IDENTIFICATION OF SEABIRDS CAPTURED IN NEW ZEALAND FISHERIES

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Abstract:
New Zealand waters support a diverse range of seabird species and much of the commercial fishing activity in the region overlaps with these seabirds. The accurate identification of seabirds captured in New Zealand fisheries is vital to determine the potential impact of fisheries interaction with these seabird populations. The autopsy programme has been in place to accurately determine the identification (and age, sex, diet and provenance) of specimens recovered dead by observers, but the identification reported for captured seabirds released alive and were not previously confirmed by an expert and were of unknown accuracy. Between 1 October 2010 and 30 June 2011 a total of 191 seabirds comprising of 12 taxa were incidentally killed as bycatch and returned for autopsy by onboard New Zealand Government observers. Birds were returned from longline (n=44) and trawl vessels (n=147). Seabirds returned were dominated numerically by five species (white-chinned petrel *Procellaria aequinoctialis*, sooty shearwater *Puffinus griseus*, New Zealand white-capped albatross *Thalassarche steadi,* Flesh-footed shearwater *Puffinus carneipes* and Buller's albatross *Thalassarche bulleri bulleri*). Two-thirds (66%) of the birds returned from the longline fisheries has injuries consistent with being hooked or entangled in the bill or throat, while most birds (89%) returned from trawl fisheries were killed through entanglement in the net. Warp interaction was the likely cause of death in 11% of trawl specimens. Mean fat scores were lower than birds in previous fishing years. Discards, including offal, appears to continue to be an attractant for many seabirds.

The photography programme was developed to enable observers to record and return images of birds incidentally captured by vessels (whether alive or dead) which would enable correct identification to be determined. All images were provided to Wildlife Management International Ltd in November 2011, which delayed the identification and reporting process. Out of 299 records of seabird captures on fishing vessels, there were photographs taken of 164 seabirds consisting of 9 taxa. Quality of the images varied widely and several could not be identified past family group. Poor images were common for birds that were alive and seen onboard for short periods (when photographs were taken from a long distance). A number of seabirds were recorded as captured and released alive, but no images were taken of these birds and as a result, identification of these birds could not be confirmed. In addition, there were a number of seabird photographs provided that were not recorded as captures. Most of these birds were alive and were likely to have left the vessel on their own.

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. Much of the commercial fishing activity within New Zealand waters overlap with these seabirds. The accurate identification of seabirds captured in commercial fisheries operations is vital to determine the potential impact of fisheries interaction with these seabird populations. New Zealand Government observers are placed on commercial vessels in order to investigate interactions with seabird species, but are not always able to identify seabirds at sea accurately. The autopsy programme has been in place to accurately determine the identification (and age, sex, diet and provenance) of specimens recovered dead by observers.

Observers present on fishing trips within New Zealand's Exclusive Economic Zone are generally required to return all seabirds caught and killed as incidental bycatch during fishing operations for necropsy. Additional information such as vessel name, location of capture (latitude and longitude) and date of capture is also recorded. Specific catch locations and vessel names have not been provided in this report on the grounds of commercial sensitivity. All autopsies were performed for

the Department of Conservation (DOC) as part of Conservation Services Programme (CSP) project INT2010/02.

In the past, the identification reported for seabirds released alive were often poor and were not confirmed by an expert. As such the photography programme was developed to enable observers to record and return images of birds interacting with vessels (whether alive or dead) which would enable correct identification to be determined.

This report summarises identification work completed on dead birds caught and returned in New Zealand fisheries and/or using photographs between 1 October 2010 and 30 June 2011. Note this none month reporting period is the result of a change in reporting from historical reporting annually by fishing year (October to September inclusive) to an annual financial and fisheries observer year (July to June inclusive).

2. OBJECTIVES

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

The specific objectives are:

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

3. METHODS

3.1 Necropsy

The necropsy 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 where current taxonomy and nomenclature is in a state of flux, a combination of Nunn *et al*. (1996) and Robertson & Nunn (1998) has been used and is consistent with the taxonomy recognised by the Agreement on the Conservation of Albatrosses and Petrels.

All specimens were allocated a unique autopsy number and photographed. This, the information from the observer specimen tag and all other information collected from the returned birds was entered into an Access database.

Birds were sexed by internal examination during necropsy except when birds were damaged by fishing gear and/or machinery, or from sea lice. 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 were birds of breeding morphology, but that active breeding could not be confirmed; breeding adults were considered to be actively breeding at the time of capture and non-breeding adults were identified by feather moult and gonadal evidence. Sub-adults (pre-breeders) were those birds in mostly adult or near adult plumage, but that had no gondal evidence of obtaining breeding condition and immatures and juveniles were birds in non-adult plumage and/or morphology.

Body condition was determined by assigning a fat score based on the relative amount of subcutaneous fat and fat on and around organs. Fat scores go from '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 is listed as unknown.

Feather moult and the condition of the brood patch were recorded. For each bird, any injuries were recorded, and together with observer comments on the autopsy label, likely cause of death was determined.

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. Additionally, any bait material was recorded, as was offal or discarded material, plastic, stones, algae and goose barnacle plates. All autopsy specimens were allocated a unique number. Details relating to each specimen are available on request from the Manager, Marine Conservation Services, DOC (email: csp@doc.govt.nz). In some cases (i.e. those specimens damaged by fishing gear and machinery, or by sea lice) it was not possible to collect all data; these are reported as 'unknown', and appear as such in the relevant tables.

3.2 Photo-identification

The photographs used in this analysis were of seabird captures where records indicated only an observer identification was made and not a confirmed identification following autopsy. This covers 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 Fisheries extracts) and may include non-capture interactions. Photographs were provided in electronic format with associated observer extracted information (such as 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 containing trip, station and sample number making it easy to correlate to the Ministry of Fisheries extract. However, photographs of live captures often contained no information on station or sample number. If the time and date stamp on the camera was set correctly this helped match data from the extract to the photograph.

All photographs 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 if necessary. Bill and head morphology and colour was usually sufficient to allow identification of albatross and larger petrels to species, but other key features (such as size, shape, foot colour, and wing markings) were needed for other smaller species. If key features were not visible in the photograph or the image was out of focus, identification to species was not possible.

All images were provides to Wildlife Management International Ltd in November 2011 which delayed the identification and reporting process.

Individual seabirds were allocated a unique autopsy number. The photograph (or photographs), the information from the observers and any other information observed in the photograph was entered into an Access database. Where possible, the taxon, age, sex and provenance of the seabirds pictured were determined.

4. RESULTS

4.1 Autopsy

4.1.1 Species returned

A total of 191 seabirds (comprising of 12 taxa) were returned from 32 vessels between 1 October 2010 and 30 June 2011 (Table 2, Figures 1 and 2). Seabirds returned to date were dominated by five species (white-chinned petrel (60, 31%), sooty shearwater (58, 30%), white-capped albatross (26, 13.5%), Buller's albatross (18, 9%) and flesh-footed shearwater (15, 8%), Table 2). These five species, together with Salvin's albatross (8, 4%) accounted for 95% of all returns to date (Table 2). Of the remaining 6 taxa, 5 had only single captures and Gibson's albatross had 2 captures (Table 2).

Two specimens had uniquely numbered bands: a Buller's albatross, band number M71153, banded as an adult on Big Solander on 22/7/97 and another Buller's albatross, band number M83716, also banded as an adult on Big Solander on 17/7/02. Specimens still need to be checked for PTT tags (PTT tag reader to be provided by DOC).

The monthly distribution of returned specimens was not evenly spread across the fishing year with most birds returned to date being caught in March (45, 23.5%), October (34, 20%) or February (33, 17%, Table 2). However this is to be expected as these specimens were only returned from those vessels fishing at sea between 1 October 2010 and 30 June 2011 and this pattern reflects the timing of seabird breeding, presence within the New Zealand EEZ, timing and location of fisheries, and observer coverage.

The majority of all birds returned were males (136, 71%); however flesh-footed shearwater (11, 73%) returns were dominated by females (Table 3). Also, with the exception of the Salvin's albatross where all birds were either sub-adults or immatures, the majority of the birds returned were adults (184, 96%, Table 3). Of the 184 adults, 141 (77%) were breeding, 34 (18%) were non-breeding and 9 (5%) could not have the breeding status confirmed due to sea lice damage. Of all the birds returned, 7 (4%) were pre-breeders or immature (Table 3).

The seabirds killed and returned were caught in a range of Fishing Management Areas (FMA 1, 2, 3, 4, 5, 6, 7 and 9) and general positions are show in Figures 1 and 2. Additional figures showing general capture positions for separate species and fishery target species and method is given in Appendix 1 (Figures 4-13).

4.1.2 Target vessel and fishery

Bottom and surface longline fisheries returned a total of 44 birds (23% of total returns), with vessels targeting tuna (*Thunnus* species) accounting for 45% (n=20) of longline specimens and those targeting 'other' species (mainly ling *Genypterus blacodes*) accounted for 55% (n=24, Table 4). Bottom and midwater trawl fisheries combined returned 147 birds (77% of total returns), with boats targeting squid (*Nototodarus* species) accounting for 51% of all trawl returns (n=75, Table 4). Trawlers targeting hoki (*Macruronus novaezelandiae*) returned 22% of all trawl returns (n=32) and those targeting scampi (*Metanephrops challengeri*) returned 14% of all trawl returns (n=21, Table 4). Trawlers targeting 'other' species returned 19 birds (13% of the total trawl returns, Table 4) and species targeted in this category were barracouta (*Thyrsites atun)*, hake (*Merluccius australis*), jack mackerel (*Trachurus* spp.), orange roughy (*Hoplostethus atlanticus*), silver warehou (*Seriolella punctata*), and white Warehou (*S. caerulea*).

For the fishing period 1 October to 30 June 2011, there were 189 observed trips on 111 vessels (Kris Ramm, CSP DOC, pers. comm.). A total of 32 vessels returned birds between 1 October 2010 and 30 June 2011 (29% of all observed vessels). The pattern of most trips and vessels returning relatively low numbers of birds, and a few trips and vessels returning relatively large numbers of birds, is highlighted in Figure 3.

4.1.3 Injuries of returned birds and likely cause of death

Many of the returned birds had a range of injuries from 'no obvious injury' to 'mangled'. Many birds had been caught in the trawl nets or recovered in the pounds (i.e. drowned, n=131) and were very wet and sandy and showed crush injuries (Table 5). Other birds showed injuries suggesting entanglement and crush injuries from the trawl warp and blocks (n=16, Table 5); many with grease covering part or all of the body with multiple fractures or missing body parts.

From the longline vessels, there were 40 birds that had hook injuries and of these, 14 still had hooks still present (1 in the foot, 4 in the wing, 5 swallowed and 4 in the bill). One bird had the remains of an old hook in the belly. The majority of these hooked birds were hooked in the bill or throat (n=29, 66%, Table 5). Both albatross and non-albatross taxa showed similar rates of injuries by hook to the bill and throat, but non-albatross taxa had higher likelihood of hooks in the wing or feet (Table 5). There were only two birds (5%) caught by longline vessels where there were no obvious injuries (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. Most birds were very wet and sandy showing crush injuries (i.e. broken wings, broken chest, crushed organs etc.) after being recovered from the net or pound. Most birds were retrieved from the net (n=131, 89%) and this was dominated by non-albatross taxa (82%, Table 5). Albatrosses were predominately affected by warp strikes (94%, Table 5) showing serious wing injuries or lacerations.

4.1.4 Body condition

Fat scores less than 3 were recorded 72% of the time in returned birds between 1 October 2010 and 30 June 2011 (Table 6). Fat scores of 3 were recorded 19% of the time. Only 3.5% of the birds (4 white-chinned petrels, 1 white-capped albatross, 1 sooty shearwater and 1 Buller's albatross) returned had fat scores over 3 (Table 6). There were ten birds (5%) that could not have fat scores confirmed due to sea lice damage (Table 6). This suggests that the mean fat scores are lower than other recent fishing years with most birds scoring less than 3 (19% compared to 56% scoring 3 in the 2009/10 fishing year, Thompson 2010b).

4.1.5 Stomach and gizzard content

Stomach contents have been identified into main groups following a similar method to Thompson (2009, 2010a, b) and are shown in Table 7. There were 87 birds (45.5%) that had offal or discards in their stomachs and five white-chinned petrels, two Buller's albatross and one sooty shearwater had bait in their stomachs (Table 7). Two birds (one black petrel and one white-chinned petrel) had blue dyed bait or traces of blue dye in their stomachs (EAB, pers. obs.). Most of the gizzard contents were natural food items (squid beaks, fish bones and eyeballs and otoliths), but 20% of the birds returned also had ingested plastic and 3% had ingested string or twine (Table 8). In addition, 14% of the birds had empty stomachs (Table 8). Samples (e.g. squid beaks and otoliths) have been collected for further analysis.

4.1.6 Seabird identification

Using the information provided by observer on the specimen tags, the majority (82%) of the returned seabirds between 1 October 2010 and 30 June 2011 were identified correctly by the observers (Table 9). There were 17 (9%) identified to the correct group or size class, but wrong species code (although this may relate to changes in the coding system). These included Gibson's albatross, Campbell albatross and NZ white-capped albatross. There were 7 (4%) seabirds identified incorrectly; NZ white-capped albatross, short-tailed shearwater, sooty shearwater and a white-chinned petrel (Table 9). It should be noted that it is difficult to distinguish short-tailed shearwaters from sooty shearwaters without measurements and this specimen was caught with a number of sooty shearwaters. In addition, 10 birds (5%) did not have an observer identification code on the return label (Table 9).

4.2 Photographs

Extracts of seabird captures from the Ministry of Fisheries Central Observer Database ("COD") and examination of photographs gave a total of 299 birds that were reported captured or photographed as bird interactions with fishing vessels (and may include some non-capture interactions). A total of 164 seabirds were photographed by observers for the period 1 October 2010 to 30 June 2011 (Tables 10 and 11). Of these, 57 birds had no matching information in COD at the time of extract, but had photographs taken by the observers (Tables 10 and 11). In addition to these photographs, there were 135 observed seabird captures that had no photographs taken (Table 10). Of the 299 records, over half were of live bird interactions (n=179, 60%, Table 10).

Examination of photographs confirmed the identification made by observers in 92% of the time (n=98, Table 12). It should be noted that the majority of the specimens were sooty shearwaters and white-chinned petrels which are relatively simple to identify (and identified correctly by observers in all cases) and Table 13 shows that some species are harder to identify (such as storm petrels and prions).

4.2.1 Quality and number of photographs

The quality of the images varied widely. There were a number of issues including only one photograph for some seabirds, not all key features were photographed, poor focus, and under or over-exposure. Poor images were common for birds that were alive and seen onboard for short periods (when photographs were taken from a long distance).

It is important that more photographs are taken of each seabird and that there are images of head, bill, feet, wings (upper and lower) and whole body shots taken. Photographs need to be taken of all bird interactions (as much as possible) and if a photograph of a seabird is taken, data relevant to that bird should be recorded (i.e. observer identification, date, time, haul, sample etc.).

4.2.2 Recommendations for photo-identification

It is recommended that:

- Wherever possible, all seabird interactions are photographed and recorded. If possible, haul and sample information should be included in the image.
- Training and instruction on the use of the cameras should be completed for all observers.
- Training on how to take suitable photographs for identification use is provided (i.e. number of images, type of images, date and time stamps etc.).
- Images (with scale if possible) should include 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.
- Photo logs are completed for all images (and that these can be correlated to date and time stamps from the camera). Descriptions of the interaction would also help identification and correlation of images.

- Photograph numbers should be recorded in the observer non-fish bycatch form.
- That the photographs (and extracts from the Ministry of Fisheries observer log books) are provided regularly throughout the fishing year for photo-identification.

5. ACKNOWLEDGEMENTS

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Tables:

Figures

Appendix 1.

Table 1 List of common and scientific names of seabirds captured and returned or photographed from New Zealand fisheries between 1 October 2010 and 30 June 2011.

COMMON NAME	SCIENTIFIC NAME
Antarctic prion	*Pachytpila desolata*
Black-backed gull	*Larus dominicanus*
Black-bellied storm petrel	*Fregetta tropica*
Black petrel	*Procellaria parkinsoni*
Buller's albatross	*Thalassarche bulleri bulleri*
Campbell albatross	*Thalassarche impavida*
Common diving petrel	*Pelecanoides urinatrix*
Fairy Prion	*Pachyptila turtur*
Flesh-footed shearwater	*Puffinus carneipes*
Gibson's albatross	*Diomedea antipodensis gibsoni*
Grey-backed storm petrel	*Garrodia nereis*
New Zealand White-capped albatross	*Thalassarche steadi*
Salvin's albatross	*Thalassarche salvini*
Short-tailed shearwater	*Puffinus tenuirostris*
Sooty shearwater	*Puffinus griseus*
Southern Royal albatross	*Diomedea epomophora*
Westland petrel	*Procellaria westlandica*
White-chinned petrel	*Procellaria aequinoctialis*
White-headed petrel	*Pterodroma lessonii*

Table 2 Species and numbers of seabirds killed and returned from observed fishing vessels between 1 October 2010 and 30 June 2011, by month of capture.

SPECIES	MONTH												TOTAL	% TOTAL BIRDS
	J	F	M	A	M	J	J	A	S	O	N	D		
Black petrel											1		**1**	**0.5**
Buller's albatross				1	12	5							**18**	**9**
Campbell albatross											1		**1**	**0.5**
Common diving petrel			1										**1**	**0.5**
Flesh-footed shearwater										15			**15**	**8**
Gibson's albatross						1					1		**2**	**1**
New Zealand White-capped albatross	2	5	6	2	6	3				1			**25**	**13**
Salvin's albatross		1								3	3	1	**8**	**4**
Short-tailed shearwater										1			**1**	**0.5**
Sooty shearwater		18	14	10	5					11			**58**	**30**
Southern Royal albatross	1												**1**	**0.5**
White-chinned petrel		9	24	3	4					3	14	3	**60**	**31**
TOTAL	**3**	**33**	**45**	**16**	**27**	**9**	**0**	**0**	**0**	**34**	**20**	**4**	**191**	
% TOTAL BIRDS	**1.5**	**17**	**23.5**	**8**	**14**	**5**	**0**	**0**	**0**	**20**	**10**	**2**		

Table 3 Species and numbers of seabirds killed and returned from observed fishing vessels between 1 October 2010 and 30 June 2011, by sex (M = male, F = female, U = unknown), age and breeding status (TA = total adults, BA = breeding adult, N = non-breeding adult, SA = sub-adult, I = immature and J = juvenile, U = unknown).

SPECIES	SEX			AGE								TOTAL	% TOTAL BIRDS
	M	F	U	ADULTS				PRE-BREEDERS					
				TA	BA	N	U	SA	I	J	U		
Black petrel	1			1		1						**1**	**0.5**
Buller's albatross	10	8		18	17	1						**18**	**9**
Campbell albatross		1		1	1							**1**	**0.5**
Common diving petrel	1			1		1						**1**	**0.5**
Flesh-footed shearwater	4	11		15	9	6						**15**	**8**
Gibson's albatross	2			2	1	1						**2**	**1**
New Zealand White-capped albatross	17	8		25	21	4						**25**	**13**
Salvin's albatross	5	3		1	1			6	1			**8**	**4**
Short-tailed shearwater		1		1		1						**1**	**0.5**
Sooty shearwater	54	4		58	46	11	1					**58**	**30**
Southern Royal albatross	1			1	1							**1**	**0.5**
White-chinned petrel	41	10	9	60	44	8	8					**60**	**31**
TOTAL	**136**	**46**	**9**	**184**	**141**	**34**	**9**	**6**	**1**			**191**	
% TOTAL BIRDS	**71**	**24**	**5**	**96**	**77**	**18**	**5**	**3**	**0.5**				

Table 4 Species and number of birds killed and returned from observed fishing vessels between 1 October 2010 and 30 June 2011, by fisheries type.

Species	Trawl						Longline				Total
	Bottom				Midwater		Surface		Bottom		
	Scampi	Squid	Hoki	Other	Hoki	Squid	Tuna	Other	Tuna	Other	
Black petrel							1				1
Buller's albatross		4		2	2		10				18
Campbell albatross								1			1
Common diving petrel						1					1
Flesh-footed shearwater	15										15
Gibson's albatross								1	1		2
NZ white-capped albatross	2	15	1	3		2	2			1	25
Salvin's albatross	2		6								8
Short-tailed shearwater				1							1
Sooty shearwater	1	30	15	11		1					58
Southern royal albatross											1
White-chinned petrel	1	10	8	2		12	6	9		12	60
Total	21	59	30	19	2	16	19	11	1	13	191

Table 5 Species, number and percentage within longline or trawl fisheries, and proportion of albatross and non-albatross taxa returned between 1 October 2010 and 30 June 2011, and assigned to a likely cause of death.

Species	Longline				Trawl		Vessel strike	Total
	Bill or Throat	Wing	Legs or Feet	Not obvious	Warp	Net		
Black petrel	1							1
Buller's albatross	9	1			3	5		18
Campbell albatross	1							1
Common diving petrel							1	1
Flesh-footed shearwater						15		15
Gibson's albatross	2							2
NZ white-capped albatross	1	1			8	14	1	25
Salvin's albatross					3	5		8
Short-tailed shearwater						1		1
Sooty shearwater					1	57		58
Southern royal albatross					1			1
White-chinned petrel	15	7	2	2		34		60
Total	29	9	2	2	16	131	2	191
% of total longline or trawl	69	21	5	5	11	89		
Albatrosses (%)	45	22	0	0	94	18	50	
Non-albatross (%)	55	78	100	100	6	82	50	

Table 6 Comparison of fat scores in the returned birds between 1 October 2010 and 30 June 2011 (1= no fat to 5 = extremely fat, U = unknown).

SPECIES	FAT SCORE						TOTAL	MEAN (±SE)
	1	2	3	4	5	U		
Black petrel			1				**1**	**3 ± 0**
Buller's albatross	9	5	3	1			**18**	**1.8 ± 0.2**
Campbell albatross		1					**1**	**2 ± 0**
Common diving petrel			1				**1**	**3 ± 0**
Flesh-footed shearwater		5	10				**15**	**2.7 ± 0.1**
Gibson's albatross	2						**2**	**1 ± 0**
New Zealand White-capped albatross	11	9	5				**25**	**1.8 ± 0.2**
Salvin's albatross	5	2	1				**8**	**1.5 ± 0.3**
Short-tailed shearwater	1						**1**	**1 ± 0**
Sooty shearwater	18	29	9	1		1	**58**	**1.8 ± 0.1**
Southern Royal albatross	1						**1**	**1 ± 0**
White-chinned petrel	30	11	6	3	1	9	**60**	**1.7 ± 0.1**
TOTAL	**77**	**62**	**36**	**5**	**1**	**10**	**191**	
% TOTAL BIRDS	**40**	**32**	**19**	**3**	**0.5**	**5**		

Table 7 Stomach contents of seabirds killed and returned on fishing vessels between 1 October 2010 and 30 June 2011.

SPECIES	EMPTY	GONE[1]	BAIT[2]	OFFAL (OR DISCARDS)[3]	NATURAL[4]	SLUDGE[5]	PROVENTRICULAR OIL
Black petrel	1						
Buller's albatross	11	1	2	7	3		1
Campbell albatross	1						
Common diving petrel	1						
Flesh-footed shearwater	4			11			
Gibson's albatross	1				1		
New Zealand White-capped albatross	7	1		14	3	1	3
Salvin's albatross	2			5	1		
Short-tailed shearwater				1			
Sooty shearwater	14	1	1	27	5	9	8
Southern Royal albatross	1						
White-chinned petrel	10	9	5	22	3	4	16
TOTAL	**53**	**12**	**8**	**87**	**16**	**15**	**28**
% TOTAL BIRDS	**28**	**6**	**4**	**45.5**	**8**	**8**	**15**

[1] Gone = stomach missing or damaged by sea lice
[2] Bait = identifiable (regularly sized) pieces of fish or squid
[3] Discards or Offal = whole fish (usually small bycatch fish); fish heads, fillets, vertebrae and skin or squid tentacles, heads and beaks
[4] Natural = identifiable prey fish or squid (whole or parts), salps and krill
[5] Sludge = usually fish sludge (minced fish or squid), could be offal or discards or natural

Table 8 Gizzard contents of seabirds killed and returned on fishing vessels between 1 October 2010 and 30 June 2011.

SPECIES	EMPTY	GONE	SQUID BEAKS	BILE	OTOLITHS	EYEBALLS (fish or squid)	FISH BONES	SLUDGE	SKIN (fish)	FLESH (squid or fish)	FEATHERS	PROVENTRICULAR OIL	PLASTIC	SEEDS OR STONE	WORMS	SEAWEED	EGG SHELL	STRING OR TWINE
Black petrel			1															1
Buller's albatross	8	1	2		2		5		1						3			
Campbell albatross			1															
Common diving petrel	1																	
Flesh-footed shearwater			8		5	2	3						13	1	1			
Gibson's albatross			2				1											
Salvin's albatross	1		2	1	3	6	4	1										
Short-tailed shearwater													1					
Sooty shearwater	8		22		8	6	10	1	1	4		4	20	6	4			2
Southern Royal albatross			1			1							1				1	
White-capped albatross	7		6		2	9	8	2		1			1		1	1		
White-chinned petrel	1	9	51		4	5	12		7	2	1		3	1	14	1		3
TOTAL	**26**	**10**	**96**	**1**	**24**	**29**	**43**	**4**	**9**	**7**	**1**	**4**	**39**	**8**	**23**	**2**	**1**	**6**
% TOTAL BIRDS	**14**	**5**	**50**	**0.5**	**12.5**	**15**	**22.5**	**2**	**5**	**4**	**0.5**	**2**	**20**	**4**	**12**	**1**	**0.5**	**3**

Table 9 Summary of identifications recorded by on-board observers at sea compared with autopsy identification for seabirds killed and returned from observed fishing boats between 1 October 2010 and 30 June 2011.

Species	ID correct	ID wrong	ID as correct 'species' group	ID as seabird large or albatross	ID as petrel unidentified	ID not on label	Total
Black petrel	1						1
Buller's albatross	16					2	18
Campbell albatross			1				1
Common diving petrel	1						1
Flesh-footed shearwater	15						15
Gibson's albatross			2				2
NZ white-capped albatross	15	1	4	3		2	25
Salvin's albatross	8						8
Short-tailed shearwater		1					1
Sooty shearwater	50	1			6	1	58
Southern royal albatross	1						1
White-chinned petrel	50	4			1	5	60
Total	157	7	7	3	7	10	191
% of total longline or trawl	82	4	4	1.5	4	5	

Table 10 Number of seabirds observed captured or photographed on fishing vessels between 1 October 2010 and 30 June 2011.

	Dead	Alive	Total
Photographed & listed in Ministry of Fisheries extract	64	43	107
Photographed, but not listed in Ministry of Fisheries extract	34	23	57
No photograph, but listed in Ministry of Fisheries extract	22	113	135
Total	120	179	299

Table 11 Species observed captured or photographed as interacting with fishing vessels between 1 October 2010 and 30 June 2011.

Species	Photo & listed as captured in COD extract	Photo, but not listed as capture in COD extract	No photograph, but listed in COD extract	Total
Albatross (unidentified)			9	9
Antarctic prion		18		18
Black-backed gull			1	1
Black-bellied storm petrel		2		2
Black-browed albatross (unidentified)			3	3
Buller's albatross	6	1	15	22
Cape petrels (unidentified)			1	1
Common diving petrel	12	2	4	18
Fairy Prion			2	2
Flesh-footed shearwater			2	2
Giant petrel (unidentified)			2	2
NZ white-capped albatross	8	1	8	17
Petrel (unidentified)	2		15	17
Procellaria petrel (unidentified)			1	1
Prion (unidentified)	6		5	11
Seabird (small)			1	1
Southern Royal Albatross			1	1
Salvin's albatross	1		10	11
Shy albatross (unidentified)			2	2
Sooty shearwater	14	19	22	55
Storm petrel (unidentified)	3		2	5
Westland petrel			2	2
White-chinned petrel	55	13	27	95
White-headed petrel		1		1
Total	107	57	135	299

Table 12 Analysis of 107 observer identifications with expert photograph identification, by life status, for observed captures listed in COD from fishing vessels between 1 October 2010 and 30 June 2011.

Where: Confirmed = identification confirmed observer identification; New, consistent = identification was to a lower taxonomic group and consistent with the observer identification; and New, not consistent = identification was not consistent with observer identification.

Life status	Confirmed	New, consistent	New, not confirmed	Total
Live	35	6	2	43
Dead	63	1	0	64
Total	98	7	2	107

Table 13 Analysis of 107 observer identifications with expert photograph identification, by species, for observed captures listed in COD from fishing vessels between 1 October 2010 and 30 June 2011.

Where: Confirmed = identification confirmed observer identification; New, consistent = identification was to a lower taxonomic group and consistent with the observer identification; and New, not consistent = identification was not consistent with observer identification.

Species (observer)	Confirmed	New, consistent	New, not confirmed	Total
Buller's albatross	6			6
Common diving petrel	11		1	12
NZ white-capped albatross	8			8
Petrel (unidentified)			2	2
Prion (unidentified)	1	1	4	6
Salvin's albatross				
Sooty shearwater	14			14
Storm petrel (unidentified)		3		3
White-chinned petrel	55			55
Total	96	4	7	107

Figure 1 Catch locations of all seabirds killed and returned in New Zealand fisheries for necropsy between 1 October 2010 and 30 June 2011.

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).

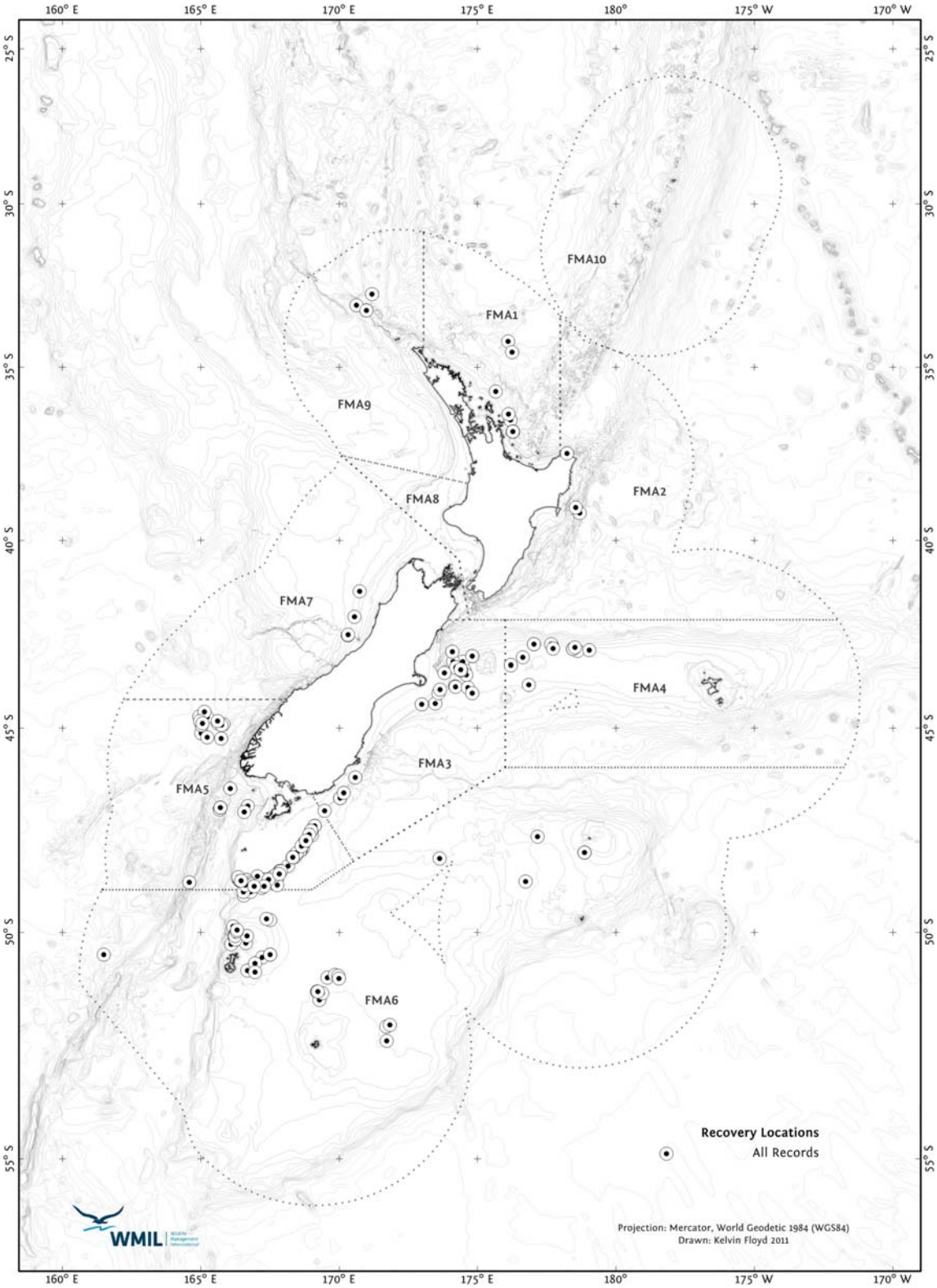

Figure 2 Catch locations of all seabirds killed and returned in NZ fisheries for necropsy between 1 October 2010 and 30 June 2011, split into (i) small petrels and shearwaters, and (ii) albatross.

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).

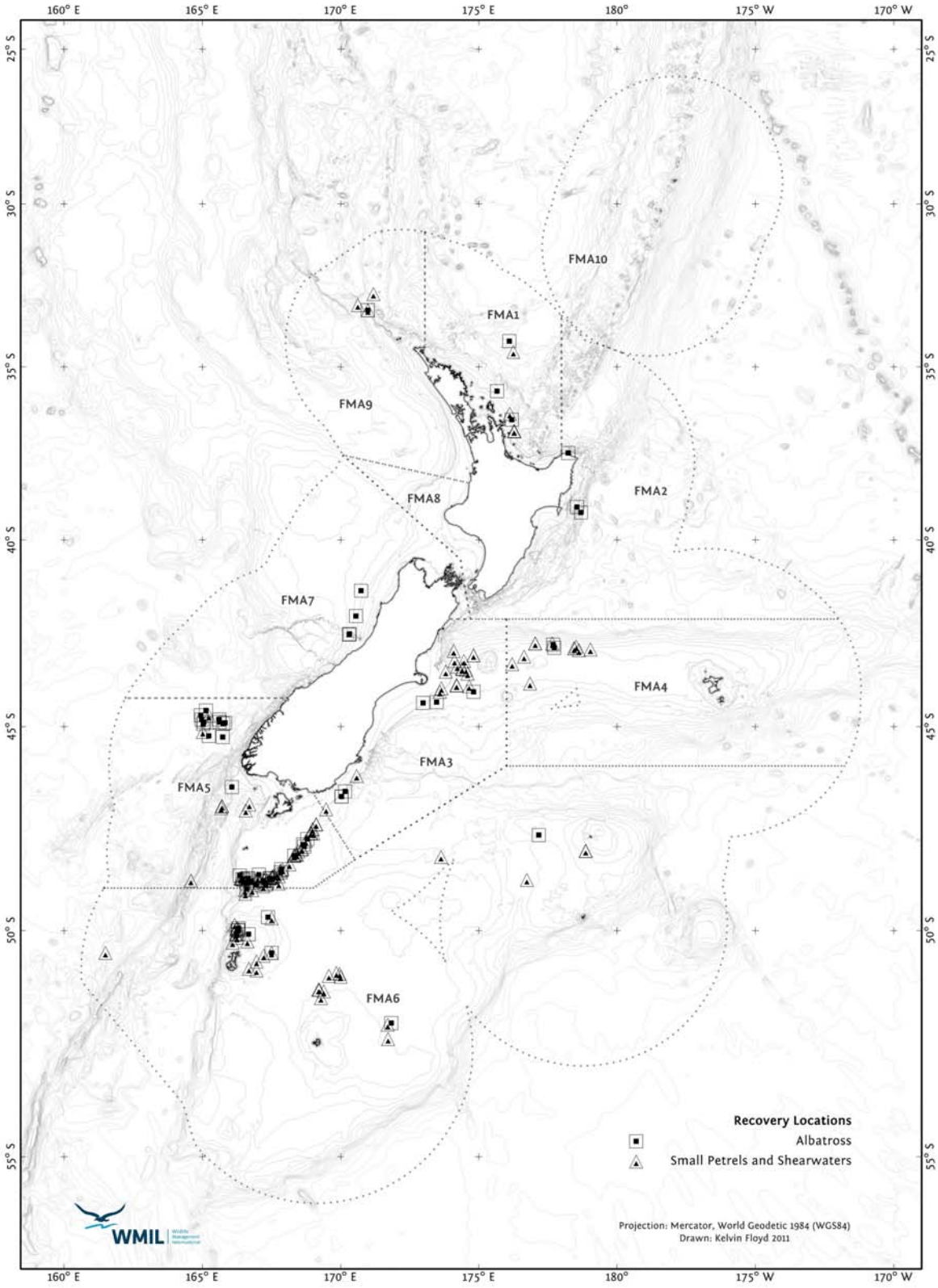

Figure 3 Frequency of the number of birds killed and returned by observed trip and observed vessel between 1 October 2010 and 30 June 2011.