's albatross, common diving petrel, grey petrel, grey-headed petrel, NZ white-capped albatross, Salvin's albatross, sooty shearwater and white-chinned petrel. Ten birds (3.1%) did not have an observer identification code on the return label or had a code that did not exist (Table 9).

3.2 Photographs

In total, 547 birds were either photographed and reported in the MPI COD extract as captured (both live and dead seabirds), photographed but not reported in the MPI COD extract 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 2015 and 30 June 2016 (Table 10).

There were 275 observed seabird captures for which no photographs had been taken (a mixture of birds that were either released alive or discarded dead by the crew) (Table 10).

There were 270 seabird interactions that were photographed and had corresponding entries in the MPI COD extract (Table 10).

There were two photographs of birds that were not listed in the MPI COD extract for this fishing period (Table 10).

Table 10 Number of seabirds of each species reported as photographed or interacting with fishing vessels between 1 July 2015 and 30 June 2016.

Species	Photographed & listed in COD extract	Photographed, but not in COD extract to date	Not photographed, but listed in COD extract	Total
Albatross (unidentified)	-	-	9	9
Antipodean albatross	2	-	-	2
Australasian gannet	-	-	1	1
Black petrel	9	-	1	10
Buller's albatross	44	-	15	59
Buller's shearwater	3	-	-	3
Campbell albatross	2	-	-	2
Cape petrels (unidentified)	-	-	5	5
Common diving petrel	14	-	7	21
Cook's petrel	1	-	-	1
Fairy prion	-	-	1	1
Flesh-footed shearwater	3	-	10	13
Gibson's albatross	1	-	-	1
Great albatross (unidentified)	-	-	4	4
Great-winged (grey-faced) petrel	5	-	3	8
Grey petrel	4	-	14	18
Grey-backed storm petrel	6	-	-	6
Light-mantled sooty albatross	-	-	3	3
Mid-sized petrel/shearwater (unidentified)	-	-	2	2

Species	Photographed & listed in COD extract	Photographed, but not in COD extract to date	Not photographed, but listed in COD extract	Total
NZ white-capped albatross	52	1	50	103
Northern giant petrel	-	-	1	1
Petrel (unidentified)	-	-	5	5
Petrels/prion/shearwaters (unidentified)	-	-	3	3
Prion (unidentified)	-	-	4	4
Procellaria petrel (unidentified)	-	-	15	15
Salvin's albatross	8	-	20	28
Seabird (unidentified)	-	-	1	1
Shearwater (unidentified)	-	-	1	1
Small albatross (unidentified)	-	-	4	4
Sooty shearwater	20	1	9	30
Southern royal albatross	3	-	-	3
Storm petrel (unidentified)	-	-	14	14
Wandering (Snowy) albatross	2	-	-	2
Wandering albatross (unidentified)	-	-	2	2
Westland petrel	-	-	5	5
White-chinned petrel	86	-	53	140
White-faced storm petrel	1	-	3	4
White-headed petrel	3	-	5	8
Wilson's storm petrel	1	-	-	1
Total	270	2	275	547
Dead	213	-	39	252
Alive	57	2	236	295

Nearly half of these interaction or photographed birds represented live bird interactions (n = 295, 54.2%) (Table 10). Only 57 of the photographed birds were released alive (21.1%) compared to 216 interaction birds (78.5%) and most of these interaction birds were released by the crew prior to the Observer being able to photograph the birds (Table 10). Four reported dead birds could not be recovered as they fell off the warp.

There were 21 different seabird taxa that had been photographed by the Observers (Table 11).

Examination of the 270 photographed seabird interactions confirmed that observers had accurately identified 76.7% (n = 207) of seabirds (Table 11). It should be noted that the majority of specimens were diving petrels, grey petrels, Salvin's albatross and sooty shearwaters which are relatively easy to identify.

Table 11 Comparison of 270 observer identifications with expert identifications for observed and photographed captures listed in COD from fishing vessels between 1 July 2015 and 30 June 2016, by species. '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.

Species	Confirmed	New, consistent	New, not consistent	Total
Antipodean albatross		2		2
Black petrel	4	5		9
Buller's albatross	21	22	1	44
Buller's shearwater	1	1	1	3

Species	Confirmed	New, consistent	New, not consistent	Total
Campbell albatross		2		2
Common diving petrel	12		2	14
Cook's petrel			1	1
Flesh-footed shearwater	3			3
Gibson's albatross		1		1
Great-winged petrel	2	2	1	5
Grey petrel	4			4
Grey-backed storm petrel	4		2	6
NZ white-capped albatross	44	1	7	52
Salvin's albatross	8			8
Sooty shearwater	15	5		20
Southern royal albatross	2	1		3
Wandering (Snowy) albatross		2		2
White-chinned petrel	83	1	2	86
White-faced storm petrel	1			1
White-headed petrel	3			3
Wilson's storm petrel		1		1
Total	207	46	17	270

A Buller's albatross, Buller's shearwater, common diving petrel, Cook's petrel, great-winged (grey-faced) petrel, grey-backed storm petrel, NZ white-capped albatross and white-chinned petrel were incorrectly identified (n= 14, 5.2%; Table 11).

One new species of seabird was observed interacting with a fishing vessel; a Wilson's storm petrel was found on the deck and was released alive by the observer once it recovered.

The seabirds that were photographed and discarded or released alive were caught in a range of Fishing Management Areas (FMA 1, 3, 4, 5, 6, 7 and 9) and general positions are show in Figure 3.

The seabirds that were reported as an interaction but not photographed were caught in a range of Fishing Management Areas (FMA 1, 2, 3, 4, 5, 6, 7, 8 and 9) as well as outside FMA7 and general positions are show in Figure 4.

The 547 seabirds that were either photographed or recorded as an interaction were from 62 different vessels; 20 on set net (3.6%), 106 on longline (19.4%) and 421 on trawl (77.0%).

For the 213 seabirds that had been photographed and were dead, 124 were drowned in the trawl nets (58.2%), 62 were drowned on longline hooks (29.1%), 22 died as results of warp strike (10.3%) and five died when it hit the deck of the vessel (2.3%).

For the 39 seabirds that were recorded dead following an interaction (not photographed) with the fishing vessel, 22 were drowned in the trawl nets (56.4%), one drowned in the set net (2.6%), seven were drowned on longline hooks (17.9%), four died when they hit the deck of the vessel (10.3%) and five could not be recovered after falling off the warp (12.8%).

Figure 3 Catch locations of all seabirds caught and photographed in New Zealand fisheries between 1 July 2015 and 30 June 2016.

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).

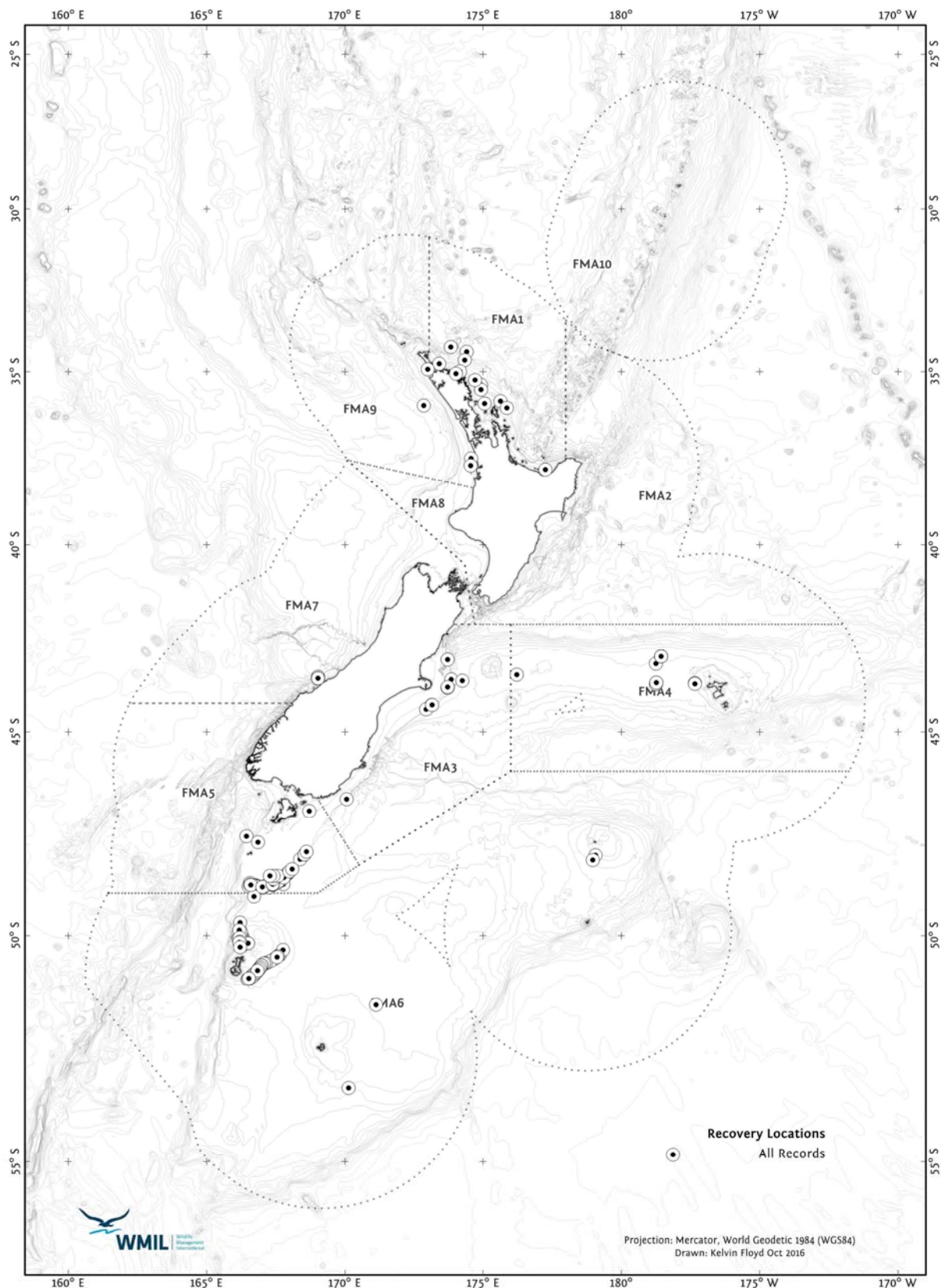
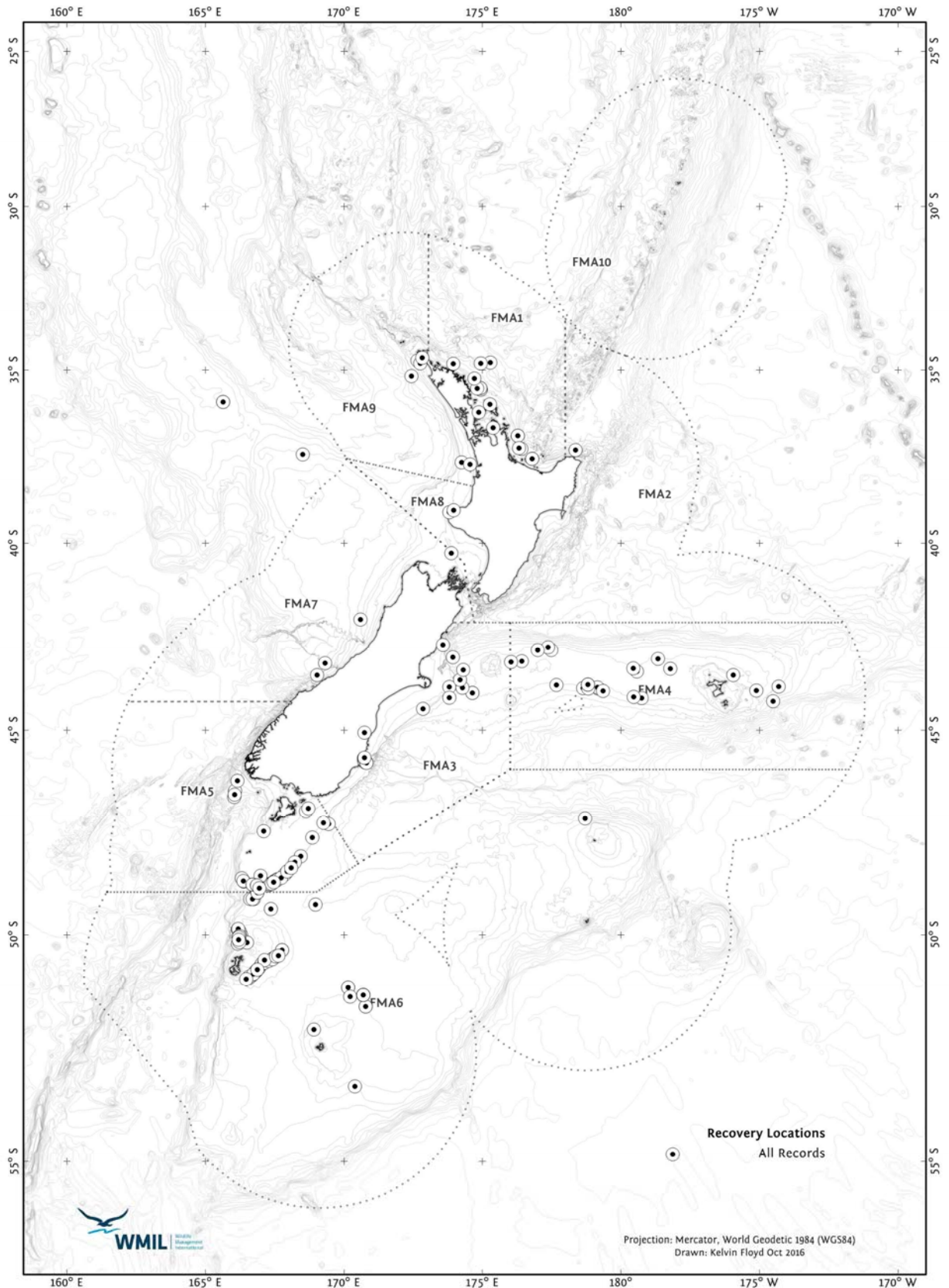


Figure 4 Catch locations of all seabirds reported as an interaction (and not photographed) in New Zealand fisheries between 1 July 2015 and 30 June 2016.
Note: catch location symbols may be obscured by overlying symbols (e.g. where several individuals were captured from the same tow or set, each bird will have the same catch location and appear on the maps as a single symbol).



3.2.1 Quality and number of photographs

The quality of the images obtained by observers continued to vary widely, particularly for live birds (Figure 5). Video footage is also now being received as well as still imagery. Photography of dead birds has improved with a number of images being taken for many of the dead specimens.

Issues included only one photograph for some seabirds, not all key features were 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).

Figure 5 Range of images received from Government observers for seabird interactions recorded between 1 July 2015 and 30 June 2016.



3.2.2 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 log books) 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.

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