Identification of seabirds captured in New Zealand fisheries: 1 July 2011 – 30 June 2012

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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 2011 and 30 June 2012 a total of 177 seabirds comprising 13 taxa were incidentally killed as bycatch and returned for autopsy by onboard New Zealand Government observers. Birds were returned from longline (*n* = 32) and trawl (*n* = 145) vessels, and were dominated numerically by four species (New Zealand white-capped albatross *Thalassarche steadi,* white-chinned petrel *Procellaria aequinoctialis*, Buller's albatross *Thalassarche bulleri bulleri* and sooty shearwater *Puffinus griseus*). All birds returned from longline fisheries had injuries consistent with being hooked or entangled in the bill or throat. In contrast, most birds (79.9%) returned from trawl fisheries were killed through entanglement in the net or cod-end, with the remaining 20.1% likely to have been killed by warp interaction. Two birds were killed by striking the deck. Birds had similar mean fat scores as in the previous fishing year, and discards, including offal, appear to continue to be an attractant for many seabirds. Out of 92 records of seabird captures on fishing vessels, photographs were taken of 33 seabirds consisting of eleven taxa. Image quality varied widely, with poor

images being particularly common for birds that were alive and seen onboard for short periods. 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 INT2010/02.

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 2011 and 30 June 2012. Identifications were based on dead birds caught and returned and/or photographs.

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). 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 and Petrels (ACAP 2010).

Table 1. Common and scientific names of seabirds captured and returned or photographed from New Zealand fisheries between 1 July 2011 and 30 June 2012.

COMMON NAME	SCIENTIFIC NAME	AUTOPSY	PHOTO
Albatross (unidentified)	Diomedeidae (Family)		✓
Antipodean albatross	*Diomedea antipodensis antipodensis*	✓	
Black petrel	*Procellaria parkinsoni*		✓
Buller's albatross	*Thalassarche bulleri bulleri*	✓	✓
Buller's shearwater	*Puffinus bulleri*		✓
Campbell albatross	*Thalassarche impavida*	✓	✓
Cape petrel	*Daption capense*	✓	
Cape petrels (unidentified)	*Daption* spp.		✓
Common diving petrel	*Pelecanoides urinatrix*		✓
Giant petrels (Unidentified)	*Macronectes* spp.		✓
Gibson's albatross	*Diomedea antipodensis gibsoni*		✓
Grey-backed storm petrel	*Garrodia nereis*		✓
Grey petrel	*Procellaria cinerea*	✓	✓
New Zealand banded dotterel	*Charadrius bicinctus*	✓	
New Zealand White-capped albatross	*Thalassarche steadi*	✓	✓
Petrel (unidentified)	*Procellaria* spp.		✓
Petrels, Prions and Shearwaters (unidentified)	Hydrobatidae, Procellariidae & Pelecanoididae (Families)		✓
Salvin's albatross	*Thalassarche salvini*	✓	✓
Shy albatross (unidentified)	*Thalassarche* spp.	✓	✓
Small albatross (unidentified)	*Thalassarche* spp.		✓
Snares cape pigeon	*Daption capense australe*	✓	
Sooty shearwater	*Puffinus griseus*	✓	✓
Southern Royal albatross	*Diomedea epomophora*	✓	✓
Storm petrels (unidentified)	Hydrobatidae (Family)		✓
Wandering albatross (unidentified)	*Diomedea exulans* spp.		✓
Westland petrel	*Procellaria westlandica*	✓	
White-chinned petrel	*Procellaria aequinoctialis*	✓	✓

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.

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.

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.

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) and images of birds that had no associated observer data (i.e. missing from Ministry of Primary Industries (MPI) Central Observer Database ('COD') extracts), and may include non-capture interactions. Photographs were provided in electronic format with associated observer 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 and photographed 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 were entered into an Access database.

3. Results

3.1 Autopsy

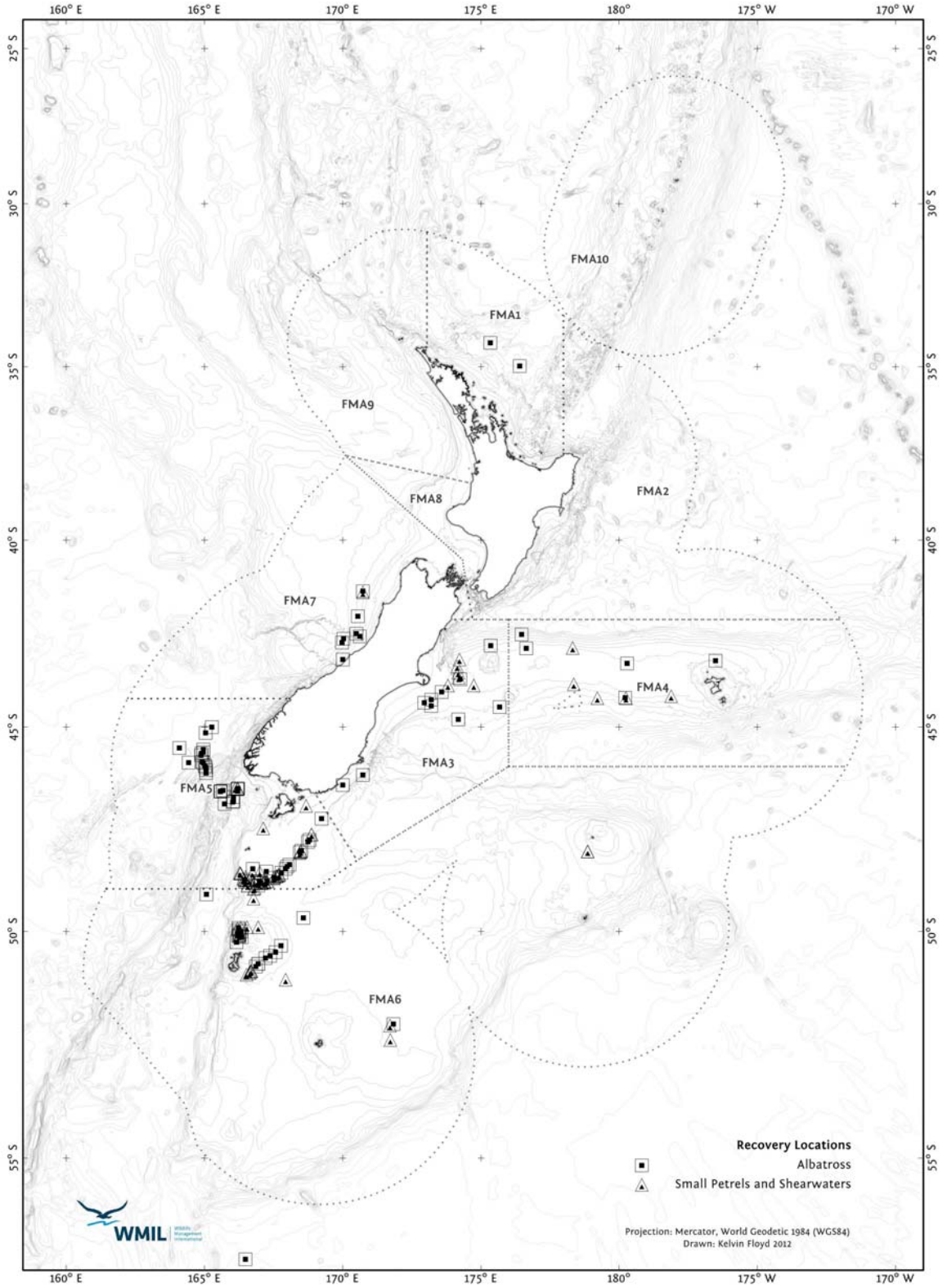
3.1.1 Returned seabirds

A total of 177 seabirds comprising 13 taxa were returned from 30 vessels between 1 July 2011 and 30 June 2012 (Table 2, Fig 1). Seabirds returned were dominated by four species: NZ white-capped albatross (*n* = 45, 25.4%), white-chinned petrel (*n* = 45, 25.4%), Buller's albatross (*n* = 36, 20.3%) and sooty shearwater (*n* = 22, 12.4%) (Table 2). These four species, together with Salvin's albatross (*n* = 9, 5.1%) accounted for 88.6% of all returns (Table 2). Of the remaining eight taxa, two had only single captures, four had two captures and Cape petrel and Grey petrel both had five captures (Table 2).

Table 2. Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2011 and 30 June 2012, by month of capture.

SPECIES	MONTH												TOTAL	% TOTAL
	J	F	M	A	M	J	J	A	S	O	N	D		
Antipodean albatross												2	2	1.1
Buller's albatross			3	5	19	7	2						36	20.3
Campbell albatross								1		1			2	1.1
Cape petrel						5							5	2.8
Grey petrel								5					5	2.8
NZ Banded Dotterel								1					1	0.6
NZ white-capped albatross	2	4	18	5	9	4	1	1		1			45	25.4
Salvin's albatross		1							1	3	4		9	5.1
Snares cape petrel						2							2	1.1
Sooty shearwater		2	2	4	2					11	1		22	12.4
Southern royal albatross						1		1					2	1.1
Westland petrel										1			1	0.6
White-chinned petrel	3	7	22	8	1					1	2	1	45	25.4
TOTAL	**5**	**14**	**45**	**22**	**31**	**19**	**3**	**9**	**1**	**18**	**7**	**3**	**177**	
% TOTAL	**2.3**	**7.9**	**25.4**	**12.4**	**17.5**	**10.7**	**1.7**	**5.1**	**0.6**	**10.2**	**4.0**	**1.7**		

Figure 1. Catch locations of all A. small petrels and B. albatrosses killed and returned from New Zealand fisheries for autopsy between 1 July 2011 and 30 June 2012. Note: some catch locations 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 map as a single symbol).



Two of the Buller's albatross had uniquely numbered bands; one having been banded as an adult on Big Solander Island on 20 July 1997 (band number M56064) and one having been banded as an adult on Snares Island on 26 February 1998 (band number M71358). One Antipodean albatross also had a uniquely numbered metal band and darvic band, having been banded as an adult on Antipodes Island on 23 January 2003 (band number R56019 on the right leg and blue darvic number 983 on the left leg). Banded specimens provide valuable longevity, survival and at-sea distribution data. Specimens still need to be checked for PIT tags.

The majority of birds returned were males (*n* = 115, 65%); however, Salvin's albatross returns had more females (*n* = 5, 55.6%) than males (Table 3). Also, most birds returned were adults (*n* = 172, 97.2%). Of the 172 adults, 130 (73.4%) were breeding, 41 (23.2%) were non-breeding and 1 (0.2%) could not have the breeding status confirmed due to sea lice damage. Of all the birds returned, 3 (1.7%) were pre-breeders or immatures (Table 3).

Table 2 Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2011 and 30 June 2012, by sex (M = male, F = female, U = unknown), age (A = adult, SA = sub-adult, I = immature, J = juvenile, U = unknown) and breeding status (B = breeding, N = non-breeding, PB =pre-breeding, U = unknown).

SPECIES	SEX			AGE					BREEDING STATUS				TOTAL	% TOTAL
	M	F	U	A	SA	I	J	U	B	NB	PB	U		
Antipodean albatross	2			2						2			2	1.1
Buller's albatross	16	19	1	35				1	29	6		1	36	20.3
Campbell albatross	2			1		1			1		1		2	1.1
Cape petrel	4	1		5						5			5	2.8
Grey petrel	3	2		5					4	1			5	2.8
NZ Banded Dotterel	1			1									1	0.6
NZ white-capped albatross	28	15	2	44	1				27	16		2	45	25.4
Salvin's albatross	4	5		9					9				9	5.1
Snares cape petrel	2			2						2			2	1.1
Sooty shearwater	21	1		22					20	2			22	12.4
Southern royal albatross	2			2					1	1			2	1.1
Westland petrel	1			1						1			1	0.6
White-chinned petrel	29	15	1	43	1			1	39	5		1	45	25.4
TOTAL	**115**	**40**	**4**	**172**	**2**	**1**	**0**	**1**	**130**	**41**	**1**	**4**	**177**	
% TOTAL	**65.0**	**22.6**	**2.3**	**97.2**	**1.1**	**0.6**	**0**	**0.6**	**73.4**	**23.2**	**0.6**	**2.3**		

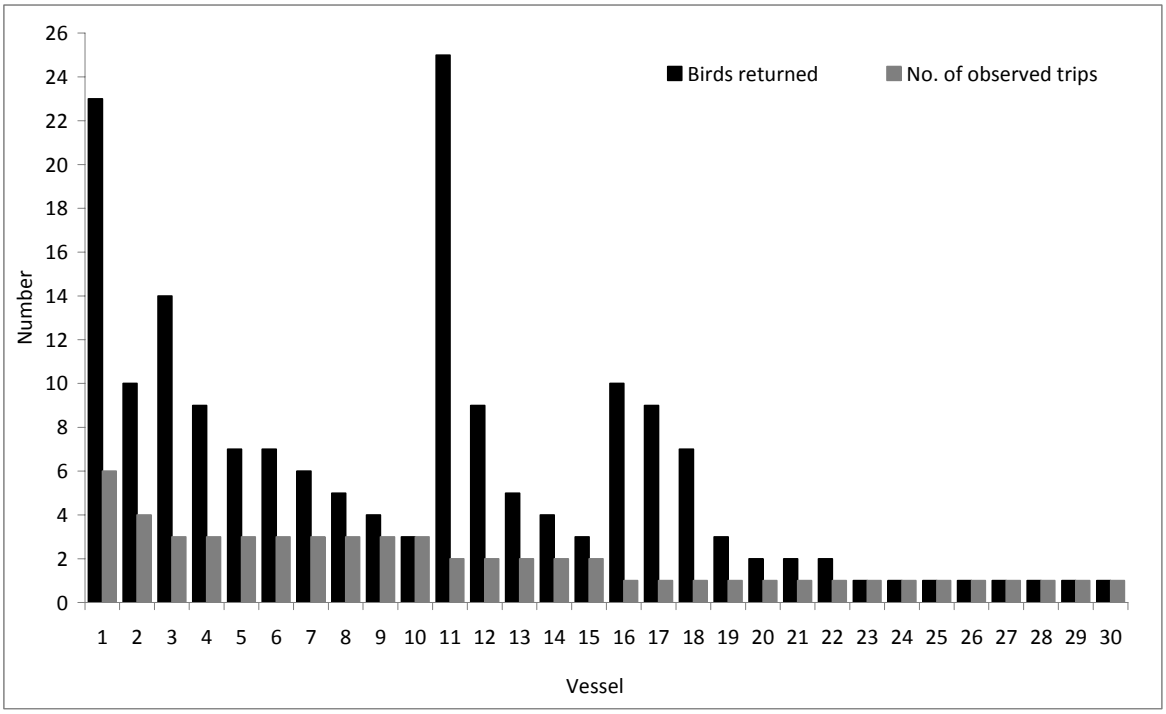
The monthly distribution of returned specimens was not evenly spread across the fishing year with most birds returned being caught in March (*n* = 45, 25.4%), May (*n* = 31, 17.5%) or April (*n* = 22, 12.4%) (Table 2). This pattern reflects the timing of seabird breeding, presence within the New Zealand EEZ, timing and location of fisheries, and observer coverage.

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 and 7) and general positions are show in Fig 1. Additional figures showing general capture positions for each species, and by fishery target species and method are provided in Appendix 1 (Figures A1.1-A1.11).

For the fishing period 1 July 2011 to 30 June 2012, there were 165 observed trips on 33 vessels (Kris Ramm, CSP DOC, pers. comm.), and 30 (91%) of these vessels returned birds during this period. Most vessels returned relatively low numbers of birds (≤ 3 birds caught and returned; *n* = 14, 46.7%), while four vessels returned relatively large numbers of birds from single trips (≥ 10 birds caught and returned) as shown in Fig. 2.

Figure 2. The number of birds killed and returned, and the number of trips for each observed vessel between 1 July 2011 and 30 June 2012.



Bottom and surface longline fisheries returned a total of 32 birds (18.1% of total returns), with vessels targeting tuna (*Thunnus* spp.) accounting for 68.75% (*n* = 22) of longline specimens and those targeting 'other' species (mainly ling *Genypterus blacodes*) accounting for 31.25% (*n* = 10) (Table 4). Bottom and midwater trawl fisheries combined returned 145 birds (81.9% of total returns), with trawlers targeting squid (*Nototodarus* spp.) accounting for 53.1% (*n* = 77) of all trawl returns, trawlers targeting hoki (*Macruronus novaezelandiae*) accounting for 22.8% (*n* = 33), trawlers targeting scampi (*Metanephrops challengeri*) accounting for 1.4% (*n* = 2) and trawlers targeting 'other' species accounting for 22.8% (*n* = 33) (Table 4). The 'other' species included barracouta (*Thyrsites atun)*, hake (*Merluccius australis*), jack mackerel (*Trachurus* spp.), orange roughy (*Hoplostethus atlanticus*), silver warehou (*Seriolella punctata*), and white warehou (*S. caerulea*).

Table 3. Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2011 and 30 June 2012, by fisheries type.

Species	Trawl								Longline				Total
	Bottom					Midwater			Surface		Bottom		
	Scampi	Squid	Hoki	Ling	Other	Hoki	Squid	Other	Tuna	Other	Tuna	Other	
Antipodean albatross									2				2
Buller's albatross	1	8				6	4		16	1			36
Campbell albatross			1			1							2
Cape petrel					1	2				2			5
Grey petrel						5							5
NZ banded dotterel			1										1
NZ White-capped albatross	1	13	1		6	5	14		4	1			45
Salvin's albatross			4		2	1		1		1			9
Snares cape petrel						2							2
Sooty shearwater		3		9	7		2			1			22
Southern Royal albatross						1				1			2
Westland petrel												1	1
White-chinned petrel		11	3	2	5		22			2			45
Total	**2**	**35**	**10**	**11**	**21**	**23**	**42**	**1**	**22**	**9**	**0**	**1**	**177**
	145								**32**				

3.1.3 Injuries of returned birds and likely cause of death

The condition of the returned birds ranged from 'no obvious injury' to 'mangled'. Of the birds caught and returned from longline vessels, 26 had hook injuries and 14 of these still had hooks still present (10 swallowed and 4 in the bill). All hooked birds were caught by the bill or throat (*n* = 26) (Table 5).

Table 5 Number of seabirds of each species killed and returned from longline and trawl fisheries between 1 July 2011 and 30 June 2012, by likely cause of death. The proportion of albatross and non-albatross taxa returned is also presented.

Species	Longline				Trawl			Vessel strike	Total
	Bill or Throat	Wing	Legs or Feet	Not obvious	Warp	Net	Cod-end		
Antipodean albatross	2								2
Buller's albatross	15				4	17			36
Campbell albatross					2				2
Cape petrel					4			1	5
Grey petrel						5			5
NZ banded dotterel								1	1
NZ White-capped albatross	5				13	26	1		45
Salvin's albatross					4	5			9
Snares cape petrel					2				2
Sooty shearwater	1					21			22
Southern Royal albatross	1				1				2
Westland petrel						1			1
White-chinned petrel	2					40	3		45
Total	**26**				**30**	**115**	**4**	**2**	**177**
% of total longline or trawl	100				20.1	77.2	2.7		
Albatrosses (%)	88.5				80	42	25		
Non-albatross (%)	11.5				20	58	75	100	

As in previous years (Robertson *et al*. 2004; Conservations Services Programme 2008; Thompson 2010 a, b), birds caught and returned from trawl fisheries had different injuries from those caught by longline vessels. Most birds had been caught in the trawl nets or recovered in the pound or cod ends (i.e. had drowned, *n* = 119, 79.9%) 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* = 30), 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 (58%) while albatross taxa were predominately affected by warp strikes (80%) exhibiting serious wing injuries or lacerations.

3.1.4 Body condition

Between 1 July 2011 and 30 June 2012, 68.3% of returned birds had fat scores of less than 3, 34% of birds had fat scores of 3 and 10.2% of birds (3 Buller's albatross, 3 cape petrels, 1 Snare's cape petrel, 3 NZ white-capped albatross, 3 sooty shearwater and 5 white-chinned petrels) had fat scores over 3 (Table 6). Four birds (2.3%) could not have their fat scores confirmed due to sea lice damage. This suggests that the mean fat scores of returned birds between 1 July 2011 and 30 June 2012 (mean (± SE) = 2.0 ± 0.1) were slightly higher than other recent fishing years (the mean fat score (± SE) of all returned birds from the 2010/11 fishing year = 1.8 ± 0.1% and 73% of returned birds had fat scores less than 3; Bell, *in press*).

Table 4. Fat scores of seabirds killed and returned from fishing vessels between 1 July 2011 and 30 June 2012 (1= no fat, to 5 = extremely fat; U = unknown).

SPECIES	FAT SCORE						TOTAL	MEAN (±SE)
	1	2	3	4	5	U		
Antipodean albatross	2						2	1.0 ± 0.0
Buller's albatross	14	11	7		3	1	34	2.1 ± 0.2
Campbell albatross		1	1				2	2.5 ± 0.5
Cape petrel	2			2	1		5	3.0 ± 0.8
Grey petrel	4		1				5	1.4 ± 0.4
NZ banded dotterel	1						1	1.0 ± 0.0
NZ White-capped albatross	20	10	8	2	3	2	45	2.0 ± 0.2
Salvin's albatross	4	2	3				9	1.9 ± 0.3
Snares cape petrel			1	1			2	3.5 ± 0.5
Sooty shearwater	5	8	6	3			22	2.3 ± 0.2
Southern Royal albatross		1	1				2	2.5 ± 0.5
Westland petrel	1						1	1.0 ± 0.0
White-chinned petrel	17	18	6	3		1	45	1.9 ± 0.1
TOTAL	**70**	**51**	**34**	**11**	**7**	**4**	**177**	**2.0 ± 0.1**
% TOTAL	**39.5**	**28.8**	**19.2**	**6.2**	**4.0**	**2.3**		

3.1.5 Stomach and gizzard content

Stomach contents were identified to main groups following a similar method to that used by Thompson (2009, 2010a, b). In total, 53 birds (29.9%) had offal or discards in their stomachs, and one NZ white-capped albatross has bait in its stomach (Table 7). In addition, 64 birds (36.2%) had empty stomachs.

Most of the gizzard contents were natural food items (squid beaks, fish bones and eyeballs and otoliths), but 6.8% of the birds returned had also ingested plastic and 3.4% had ingested stones or seeds (Table 8). In addition, 39 birds (22.0%) had empty stomachs. Samples (e.g. squid beaks and otoliths) have been collected for detailed identification to species if required.

Table 7. Stomach contents of seabirds killed and returned from fishing vessels between 1 July 2011 and 30 June 2012.
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* = 177).

SPECIES	EMPTY	GONE[1]	BAIT[2]	OFFAL (OR DISCARDS)[3]	NATURAL[4]	SLUDGE[5]	PROVENTRICULAR OIL
Antipodean albatross					2		
Buller's albatross	16	1		17	1		1
Campbell albatross					1	1	
Cape petrel	3				2		1
Grey petrel				5			4
NZ banded dotterel	1						
NZ White-capped albatross	14	2	1	17	5	2	1
Salvin's albatross	2			6	4	2	1
Snares cape petrel	1						1
Sooty shearwater	12			8	4	1	1
Southern Royal albatross	2						
Westland petrel						1	1
White-chinned petrel	13	2		14	21	3	1
TOTAL	**64**	**5**	**1**	**53**	**40**	**10**	**12**
% TOTAL	**36.2**	**2.8**	**0.6**	**29.9**	**22.6**	**5.6**	**6.8**

[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.

Table 8. Gizzard contents of seabirds killed and returned from fishing vessels between 1 July 2011 and 30 June 2012.
Note: Birds can have multiple items in the gizzard resulting in higher figures than the total number of seabirds killed and returned (*n* = 177).

SPECIES	EMPTY	GONE	SQUID BEAKS	OTOLITHS	FISH OR SQUID EYEBALLS	FISH BONES OR SKIN	PLASTIC	SEEDS OR STONE	WORMS	SEAWEED
Antipodean albatross			2							
Buller's albatross	17	1	8	1	5	7			1	
Campbell albatross			1	1	1	1				
Cape petrel	2		2					1		1
Grey petrel	1		5	1		2				
NZ banded dotterel	1									
NZ White-capped albatross	15	1	7	2	12	13				
Salvin's albatross	1		1	2	3	8			1	
Snares cape petrel						1	1	1	1	
Sooty shearwater	1		14	4	2	8	10	4	2	
Southern Royal albatross			2	1	2				1	
Westland petrel					1	1				
White-chinned petrel		2	41	4	4	5	1		2	
TOTAL	**39**	**4**	**83**	**16**	**30**	**46**	**12**	**6**	**8**	**1**
% TOTAL	**22.0**	**2.3**	**46.9**	**9.0**	**16.9**	**26.0**	**6.8**	**3.4**	**4.5**	**0.6**

3.1.6 Seabird identification

Autopsy confirmed that the majority (72%) of the seabirds returned between 1 July 2011 and 30 June 2012 were identified correctly by the observers (based on the information provided by observers on the specimen tags) (Table 9). Thirty-one (17.5%) 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), which included Antipodean albatross, Buller's albatross, NZ white-capped albatross, cape petrel, Snares cape petrel and grey petrel. A further twelve (6.8%) were identified incorrectly; a Buller's albatross, Campbell albatross, NZ white-capped albatross, sooty shearwater, southern royal albatross, Westland petrel and a white-chinned petrel. Six birds (3.4%) did not have an observer identification code on the return label (Table 9). One bird required a new code (NZ banded dotterel).

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 2011 and 30 June 2012.

Species	ID correct	ID'd to correct 'species' group*	ID'd as seabird large or albatross*	ID'd as petrel unidentified*	ID wrong	ID not on label	ID new code required	**Total**
Antipodean albatross			2					**2**
Buller's albatross	31		2		3			**36**
Campbell albatross	1				1			**2**
Cape petrel		5						**5**
Grey petrel	2			3				**5**
NZ banded dotterel							1	**1**
NZ White-capped albatross	34	3	3		4	1		**45**
Salvin's albatross	9							**9**
Snares cape petrel		2						**2**
Sooty shearwater	17				1	4		**22**
Southern Royal albatross	1				1			**2**
Westland petrel					1			**1**
White-chinned petrel	32			11	1	1		**45**
Total	**127**	**10**	**7**	**14**	**12**	**6**	**1**	**177**
% total longline or trawl	**71.8**	**5.6**	**4.0**	**7.9**	**6.8**	**3.4**	**0.6**	

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

3.2 Photographs

In total, 92 birds were reported as captured in extracts of seabird captures from the MPI COD or were photographed interacting with fishing vessels (this number may include some non-capture interactions) between 1 July 2011 and 30 June 2012; over three-quarters of these represented live bird interactions (*n* = 70, 76.1%) (Table 10). Observers photographed 33 seabirds during this time, of which 3 birds had no matching information in COD at the time of extract and as these birds were alive may have left the vessel on their own (Table 10). There were also 59 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).

Table 10. Number of seabirds of each species reported as captured or photographed as interacting with fishing vessels between 1 July 2011 and 30 June 2012.

Species	Photographed & listed as captured in COD extract	Photographed, but not listed as captured in COD extract	No photograph, but listed in COD extract	Total
Albatross (unidentified)			3	**3**
Black petrel	1			**1**
Buller's albatross	4		4	**8**
Buller's shearwater			1	**1**
Campbell albatross			1	**1**
Cape petrels (unidentified)			2	**2**
Common diving petrel	1	1		**2**
Giant petrel (unidentified)			1	**1**
Gibson's albatross	3			**3**
Grey petrel	1		1	**2**
Grey-backed storm petrel	2			**2**
New Zealand white-capped albatross	1	2	9	**12**
Petrel (unidentified)			6	**6**
Petrel, Prion or Shearwater (unidentified)			2	**2**
Salvin's albatross	5		6	**11**
Shy albatross (unidentified)			2	**2**
Small albatross (unidentified)			2	**2**
Sooty shearwater	3		6	**9**
Southern royal albatross	1		1	**2**
Storm petrel (unidentified)			2	**2**
Wandering albatross (unidentified)			2	**2**
White-chinned petrel	8		8	**16**
Total	**30**	**3**	**59**	**92**
Dead	**16**	**1**	**5**	**22**
Alive	**14**	**2**	**54**	**70**

Examination of photographs confirmed that observers had accurately identified 83.3% (*n* = 25) of seabirds (Table 11). It should be noted that the majority of specimens were sooty shearwaters and white-chinned petrels, however, which are relatively simple to identify (and identified correctly by observers in all cases); other species, such as storm petrels and larger albatrosses, were harder to identify (Table 11).

Table 11. Comparison of 30 observer identifications with expert photograph identifications for observed captures listed in COD from fishing vessels between 1 July 2011 and 30 June 2012, 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**
Black petrel	1			**1**
Buller's albatross	4			**4**
Common Diving Petrel	1			**1**
Gibson's albatross	1	1	1	**3**
Grey petrel	1			**1**
Grey-backed storm petrel		1	1	**2**
NZ white-capped albatross	1			**1**
Salvin's albatross	5			**5**
Sooty shearwater	3			**3**
Southern Royal albatross			1	**1**
White-chinned petrel	8			**8**
Total	**25**	**2**	**3**	**30**
Live	**13**	**2**	**2**	**14**
Dead	**12**		**1**	**16**

3.2.1 Quality and number of photographs

The quality of the images obtained by observers varied widely. 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 onboard for short periods (when photographs were taken from a long distance).

3.2.2 Recommendations for photo-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.
3. Photo logs are completed for all images (which can be correlated to date and time stamps form 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 is provided (i.e. number of images, type of images, date and time stamps etc.) is provided for all observers.

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