

Identification of seabirds captured in New Zealand fisheries: 1 July 2013 – 30 June 2014

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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 2013 and 30 June 2014 a total of 354 seabirds comprising 20 taxa were incidentally killed as bycatch and returned for autopsy by onboard New Zealand Government observers. Birds were returned from longline ($n = 63$) and trawl ($n = 291$) vessels, and were dominated numerically by five species (white-chinned petrel *Procellaria aequinoctialis*, sooty shearwater *Puffinus griseus*, New Zealand white-capped albatross *Thalassarche steadi*, Salvin's albatross *Thalassarche salvini* and Buller's albatross *Thalassarche bulleri bulleri*). All birds returned from longline fisheries had injuries consistent with being hooked or entangled in the bill or throat. In contrast, most birds (79.7%) returned from trawl fisheries were killed through entanglement in the net or cod-end, with the remaining 20.3% likely to have been killed by warp interaction or entanglement. Nine birds were killed by striking the deck. Birds had a lower 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 342 records of seabird interactions on fishing vessels, photographs were taken of 66 seabirds consisting of 12

taxa. Of these, 66 images, only 50 had corresponding information recorded in the COD extract. 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 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 2013 and 30 June 2014. 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).

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), images of birds that had no associated observer data (i.e. missing from Ministry of 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. 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 or the MPI COD extract were entered into an Access database.

3. Results

3.1 Autopsy

3.1.1 *Returned seabirds*

A total of 354 seabirds comprising 20 taxa were returned from 43 vessels between 1 July 2013 and 30 June 2014 (Table 2, Fig 1). Seabirds returned were dominated by five species: white-chinned petrel ($n = 95$, 26.7%), sooty shearwater ($n = 80$, 22.5%), NZ white-capped albatross ($n = 49$, 13.8%), Salvin's albatross ($n = 48$, 13.5%) and Buller's albatross ($n = 44$, 12.4%) (Table 2). These five species accounted for 88.9% of all returns (Table 2). Of the remaining fifteen taxa, nine had only single captures, one had two captures, two had

three captures, black petrel had five captures and flesh-footed shearwater had six captures (Table 2).

One female Salvin's albatross had a uniquely numbered metal band, having been banded in 2012 as an adult on Proclamation Island, Bounties Islands (band number O37151); this bird was also carrying a geolocator device as part of a tracking study by NIWA (P. Sagar, pers. comm.). 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 ($n = 238$, 67.2%); however, black petrel, Campbell albatross, flesh-footed shearwater, Gibson's albatross, Snares cape petrel and Westland petrel returns had either equal numbers or more females than males (Table 3). Also, most birds returned were adults ($n = 349$, 98.6%). Of the 349 adults, 267 (76.5%) were breeding, 47 (13.5%) were non-breeding and 35 (10.0%) could not have the breeding status confirmed due to damage. Of all the birds returned, 4 (1.1%) were pre-breeders (Table 3).

The monthly distribution of returned specimens was not evenly spread across the fishing year with most birds returned being caught in April ($n = 53$, 15.0%), October ($n = 49$, 13.8%), February ($n = 48$, 13.6%) or May ($n = 42$, 11.9%) (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 shown 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-A1.10).

For the fishing period 1 July 2013 to 30 June 2014, there were 357 observed trips on 140 vessels (Kris Ramm, CSP DOC, pers. comm.), and 43 (30.7%) of these vessels returned birds during this period. Half the vessels returned relatively low numbers of birds (< 5 birds caught and returned; $n = 22$, 51.20%) (Fig. 2). On average, there were 8.2 birds (± 1.5) caught and returned from 2.4 trips (± 0.3) per vessel. Six vessels caught over 20 birds as shown in Fig. 2.

Bottom and surface longline fisheries returned a total of 63 birds (17.8% of total returns), with vessels targeting tuna (*Thunnus* spp.) accounting for 35.9% ($n = 14$) of longline specimens and the remainder targeting 'other' species (mainly hoki *Macruronus novaezelandiae* or snapper *Centroberyx affinis*) (Table 4). Bottom and midwater trawl fisheries combined returned 291 birds (82.2% of total returns), with trawlers targeting squid (*Nototodarus* spp.) accounting for 39.2% ($n = 114$) of all trawl returns, trawlers targeting hoki (*Macruronus novaezelandiae*) accounting for 38.8% ($n = 113$), trawlers targeting scampi (*Metanephrops challengeri*) accounting for 1.0% ($n = 3$) and trawlers targeting 'other' species accounting for 20.3% ($n = 59$) (Table 4). The 'other' species included barracouta (*Thyrsites atun*), hake (*Merluccius australis*), jack mackerel (*Trachurus* spp.), silver warehou (*Seriolella punctata*), and white warehou (*S. caerulea*).

3.1.3 Injuries of returned birds and likely cause of death

The condition of the returned birds ranged from 'no obvious injury' to 'crushed'. Of the birds caught and returned from longline vessels, 17 had hook injuries and 10 of these still had hooks still present (1 in the wing and 9 in the bill or down the throat) (Table 5).

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, $n = 232$, 79.7%) 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 ($n = 55$), 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 (71.3%) while only albatross taxa were affected by warp strikes (100%) exhibiting serious wing injuries or lacerations.

3.1.4 Body condition

Between 1 July 2013 and 30 June 2014, 85.0% of returned birds had fat scores of less than 3, 6.8% of birds had fat scores of 3 and 1.4% of birds (4 Salvin's albatross and 1 white-headed petrel) had fat scores over 3 (Table 6). This suggests that the mean fat scores of returned birds between 1 July 2013 and 30 June 2014 (mean (\pm SE) = 1.4 ± 0.04) was less than the last fishing year (the mean fat score (\pm SE) of all returned birds from the 2012/13 fishing year = 2.1 ± 0.1 ; Bell, *in press*). Twenty-four birds (6.8%) could not have their fat scores confirmed due to damage.

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, 127 birds (35.9%) had offal or discards in their stomachs, and 40 birds had bait in their stomach (11.3%) (Table 7). In addition, 109 birds (30.8%) had empty stomachs.

Most of the gizzard contents were natural food items (squid beaks, fish bones and eyeballs and otoliths), but 7.3% of the birds returned had also ingested plastic or string and 16.7% had ingested stones or seeds (Table 8). In addition, 55 birds (15.5%) had empty stomachs. Samples (e.g. squid beaks and otoliths) have been collected for detailed identification to species if required.

3.1.6 Seabird identification

Autopsy confirmed that the majority (79.9%) of the seabirds returned between 1 July 2013 and 30 June 2014 were identified correctly by the observers (based on the information provided by observers on the specimen tags) (Table 9). Eighteen (5.1%) 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 Buller's albatross, Campbell albatross, Gibson's albatross, NZ white-capped albatross, Snares cape petrel, sooty shearwater, Westland petrel and white-chinned petrel. A further 35 (9.9%) were identified incorrectly including the following species: antarctic prion, Buller's albatross, Campbell albatross, flesh-footed shearwater, grey petrel, NZ white-capped albatross, Salvin's albatross, short-tailed shearwater, sooty shearwater, southern giant petrel and white-chinned petrel. Six birds (1.7%) did not have an observer identification code on the return label (Table 9).

3.2 Photographs

In total, 390 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 2013 and 30 June 2014; over two-thirds of these represented live bird interactions ($n = 293$, 75.1%) (Table 10). There were 311 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) and 9 photographed birds with no corresponding information in the MPI COD extract (Table 10).

Examination of 70 photographs confirmed that observers had accurately identified 70.0% ($n = 49$) of seabirds (Table 11). It should be noted that the majority of specimens were flesh-footed shearwaters, Buller's albatross, white-capped albatross and Salvin's albatross which are relatively simple to identify. All of the fluttering shearwaters, sooty shearwater, southern royal albatross and Chatham Island albatross were incorrectly identified; this was despite the fluttering shearwaters being dead specimens (Table 11). One new species of seabird was observed interacting with a fishing vessel; a Cook's petrel hit the deck and was released alive by the observer once it recovered.

3.2.1 *Quality and number of photographs*

The quality of the images obtained by observers continued to vary 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 (particularly 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. 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 is provided (i.e. number of images, type of images, date and time stamps etc.) is provided for all observers.

4. Acknowledgements

This work was funded through the Conservation Services Programme (INT2013/02), Department of Conservation. This autopsy and photo-identification work would not have been possible without the dedication of Ministry of Primary Industries observers who retained the birds for autopsy, took the photographs, and completed log books (which contain important information on cause of death and other aspects of the interaction onboard). Kristopher Ramm provided the link between Wildlife Management International Ltd, the Department of Conservation and the Ministry of Primary Industries

Observer Programme, and helped provide clarification on any discrepancies with autopsy tag data and photograph records. Kelvin Floyd (WMIL) developed the WMIL autopsy and photo-identification database and produced all maps.

5. References

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Appendix 1

Catch locations of seabirds killed and returned from New Zealand fisheries for autopsy between 1 July 2012 and 30 June 2013, by species, fishery target species and method

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 maps as a single symbol).

Figure A1.1. Gibson's albatross and Southern royal albatross.

Figure A1.2. Buller's albatross, Chatham Island albatross and Campbell albatross.

Figure A1.3. New Zealand white-capped albatross and Salvin's albatross.

Figure A1.4. *Procellaria* petrels.

Figure A1.5. Sooty shearwaters and flesh-footed shearwaters.

Figure A1.6. Buller's albatross, split by fisheries target species and method.

Figure A1.7. New Zealand white-capped albatross, split by fisheries target species and method.

Figure A1.8. Salvin's albatross, split by fisheries target species and method.

Figure A1.9. White-chinned petrel, split by fisheries target species and method.

Figure A1.10. Sooty shearwater, split by fisheries target species and method.

FIGURES

Figure 1. Catch locations of all A. small petrels and B. albatrosses killed and returned from New Zealand fisheries for autopsy between 1 July 2013 and 30 June 2014. 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).

Figure 2. The number of birds killed and returned, and the number of trips for each observed vessel between 1 July 2013 and 30 June 2014.

TABLES

- Table 1. Common and scientific names of seabirds captured and returned or photographed from New Zealand fisheries between 1 July 2013 and 30 June 2014.
- Table 2. Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2013 and 30 June 2014, by month of capture.
- Table 3. Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2013 and 30 June 2014, 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).
- Table 4. Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2013 and 30 June 2014, by fisheries type.
- Table 5. Number of seabirds of each species killed and returned from longline and trawl fisheries between 1 July 2013 and 30 June 2014, by likely cause of death. The proportion of albatross and non-albatross taxa returned is also presented.
- Table 6. Fat scores of seabirds killed and returned from fishing vessels between 1 July 2013 and 30 June 2014 (1= no fat, to 5 = extremely fat; U = unknown).

Table 7. Stomach contents of seabirds killed and returned from fishing vessels between 1 July 2013 and 30 June 2014.

Note: Birds can have multiple items in the stomachs resulting in higher stomach content figures than the total number of seabirds killed and returned ($n = 354$).

Table 8. Gizzard contents of seabirds killed and returned from fishing vessels between 1 July 2013 and 30 June 2014.

Note: Birds can have multiple items in the gizzard resulting in higher figures than the total number of seabirds killed and returned ($n = 354$).

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 2013 and 30 June 2014.

Table 10. Number of seabirds of each species reported as captured or photographed as interacting with fishing vessels between 1 July 2013 and 30 June 2014.

Table 11. Comparison of 50 observer identifications with expert photograph identifications for observed captures listed in COD from fishing vessels between 1 July 2013 and 30 June 2014, 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.

Table 1. Common and scientific names of seabirds captured and returned or photographed from New Zealand fisheries between 1 July 2013 and 30 June 2014.

COMMON NAME	SCIENTIFIC NAME	AUTOPSY	PHOTO
Albatross (unidentified)	Diomedidae (Family)		✓
Antarctic prion	<i>Pachyptila desolata</i>	✓	
Black petrel	<i>Procellaria parkinsoni</i>	✓	✓
Black-backed gull	<i>Larus dominicanus</i>		✓
Black-browed albatross (unidentified)	<i>Thalassarche</i> spp.		✓
Buller's albatross	<i>Thalassarche bulleri bulleri</i>	✓	✓
Buller's and Pacific albatross	<i>Thalassarche bulleri</i>		✓
Buller's shearwater	<i>Puffinus bulleri</i>		✓
Campbell albatross	<i>Thalassarche impavida</i>	✓	✓
Cape petrels	<i>Daption</i> spp.		✓
Chatham Island albatross	<i>Thalassarche eremita</i>	✓	✓
Common diving petrel	<i>Pelecanoides urinatrix</i>	✓	✓
Cook's petrel	<i>Pterodroma cookii</i>		✓
Fairy prion	<i>Pachyptila turtur</i>	✓	✓
Flesh-footed shearwater	<i>Puffinus carneipes</i>	✓	✓
Fluttering shearwater	<i>Puffinus gavia</i>		✓
Giant petrel (unidentified)	<i>Macronectes</i> spp.		✓
Gibson's albatross	<i>Diomedea antipodensis gibsoni</i>	✓	
Great albatross (unidentified)	<i>Diomedea</i> spp.		✓
Grey petrel	<i>Procellaria cinerea</i>	✓	✓
New Zealand white-capped albatross	<i>Thalassarche steadi</i>	✓	✓
Petrel (unidentified)	<i>Procellaria</i> spp.		✓
Petrels, prion and shearwaters (unidentified)	Hydrobatidae, Procellariidae & Pelecanoididae (Families)		✓
Prion (unidentified)	<i>Pachyptila</i> spp.		✓

Procellaria petrel (unidentified)	<i>Procellaria</i> spp.		✓
Salvin's albatross	<i>Thalassarche salvini</i>	✓	✓
Short-tailed shearwater	<i>Puffinus tenuirostris</i>	✓	
Small albatross (unidentified)	<i>Thalassarche</i> spp.		✓
Snares Cape petrel	<i>Daption capense australe</i>	✓	✓
Sooty shearwater	<i>Puffinus griseus</i>	✓	✓
Southern giant petrel	<i>Macronectes giganteus</i>	✓	
Southern royal albatross	<i>Diomedea epomophora</i>	✓	
Spotted shag	<i>Phalacrocorax punctatus</i>		✓
Storm petrel (unidentified)	Hydrobatidae (Family)		✓
Westland petrel	<i>Procellaria westlandica</i>	✓	✓
White-chinned petrel	<i>Procellaria aequinoctialis</i>	✓	✓
White-faced storm petrel	<i>Pelagodroma marina</i>		✓
White-headed petrel	<i>Pterodroma lessonii</i>	✓	

Table 2. Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2013 and 30 June 2014, by month of capture.

SPECIES	MONTH												TOTAL	% TOTAL
	J	F	M	A	M	J	J	A	S	O	N	D		
Antarctic prion		1											1	0.3
Black petrel	1	4											5	1.4
Buller's albatross		1		2	12	19	4	2	1		1	2	44	12.4
Campbell albatross					1		1		1				3	0.8
Chatham Island albatross										1			1	0.3
Common diving petrel			1										1	0.3
Fairy prion	1												1	0.3
Flesh-footed shearwater		4		2									6	1.7
Gibson's albatross											1		1	0.3
Grey petrel						1		9					10	2.8
NZ white-capped albatross	11	17	6	2	7		2		1		2	1	49	13.8
Salvin's albatross	4	2	1	1				7	12	12	8	1	48	13.6
Short-tailed shearwater										3			3	0.8

Snares Cape petrel								1					1	0.3
Sooty shearwater		8	9	29	19				1	9	3	2	80	22.6
Southern giant petrel												1	1	0.3
Southern royal albatross							1						1	0.3
Westland petrel					1			1					2	0.6
White-chinned petrel	9	11	19	17	1					24	9	5	95	26.8
White-headed petrel					1								1	0.3
TOTAL	26	48	36	53	44	20	8	20	16	49	24	12	354	
% TOTAL	7.3	13.6	10.2	15.0	12.4	5.7	2.3	5.7	4.5	13.8	6.8	3.4		

Table 3 Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2013 and 30 June 2014, 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		
Antarctic prion	1			1						1			1	0.3
Black petrel	2	3		5					5				5	1.4
Buller's albatross	28	14	2	43				1	39	4		1	44	12.4
Campbell albatross	1	1	1	2		1			2		1		3	0.8
Chatham Island albatross	1			1					1				1	0.3
Common diving petrel	1			1						1			1	0.3
Fairy prion	1			1						1			1	0.3
Flesh-footed shearwater	3	3		6					6				6	1.7
Gibson's albatross		1		1					1				1	0.3
Grey petrel	9	1		10					10				10	2.8

NZ white-capped albatross	26	16	7	48		1			35	5	1	8	49	13.8
Salvin's albatross	24	21	3	47		1		2	34	5	1	8	48	13.6
Short-tailed shearwater	2	1		3				1		2		1	3	0.8
Snares Cape petrel		1			1						1		1	0.3
Sooty shearwater	77	3		80					64	13		3	80	22.6
Southern giant petrel	1			1						1			1	0.3
Southern royal albatross	1			1						1			1	0.3
Westland petrel		2		2					1	1			2	0.6
White-chinned petrel	59	28	8	95					70	11		14	95	26.8
White-headed petrel	1			1						1			1	0.3
TOTAL	238	95	21	349	1	3	0	1	268	47	4	35	354	
% TOTAL	67.2	26.8	5.9	98.6	0.3	0.8	0	0.3	75.7	13.3	1.1	9.9		

Table 4 Number of seabirds of each species killed and returned from observed fishing vessels between 1 July 2013 and 30 June 2014, by fisheries type.

Species	Trawl (Bottom/Midwater)					Longline (Surface/Bottom)			Total
	Scampi	Squid	Hoki	Ling	Other	Tuna	Snapper	Other	
Antarctic prion		1							1
Black petrel							5		5
Buller's albatross		6	14		10	14			44
Campbell albatross			2			1			3
Chatham Island albatross			1						1
Common diving petrel		1							1
Fairy prion			1						1
Flesh-footed shearwater					4		2		6
Gibson's albatross						1			1
Grey petrel					9	1			10
NZ white-capped albatross	1	33	9	1	4	1			49
Salvin's albatross	2	2	15		18			11	48

Short-tailed shearwater					2			1	3
Snares Cape petrel					1				1
Sooty shearwater		26	48		5			1	80
Southern giant petrel								1	1
Southern royal albatross					1				1
Westland petrel			2						2
White-chinned petrel		45	20	1	5			24	95
White-headed petrel			1						1
Total	3	114	113	2	59	18	7	38	354
	291					63			

Table 5 Number of seabirds of each species killed and returned from longline and trawl fisheries between 1 July 2013 and 30 June 2014, by likely cause of death. The proportion of albatross and non-albatross taxa returned is also presented.

Species	Longline				Trawl			Tangled	Vessel strike	Total
	Bill or Throat	Wing	Legs or Feet	Not obvious	Warp	Net	Pound or Cod-end			
Antarctic prion						1				1
Black petrel	1			3		1			1	5
Buller's albatross	2			13	11	15	3		2	44
Campbell albatross				1	1		1			3
Chatham Island albatross					1					1
Common diving petrel						1				1
Fairy prion						1				1
Flesh-footed shearwater	1					5			1	6
Gibson's albatross	1								1	1
Grey petrel				1		9				10

NZ white-capped albatross				1	24	21	3			49
Salvin's albatross		2	1	5	17	22	1			48
Short-tailed shearwater				1		2				3
Snares Cape petrel								1		1
Sooty shearwater				1		62	16	1		80
Southern giant petrel				1						1
Southern royal albatross					1					1
Westland petrel						2				2
White-chinned petrel	4	5		19		60	6	1	4	95
White-headed petrel								1		1
Total	9	7	1	46	55	202	30	4	9	354
% of total longline or trawl	14.3	11.1	1.6	73.0	18.9	69.4	10.3			
Albatrosses (%)	33.3	28.6	100	65.2	100	28.7	26.6	0	33.3	
Non-albatross (%)	66.7	71.4	0	34.8	0	71.3	73.4	100	66.7	

Table 6 Fat scores of seabirds killed and returned from fishing vessels between 1 July 2013 and 30 June 2014 (1= no fat, to 5 = extremely fat; U = unknown).

SPECIES	FAT SCORE						TOTAL	MEAN (\pm SE)
	1	2	3	4	5	U		
Antarctic prion	1						1	1.0 \pm 0.0
Black petrel	5						5	1.0 \pm 0.0
Buller's albatross	33	8	1			2	44	1.2 \pm 0.1
Campbell albatross	1	1				1	3	1.5 \pm 0.5
Chatham Island albatross	1						1	1.0 \pm 0.0
Common diving petrel	1						1	1.0 \pm 0.0
Fairy prion		1					1	2.0 \pm 0.0
Flesh-footed shearwater	2	4					6	1.7 \pm 0.2
Gibson's albatross	1						1	1.0 \pm 0.0
Grey petrel	6	4					10	1.4 \pm 0.2
NZ white-capped albatross	26	8	5			10	49	1.5 \pm 0.1
Salvin's albatross	22	14	5	4		3	48	1.8 \pm 0.1
Short-tailed shearwater	3						3	1.0 \pm 0.0

Snares Cape petrel	1						1	1.0 ± 0.0
Sooty shearwater	54	21	5				80	1.4 ± 0.1
Southern giant petrel	1						1	1.0 ± 0.0
Southern royal albatross	1						1	1.0 ± 0.0
Westland petrel		1	1				2	1.4 ± 0.1
White-chinned petrel	62	18	7			8	95	1.4 ± 0.1
White-headed petrel					1		1	5.0 ± 0.0
TOTAL	221	80	24	4	1	24	354	1.4 ± 0.04
% TOTAL	62.4	22.6	6.8	1.1	0.3	6.8		

Table 7 Stomach contents of seabirds killed and returned from fishing vessels between 1 July 2013 and 30 June 2014.

Note: Birds can have multiple items in the stomachs resulting in higher stomach content figures than the total number of seabirds killed and returned ($n = 354$).

SPECIES	EMPTY	GONE ¹	BAIT ²	OFFAL (OR DISCARDS) ³	NATURAL ⁴	SLUDGE ⁵	PROVENTRICULAR OIL	OTHER ⁶
Antarctic prion	1							
Black petrel	4				1			
Buller's albatross	14	2	9	16	5		1	1
Campbell albatross	2							
Chatham Island albatross				1				
Common diving petrel	1							
Fairy prion	1							

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, worms or nylon cord

Flesh-footed shearwater	3			1	2			
Gibson's albatross	1							
Grey petrel	3			2				
NZ white-capped albatross	13	4	7	29	5	2	6	
Salvin's albatross	13	3	2	34	14	1		2
Short-tailed shearwater				2	3			
Snares Cape petrel	1							
Sooty shearwater	25	2	14	16	29	2	1	1
Southern giant petrel			1					
Southern royal albatross				1				
Westland petrel						2	1	
White-chinned petrel	26	7	7	25	27		1	
White-headed petrel	1							
TOTAL	109	18	40	127	86	7	10	5
% TOTAL	30.8	5.1	11.3	35.9	24.3	2.0	2.8	1.4

Table 8 Gizzard contents of seabirds killed and returned from fishing vessels between 1 July 2013 and 30 June 2014.

Note: Birds can have multiple items in the gizzard resulting in higher figures than the total number of seabirds killed and returned ($n = 354$).

SPECIES	EMPTY	GONE	SQUID BEAKS	OTOLITHS	FISH OR SQUID EYEBALLS	FISH BONES OR SKIN	PLASTIC OR STRING	SEEDS, STONES OR SHELL	WORMS	BARNACLES OR SEAWEED
Antarctic prion	1									
Black petrel			4		3		1			
Buller's albatross	15	2	9	5	9	10		4	10	
Campbell albatross	1			1				1		
Chatham Island albatross			1							1
Common diving petrel	1									
Fairy prion				1				1		
Flesh-footed shearwater			4	1			1	2	1	
Gibson's albatross			1							
Grey petrel			9	3	4	2			4	
NZ white-capped albatross	16	6	7	7	16	18	2	1	4	

Salvin's albatross	8	3	11	16	20	23	1	6	7	3
Short-tailed shearwater			2			1	1	3		
Snares Cape petrel			1					3		
Sooty shearwater	12	2	31	20	10	10	14	27	8	
Southern giant petrel								2		
Southern royal albatross				1	1	1				
Westland petrel			2			1			1	
White-chinned petrel	1	8	84	22	8	5	6	9	23	
White-headed petrel			1							
TOTAL	55	21	167	77	71	71	26	59	58	4
% TOTAL	15.5	5.9	47.2	21.8	20.1	20.1	7.3	16.7	16.4	1.1

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 2013 and 30 June 2014.

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	Total
Antarctic prion					1		1
Black petrel	5						5
Buller's albatross	35	5	1		3		44
Campbell albatross		1			2		3
Chatham Island albatross	1						1
Common diving petrel	1						1
Fairy prion	1						1
Flesh-footed shearwater	3				2	1	6
Gibson's albatross		1					1
Grey petrel	9				1		10
NZ white-capped albatross	45	2	1		1		49
Salvin's albatross	33		3		9	3	48
Short-tailed shearwater					3		3
Snares Cape petrel		1					1
Sooty shearwater	70	3			6	1	80
Southern giant petrel					1		1
Southern royal albatross	1						1

Westland petrel	1	1					2
White-chinned petrel	77	4		7	6	1	95
White-headed petrel	1						1
Total	283	18	5	7	35	6	354
% total	79.9	5.1	1.4	2.0	9.9	1.7	

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

Table 10 Number of seabirds of each species reported as captured or photographed as interacting with fishing vessels between 1 July 2013 and 30 June 2014.

Species	Photographed & listed as captured in COD extract	Photographed, but not listed in COD extract	No photograph, but listed in COD extract	Total
Albatross (unidentified)			18	18
Australasian gannet			1	1
Black petrel			10	10
Black-backed gull			2	2
Black-browed albatross (unidentified)			2	2
Buller's albatross	5		16	21
Buller's and Pacific albatross	1		1	2
Buller's shearwater	6		1	7
Cape petrels (unidentified)			7	7
Cape petrel	1			1
Chatham Island albatross	1			1
Common diving petrel	1	1	3	5
Cook's petrel	1			1
Fairy prion	2	2	4	8
Flesh-footed shearwater	23		22	45
Fluttering shearwater	3		2	5
Giant petrel (unidentified)			3	3
Great albatross (unidentified)			1	1
Grey petrel			2	2
Mid-sized petrel & shearwater (unidentified)			1	1

NZ white-capped albatross	10	3	28	41
Petrel (unidentified)			39	39
Petrels, prion and shearwaters (unidentified)			2	2
Prion (unidentified)			7	7
Procellaria petrel (unidentified)			8	8
Salvin's albatross	6		15	21
Shearwater (unidentified)			1	1
Small albatross (unidentified)			5	5
Snares Cape petrel	1			1
Sooty shearwater		1	56	57
Southern Royal albatross	1			1
Spotted shag		1		1
Storm petrel (unidentified)			1	1
Wandering albatross (unidentified)			2	2
Westland petrel	2		11	13
White-chinned petrel	6		40	46
White-faced storm petrel		1		1
Total	70	9	311	390
Dead	43	3	51	97
Alive	27	6	260	293

Table 11 Comparison of 50 observer identifications with expert photograph identifications for observed captures listed in COD from fishing vessels between 1 July 2013 and 30 June 2014, 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
Buller's albatross	5			5
Buller's shearwater		6		6
Cape petrel		1		1
Chatham Island albatross			1	1
Common diving petrel	1			1
Cook's petrel		1		1
Fairy prion	1		1	2
Flesh-footed shearwater	23			23
Fluttering shearwater			3	3
NZ white-capped albatross	8	2		10
Pacific or Buller's albatross	1			1
Salvin's albatross	5	1		6
Snares cape petrel		1		1
Southern royal albatross			1	1
Westland petrel	2			2
White-chinned petrel	3	3		6
Total	49	15	6	70

Live	12	5	2	19
Dead	37	10	4	51