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Autopsy report for seabirds killed and returned from New Zealand fisheries, 1 October 2008 to 30 September 2009

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Report prepared for the Conservation Services Programme, Department of Conservation: Contract INT2007/02

April 2010

Abstract

Large numbers of a diverse range of seabird species frequent New Zealand commercial fishing waters. The accurate identification of seabirds captured in New Zealand fisheries is key for examining the potential threat to population viability posed by incidental fisheries captures. Additionally, autopsy is required in the majority of cases to determine age-class, sex and provenance of captured seabirds. Between 1 October 2008 and 30 September 2009 (the 2008/09 fishing year) a total of 384 seabirds comprising 27 taxa were incidentally killed as bycatch and returned for autopsy by on-board New Zealand Government fisheries observers. Birds were returned from longline, trawl and setnet vessels. Seabirds returned during 2008/09 were dominated numerically by three species (sooty shearwater *Puffinus griseus*, white-capped albatross *Thalassarche steadi* and white-chinned petrel *Procellaria aequinoctialis*). Half (50%) of birds returned from longline fisheries had injuries consistent with being hooked or entangled in the bill or throat, while most birds (82%) returned from trawl fisheries were killed through entanglement in the net. Warp interaction was the likely cause of death in 18% of trawl specimens. Mean fat scores were generally similar or higher in birds from 2008/09 than in the previous year, although this was not the case for Buller's albatross. Seabirds returned from the 2008/09 fishing year, and from trawl fisheries in particular, showed clear size-related differences in the likely cause of death, and discarded material, including offal, appears to continue to be an attractant for many taxa.

Keywords: commercial fishing, seabirds, autopsy, incidental mortality, longline, trawl, setnet

1. Introduction

The correct identification of seabirds killed by commercial fishing operations is a necessary and crucial first step towards a better understanding of which species and populations may be at risk from such operations. Furthermore, although at-sea identifications of birds killed by observers are usually, but not always, accurate, post mortem analysis is generally required in order to correctly assign gender to specimens, and additionally provide information on status, dietary preferences, condition and provenance.

In keeping with previous fishing years, during the 2008/09 fishing year (1 October 2008 to 30 September 2009) Government observers were present on a non-random selection of fishing trips within New Zealand's EEZ. One component of the observers' remit is to return for autopsy all seabirds caught and killed as incidental bycatch during fishing operations. Ancillary information (for example, vessel name, location of capture as latitude and longitude coordinates, date of capture, and additional comments provided by the observer) is also recorded by the observer.

Due to the non-random nature of seabird capture and return, the totals for each species of seabird presented in this report do not reflect 'catch rates' for particular fishing methods or fisheries generally. Specific catch locations and the names of vessels from which specimens were returned have not been provided in this report on the grounds of commercial sensitivity.

All autopsies were performed for the Department of Conservation as part of Conservation Services Programme project INT2007/02 (Conservation Services Programme 2007). The overall objective of this project was to determine which seabird species are captured in fisheries and the mode of their capture. The specific objectives were:

1. to determine, through examination of returned seabird specimens, the taxon, sex, and where possible age-class and provenance of seabirds captured in New Zealand fisheries.
2. to detail the injuries, body condition and stomach contents of returned seabirds and, where possible, the likely cause of mortality.
3. to report any changes in the protocol used for the necropsy of seabirds.

2. Methods

Methods followed those described by Bartle (2000) and used in autopsies in subsequent fishing years (Robertson 2000, Robertson & Bell 2002a, 2002b, Robertson et al. 2003, 2004, Conservation Services Programme 2008, Thompson 2009, 2010). The author undertook all autopsies and identifications, to species where possible. Birds were sexed by internal examination during dissection except where this was precluded through damage from fishing gear and machinery or from sea lice. Birds were characterised as either breeding adult, adult, non-breeding adult or juvenile based on a combination of plumage and other morphological characteristics (for example, bill morphology), gonadal characteristics and brood patch characteristics. Breeding adults were birds considered to be actively breeding at the time of capture; adults were those birds of breeding adult morphology where active breeding could not be confirmed; non-breeding adults were classified as such primarily based on main

feather moult and gonadal evidence and were definitely not actively breeding at the time of capture; and juveniles were birds in non-adult plumage/morphology.

As in previous years, body condition was determined through a fat score, initially based on the relative amount of subcutaneous fat and more recently including an assessment of the amount of fat deposited on and around organs and structures within the body cavity (Bartle 2000, Conservation Services Programme 20008). Fat scores (ascending from '1' = no fat, to '5' = extremely fat, or fat to an extent that internal examination becomes difficult), presented in this report combine an assessment of the amount of both subcutaneous fat under the skin in the pectoral region and fat deposited on and around organs within the body cavity. The more detailed criteria used for fat score assessment summarised by Conservation Services Programme (2008), based on work undertaken on white-chinned petrel (Fraser 2005), were generally not employed in this report (the 5-point scale being simple and straight forward to apply), and in any case were not directly applicable to larger taxa.

Feather moult and the condition of the brood patch were recorded. For each specimen, the injuries sustained were recorded, and together with observer comments on the autopsy tag, a most likely cause of death was determined. Contents of the proventriculous (stomach) and ventriculous (gizzard) were identified to broad dietary groupings (squid, fish, crustaceans) and any hard parts (cephalopod 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. Elsewhere in this report 'offal' refers to any discarded material, not just internal organs.

All autopsy specimens were allocated a unique number. Details relating to each specimen will be found in the Data Supplement. In some cases (for example, those specimens damaged by fishing gear and machinery or by sea lice) it was not possible to complete all data fields within the Supplement: these are reported as 'unknown', and appear as such in the summary tables presented in this report.

Common and scientific names of all species referred to in this report 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), Robertson & Nunn (1998) and BirdLife International (see http://www.birdlife.org) has been used.

3. Results

3.1. Species returned

A total of 385 seabirds were returned from 76 separate fishing trips undertaken by 63 different vessels (11 vessels returned birds from two separate trips, and a single vessel returned birds from three separate trips) during the 2008/09 fishing year. One specimen, a blue penguin *Eudyptula minor*, was already dead and decomposing when it was gaffed from the water. This specimen was not killed as a result of fishing activity by the vessel from which it was returned, and although it is noted in Table 2, this bird and the returning vessel have not been considered further and do not contribute to any of the summary statistics included in this report, other than in Table

2. Excluding this bird, the total number of seabirds killed and returned becomes 384, from 75 trips undertaken by 62 vessels.

Specimens were identified to one of 27 taxa (distinct species), with two specimens (each an incomplete collection of bones and assorted feathers only) identified to genus, and recorded as 'unidentified *Thalassarche* albatross' (Table 2). There were no species new to the autopsy programme during 2008/09.

Seabirds returned during the 2008/09 fishing year were dominated numerically by three species, which combined accounted for 60% of all specimens: sooty shearwater *Puffinus griseus* was the most numerous species returned (94 birds, 24% of the total), followed by white-chinned petrel *Procellaria aequinoctialis* (75 birds, 19%) and white-capped albatross *Thalassarche steadi* (67, 17%). These three species, together with Buller's albatross *T. bulleri bulleri*, grey petrel *Procellaria cinerea*, and Salvin's albatross *T. salvini*, the most numerous six species returned historically, accounted for 304 (79%) of all returns (Table 2). All of the remaining species returned during the 2008/09 fishing year amounted to single figure totals, with the exception of spotted shag *Phalacrocorax punctatus*: 33 birds were returned, with 32 of these from a single trip (Table 2). The nine black petrels *Procellaria parkinsoni* returned during the 2008/09 fishing year (Table 2) represent the largest number from any fishing year for this species. A total of 12 species were represented by one specimen only (Table 2).

Four specimens were returned with uniquely-numbered metal bands or were carrying a passive implanted transponder (PIT) tag: black petrel, band number H-34388, was banded as an adult at Great Barrier Island on 2/02/2007; yellow-eyed penguin *Megadyptes antipodes*, band number J-17683, was banded as an adult at Otago Peninsula on 2/03/2004; yellow-eyed penguin, band number J-19172, was banded as a chick near Waianakarua, north Otago, on 11/02/2008; yellow-eyed penguin, carrying a PIT tag implanted as a chick at East Smoky, Stewart Island in February 2006.

The monthly distribution of returned specimens was clearly not evenly spread across the fishing year, reflecting an interaction between timing of seabird breeding, and therefore presence and availability within New Zealand's EEZ, timing and location of fishery operations, together with observer coverage. As was the case for the 2007/08 fishing year, the highest monthly total for 2008/09 was achieved in February, with 132 specimens representing 34% of all birds returned. Overall, 80% of all specimens were returned during the period February to May (Table 2). This 'unevenness' in timing of returns is exemplified by the six most numerous species returned (Figure 1): for example, 43% of all white-chinned petrel were returned in February alone, 68% of all Buller's albatross were returned in May alone and 88% of all sooty shearwater were returned in February to April (Table 2; Figure 1).

In keeping with previous years' findings, the majority of birds returned were males (71% of all birds, and 76% of sexed birds: Table 2). This pattern was again particularly strong for sooty shearwater, where males comprised 93% of birds returned, whereas females were more numerous than males in grey petrels (Table 2). There was a similarly strong bias in the age/status of birds returned, with 92% classified as either breeding adults, adults or non-breeding adults (Table 2). Intra-specific, competitive exclusion is a possible explanation for the modest number of juvenile birds returned (26 or 7% of birds, Table 2): older, more experienced and

dominant adult birds will likely preclude younger birds from gaining access to food sources around fishing vessels.

3.2. Target fisheries and vessels

Longline fisheries combined returned a total of 58 birds (14% of total returns), with chartered vessels targeting tuna *Thunnus* species accounting for 27 (47%) of longline specimens (Table 3). Target fisheries classified as 'other, longline' included bass *Polyprion americanus*, hapuku *P. oxygeneios*, ling *Genypterus blacodes* and red snapper *Centroberyx affinis*. Trawl fisheries combined returned 322 birds (84% of total returns), with boats targeting squid *Nototodarus* spp accounting for 167 birds, or 52% of all trawl returns (Table 3). Trawlers targeting hoki *Macruronus novaezelandiae* returned 30 birds (9% of all trawl returns). Trawlers targeting 'other' species returned 111 specimens, or 34% of the total trawl returns. Species targeted in this category were barracouta *Thyrsites atun*, common warehou *Seriolella brama*, unspecified flat fish as 'flats', hake *Merluccius australis*, jack mackerel *Trachurus* spp., ling *Genypterus blacodes*, orange roughy *Hoplostethus atlanticus*, red cod *Pseudophycis bachus*, silver warehou *S. punctata*, smooth oreo *Pseudocyttus maculates*, spiny dogfish *Squalus acanthias*, tarakihi *Nemadactylus macropterus* and white warehou *S. caerulea*.

Four birds, all yellow-eyed penguin, were returned from setnet fisheries targeting school shark *Galeorhinus galeus* (Table 3).

The pattern of most trips and vessels returning relatively low numbers of birds, with a small number of trips and vessels returning relatively large numbers of birds is highlighted in Figure 2. As expected, the histogram plots show a 'shift to the right' from birds per trip to birds per vessel, as 12 vessels made more than one trip from which birds were returned (see above). There was no clear pattern in the numbers of birds killed on separate trips made by these 12 vessels.

For the 2008/09 fishing year, nine species were caught exclusively by longline fisheries (Antipodean wandering albatross *Diomedea antipodensis antipodensis*, black petrel, black-backed gull *Larus dominicanus*, Buller's shearwater *Puffinus bulleri*, Campbell albatross *Thalassarche impavida*, fluttering shearwater *Puffinus gavia*, Gibson's wandering albatross *D. a. gibsoni*, grey petrel and northern royal albatross *D. sanfordi*), although with the exception of black petrel and grey petrel only one or two individual birds were retruned (Table 3). Similarly, nine species (Antarctic prion *Pachyptila desolata*, black-bellied storm petrel *Fregetta tropica*, common diving petrel *Pelecanoides urinatrix*, fairy prion *Pachyptila turtur*, mottled petrel *Pterodroma inexpectata*, sooty shearwater, spotted shag, white-faced storm petrel *Pelagodroma marina* and white-headed petrel *Pterodroma lessonii*) were captured exclusively in trawl fisheries (Table 3). Remaining species were captured by both longline and trawl boats, with the exception of yellow-eyed penguin, which was only captured in set nets (Table 3).

In longline fisheries overall, albatross taxa made up 45% of returned birds, but this proportion increased to 74% and 56% in chartered and domestic tuna fisheries, respectively (Figure 3). The snapper longline fishery returned exclusively non-albatross taxa, primarily black petrel and a mix of shearwater species (Table 3). In

trawl fisheries overall, non-albatross taxa made up 66% of all returns, although albatross taxa accounted for 79% of returns from the scampi *Metanephrops challengeri* fishery (Figure 3).

3.3. Injuries of returned birds and likely cause of death

Returned birds exhibited diverse injuries. In keeping with previous years, at one extreme, birds were described as having 'no obvious injury', and were in excellent condition both externally and internally. In contrast, some specimens were returned in a completely mangled state, with multiple fractures, crush injuries, pulped internal organs and missing entire organs and/or body parts. Often injury classifications were not exclusive, such that some birds exhibited many separate injuries.

Not surprisingly, injuries involving hooks and snoods were recorded exclusively from birds captured in longline fisheries. Of all birds (58) returned from all longline fisheries, 51 (88%) had injuries consistent with hook impalement or snood entanglement to some part of the body. Of these, the majority (57%) had injuries to the bill or throat. Albatrosses were more likely to exhibit hook injuries to the bill or throat (69% of 26 birds) compared to non-albatross taxa (34% of 32 birds). Four (15%) albatross showed evidence (usually part of the abdomen was missing) of shark attack, whereas only one (3%) non-albatross specimen exhibited similar injuries. In 14% of all birds returned from longline fisheries was there no obvious sign of injury.

In contrast to birds from longline fisheries, and in keeping with findings from previous fishing years (summaries in Robertson *et al*. 2004 and Conservation Services Programme 2008) returns from trawl fisheries exhibited a different set of predominant injuries. For example, of the 322 birds returned from trawl fisheries, 28% had broken or badly damaged wings, but the proportion of albatrosses with wing injuries (68% of 108 birds) was far greater than that in non-albatross taxa (7% of 214 birds). In albatross taxa, wing injuries were often consistent with collision with warps, and included fractures, ripped skin and lacerations at the 'elbow', and additionally were often associated with thick, brown grease as reported previously. Among albatrosses, 31% of birds exhibited grease on the plumage, whereas only one specimen of non-albatross taxa was found with brown grease on the plumage. Overall, 53% of trawl returns showed no obvious injury: 19% of albatrosses fell into this category compared to 70% of non-albatross taxa.

Using information on injuries, and incorporating extremely valuable comments on how birds were captured and recorded by observers on the autopsy label attached to each bird, the most likely cause of death has been assigned to each bird (Table 4). For birds returned from longline fisheries the likely cause of death mirrors to a large extent the main injuries sustained, and obviously will entail being hooked or entangled by the snood somewhere on the body. In 50% of all cases, birds were hooked in the bill or throat, compared to 16%, 5% and 10% of birds which were hooked or entangled in the wing(s), legs/feet or body, respectively (Table 4). In the remaining 19% of birds returned from longline fisheries, it was not obvious how the bird died (Table 4). Albatrosses were more likely to be hooked in the bill or throat (62%), whereas non-albatross taxa were more likely to be hooked or entangled in the wings (67%), legs/feet (100%) or body (67%: Table 4).

Returned birds from trawl fisheries were assigned to one of two likely cause of death categories. Specimens assigned to the 'warp interaction' category were not necessarily recovered from the warp itself, as birds that hit a warp, based on injuries, could ultimately be recovered from the net. However, birds assigned to the 'net' category exhibited none of the injuries typical of interacting with a warp, never had brown grease on the wings and often had fish scales on the plumage indicative of time spent in the net and/or fish pound. For all trawl fisheries combined, there were striking differences in the likely cause of death between albatross and non-albatross taxa. Only 18% of 322 trawl specimens could be assigned to warp interaction, but of these birds 88% were albatrosses, primarily white-capped albatross (Table 4). Conversely, 82% of all birds likely died as a result of becoming entangled in the net or from diving into the net itself, and of these 78% were non-albatross taxa, primarily sooty shearwater and white-chinned petrel (Table 4). Indeed, of the 94 sooty shearwater returned from trawl fisheries, all but four likely died from interactions with the net. Similarly, all but two of the 71 white-chinned petrel trawl returns were net victims (Table 4). In contrast to most previous years, during the 2008/09 fishing year there were slightly more white-capped albatross trawl returns that likely died as a result of interacting with the net (33 birds) compared to those interacting with a warp (31 birds).

All four yellow-eyed penguins returned during 2008/09 died as a result of entanglement in setnets. There were additionally seven birds classified as killed through deck strike (Table 4), based mainly on observer comments.

3.4. Body condition

Mean fat scores for four of the most numerous six species returned historically were 3.0 or 3.1 in birds from the 2008/09 fishing year, except for Buller's albatross and white-chinned petrel which were both 2.7 (Table 5). Overall, mean fat scores in these six species from 2008/09 were slightly higher than in birds from the 2007/08 fishing year, lower than in the 2006/07 and 2005/06 fishing years (Thompson 2009, 2010), and at or above mean levels for the years 1997/98 through to 2004/05 (summaries in Robertson *et al*. 2004 and Conservation Services Programme 2008). During the eight years between 1997/98 and 2004/05, mean seabird fat score was only infrequently at '3' or higher (Conservation Services Programme 2008).

3.5. Stomach contents

In keeping with previous years, stomach (proventriculous) contents have been tentatively identified (presence-absence) as falling within one of nine categories, with 'no stomach' making up a tenth category (see Table 6). Ultimately it is hoped to be able to produce a more quantitative and detailed dietary account, particularly for the more commonly-caught species, but to date, accurate identification of many prey species (particularly when based on relatively very small cephalopod beaks and small otoliths, which are often eroded) remains extremely difficult.

For longline fisheries, bait or bait plus natural prey remains were recorded in stomachs of birds returned from all fisheries, occurring in 10% of albatross and in 43% of non-albatross taxa returned from the chartered tuna longline fishery. Discards (including offal) were recorded from a relatively low proportion of birds returned from longline fisheries, reaching a maximum of 29% in non-albatross taxa returned

from chartered tuna longline boats (Table 6). Food remains identified as natural were recorded primarily in non-albatross taxa returned from longline fisheries (Table 6).

For birds returned from trawl fisheries, discarded material alone was present in 36-91% of albatross stomachs and in 0-34% of stomachs from non-albatross taxa (Table 6). Natural food remains were recorded from returns from all trawl fisheries for non-albatross taxa, but only rarely from trawlers targeting scampi and squid for albatross taxa (Table 6).

Across all fisheries, empty stomachs made up 65-100% of albatross returns and 0-48% of non-albatross returns (Table 6).

3.6. Seabird identification

Table 7 presents summary identification information provided by observers on board fishing vessels, and returned on the autopsy tag attached to each specimen. The majority (66%) of seabirds were identified correctly to species from the 2008/09 fishing year, with only 9% of identifications inaccurate. Inaccurate identifications would fall to 5% if those defined as 'ID as correct spp. group' were excluded from the 'wrong' total (Table 7): 18 birds fell into this category – one Antipodean albatross, two Campbell albatross, one Gibson's albatross, five southern cape petrel *Daption capense capense* and nine white-capped albatross. Ten Salvin's albatross and ten white-capped albatross (5% of all returns) were identified as 'albatross' and a total of 61 birds (16%) were recorded as 'unidentified' within a generic grouping (petrel, prion, shag or penguin). For 16 specimens (4%) no identification of any sort was recorded (Table 7).

4. Acknowledgements

This work and report would not have been possible without the sterling efforts of Government observers, who not only retained the birds for autopsy but in many cases augmented the autopsy tags with invaluable and specific comments which helped identify, or in many cases defined, the cause of death. Stephanie Rowe provided the important link through the Department of Conservation to the Observer Programme, and helped with disentangling the occasional discrepancy with autopsy tag data. Lynda Griggs (NIWA, Greta Point) helped ensure the autopsy data were consistent with other databases. This work was funded through the Conservation Services Programme INT2007/02, Department of Conservation.

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Table 1. List of common and scientific names of all seabird taxa (species) referred to in this report.

Common name	**Scientific name**
Antarctic prion	*Pachyptila desolata*
Antipodean albatross	*Diomedea antipodensis antipodensis*
Black petrel	*Procellaria parkinsoni*
Black-backed gull	*Larus dominicanus*
Black-bellied storm petrel	*Fregetta tropica*
Blue penguin	*Eudyptula minor*
Buller's albatross	*Thalassarche bulleri bulleri*
Buller's shearwater	*Puffinus bulleri*
Campbell albatross	*Thalassarche impavida*
Chatham albatross	*Thalassarche eremita*
Common diving petrel	*Pelecanoides urinatrix*
Fairy prion	*Pachyptila turtur*
Flesh-footed shearwater	*Puffinus carneipes*
Fluttering shearwater	*Puffinus gavia*
Gibson's albatross	*Diomedea antipodensis gibsoni*
Grey petrel	*Procellaria cinerea*
Mottled petrel	*Pterodroma inexpectata*
Northern royal albatross	*Diomedea sanfordi*
Salvin's albatross	*Thalassarche salvini*
Sooty shearwater	*Puffinus griseus*
Southern cape petrel	*Daption capense capense*
Spotted shag	*Phalacrocorax punctatus*
Westland petrel	*Procellaria westlandica*
White-capped albatross	*Thalassarche steadi*
White-chinned petrel	*Procellaria aequinoctialis*
White-faced storm petrel	*Pelagodroma marina*
White-headed petrel	*Pterodroma lessonii*
Yellow-eyed penguin	*Megadyptes antipodes*

Table 2. Species and numbers of seabirds killed and returned from observed fishing boats between 1 October 2008 and 30 September 2009, by month of capture, sex (M = male, F = female, U = unknown) and age (BA = breeding adult, A = adult, N = non-breeding adult, J = juvenile (immature), U = unknown).

Species	**Month**												**Sex**			**Age**					**Total**	**% Total**
	J	F	M	A	M	J	J	A	S	O	N	D	M	F	U	BA	A	N	J	U		
Antarctic prion		1											1				1				1	<1
Antipodean albatross											1				1			1			1	<1
Black petrel				8							1		7	2			9				9	2
Black-backed gull				1										1					1		1	<1
Black-bellied storm petrel										1				1			1				1	<1
Blue penguin				1											1		1				1	<1
Buller's albatross				4	21	3	3						22	9		12	16		3		31	8
Buller's shearwater					1								1				1				1	<1
Campbell albatross							1				1		1	1		1	1				2	1
Chatham albatross	1								1				1	1			2				2	1
Common diving petrel		1			1								2				2				2	1
Fairy prion												1		1			1				1	<1
Flesh-footed shearwater				4								2	4	2		2	4				6	2
Fluttering shearwater				1										1			1				1	<1
Gibson's albatross							1							1				1			1	<1
Grey petrel					1		6	2	1				3	6	1	1	9				10	3
Mottled petrel					1								1				1				1	<1
Northern royal albatross		1											1				1				1	<1
Salvin's albatross		11	1				2		10		1	2	14	13		10	9		8		27	7
Sooty shearwater	1	34	28	21	2					4	4		87	5	2	5	89				94	24
Southern cape petrel							2	2		1			2	3			5				5	1
Spotted shag		33											22	10	1			21	12		33	9
Unidentified Thalassarche albatross			1								1				2					2	2	1
Westland petrel						1	1						1	1		1	1				2	1
White-capped albatross	6	14	17	14	9	3						4	40	15	12	15	49	2	1		67	17
White-chinned petrel		32	28	9	3				2			1	64	11		3	72				75	19

White-faced storm petrel		1	1										1		1		2				2	1
White-headed petrel					1									1			1				1	<1
Yellow-eyed penguin		4											1	3		2	1		1		4	1
Total	8	132	76	63	40	7	16	4	14	6	9	10	275	89	21	52	279	25	26	2	385	
% Total	2	34	20	16	10	2	4	1	4	2	2	3	71	23	6	14	72	6	7	1		

Table 3. Species and numbers of seabirds killed and returned from observed fishing boats between 1 October 2008 and 30 September 2009, by target fishery. * excludes the single blue penguin.

Species	Chartered tuna, longline	Domestic tuna, longline	Snapper, longline	Other, longline	Hoki, trawl	Scampi, trawl	Squid, trawl	Other, trawl	School shark, setnet	Total
Antarctic prion							1			1
Antipodean albatross		1								1
Black petrel		1	8							9
Black-backed gull			1							1
Black-bellied storm petrel					1					1
Buller's albatross	15				3	1	2	10		31
Buller’s shearwater			1							1
Campbell albatross		2								2
Chatham albatross				1				1		2
Common diving petrel							1	1		2
Fairy prion								1		1
Flesh-footed shearwater			3	1		2				6
Fluttering shearwater				1						1
Gibson’s albatross	1									1
Grey petrel	5	1		4						10
Mottled petrel							1			1
Northern royal albatross		1								1
Salvin's albatross	2				3	10	1	11		27
Sooty shearwater					15		51	28		94
Southern cape petrel				1	2	1		1		5
Spotted shag								33		33
Unid. Thalassarche albatross					1		1			2
Westland petrel		1						1		2
White-capped albatross	2	1			4		43	17		67

White-chinned petrel	2	1		1	1		65	5		75
White-faced storm petrel								2		2
White-headed petrel							1			1
Yellow-eyed penguin									4	4
Total	27	9	13	9	30	14	167	111	4	384*
% Total	7	2	3	2	8	4	43	29	1	

Table 4. Species, number, percentage within longline or trawl fisheries, and percentage albatrosses and other, non-albatross taxa returned between 1 October 2008 and 30 September 2009 and assigned to a likely cause of death. Longline specimens were either hooked or entangled by the snood, 'not obvious' indicates that it was not possible to identify a specific part of the body where this occurred. Trawl specimens classified as 'net' were deemed to have been either entangled in, or recovered from, the net. Excludes the single blue penguin.

Species	Longline – Hook, Snood					Trawl		Setnet	Deck Strike
	Bill Throat	Wings	Legs Feet	Body	Not Obvious	Warp Interaction	Net		
Antarctic prion							1		
Antipodean albatross	1								
Black petrel	1	4	2	1	1				
Black-backed gull	1								
Black-bellied storm petrel							1		
Buller's albatross	12	1		1	1	12	4		
Buller's shearwater					1				
Campbell albatross		1		1					
Chatham albatross					1	1			
Common diving petrel									2
Fairy prion							1		
Flesh-footed shearwater	1	1			2		2		
Fluttering shearwater					1				
Gibson's albatross	1								
Grey petrel	5	1	1	1	2				
Mottled petrel									1
Northern royal albatross	1								
Salvin's albatross	2					7	18		
Sooty shearwater						3	90		1
Southern cape petrel					1	2	2		
Spotted shag							33		
Unid. Thalassarche albatross							2		
Westland petrel				1			1		
White-capped albatross	1	1			1	31	33		

White-chinned petrel	3			1		2	69		
White-faced storm petrel									2
White-headed petrel									1
Yellow-eyed penguin								4	
% of total longline or trawl	50	16	5	10	19	18	82		
Albatrosses (%)	62	33	0	33	27	88	22	0	0
Others (%)	38	67	100	67	73	12	78	100	100

Table 5. Comparison of numbers of birds with different fat scores (1 = no fat through to 5 = extremely fat, U = unknown) for the most numerous six species returned historically.

Species	**Fat Score**						**Total**	**Mean± SD**
	1	2	3	4	5	U		
Buller's albatross	3	10	10	8	0	0	31	2.7±1.0
Grey petrel	0	0	8	1	0	1	10	3.1±0.3
Salvin's albatross	2	4	14	6	1	0	27	3.0±0.9
Sooty shearwater	0	18	60	13	1	2	94	3.0±0.6
White-capped albatross	0	12	34	7	3	11	67	3.0±0.8
White-chinned petrel	2	25	43	5	0	0	75	2.7±0.6
Total	7	69	169	40	5	14	304	
% Total	2	23	56	13	2	5		

Table 6. Stomach (proventriculous) contents of seabirds killed and returned from observed fishing boats between 1 October 2008 and 30 September 2009, by target fishery. Contents values are percentages. Excludes the single blue penguin.

Stomach Contents	**Longline**				**Trawl**				**Set net**
	Chartered Tuna	**Domestic Tuna**	**Snapper**	**Other**	**Hoki,**	**Scampi**	**Squid**	**Other**	**School shark**
Albatross taxa									
No Stomach	5	20			36		23	14	
Empty	65	80		100	27		28	18	
Natural?	5					9	2		
Sludge									
Bait	10								
Bait + Natural									
Bait + Discards	5								
Discards	10				36	91	45	69	
Discards + Natural							2		
Bait + Discards + Natural									
Number of birds	20	5	0	1	11	11	47	39	0
Non-albatross taxa									
No Stomach		25		13			3	4	
Empty	14		38	13	47	33	48	33	25
Natural?		50	15	25	32	67	16	51	75
Sludge	14				5				
Bait	43		23	38					
Bait + Natural		25	8						
Bait + Discards									
Discards	29		15	13	16		34	8	
Discards + Natural									
Bait + Discards + Natural									
Number of birds	7	4	13	8	19	3	120	72	4

Table 7. 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 2008 and 30 September 2009. * excludes two birds recorded as 'unidentified *Thalassarche* albatross', and the single blue penguin.

Species	**ID correct**	**ID wrong**	**ID as correct 'spp.' group**	**ID as seabird large or albatross**	**ID as petrel, prion, penguin or shag unidentified**	**ID as seabird, seabird small or seagull**	**ID not on label**	**Total**
Antarctic prion					1			1
Antipodean albatross		1	(1)					1
Black petrel	9							9
Black-backed gull	1							1
Black-bellied storm petrel	1							1
Buller's albatross	26	1					4	31
Buller's shearwater	1							1
Campbell albatross		2	(2)					2
Chatham albatross	2							2
Common diving petrel					2			2
Fairy prion		1						1
Flesh-footed shearwater	6							6
Fluttering shearwater							1	1
Gibson's albatross		1	(1)					1
Grey petrel	10							10
Mottled petrel	1							1
Northern royal albatross	1							1
Salvin's albatross	16	1		10				27
Sooty shearwater	86	4			3		1	94
Southern cape petrel		5	(5)					5
Spotted shag					32		1	33
Westland petrel		2						2
White-capped albatross	40	12	(9)	10			5	67
White-chinned petrel	50	3			19		3	75
White-faced storm petrel					2			2
White-headed petrel	1							1
Yellow-eyed penguin	1				2		1	4
Total	252	33		20	61		16	382*
% Total	66	9		5	16		4	

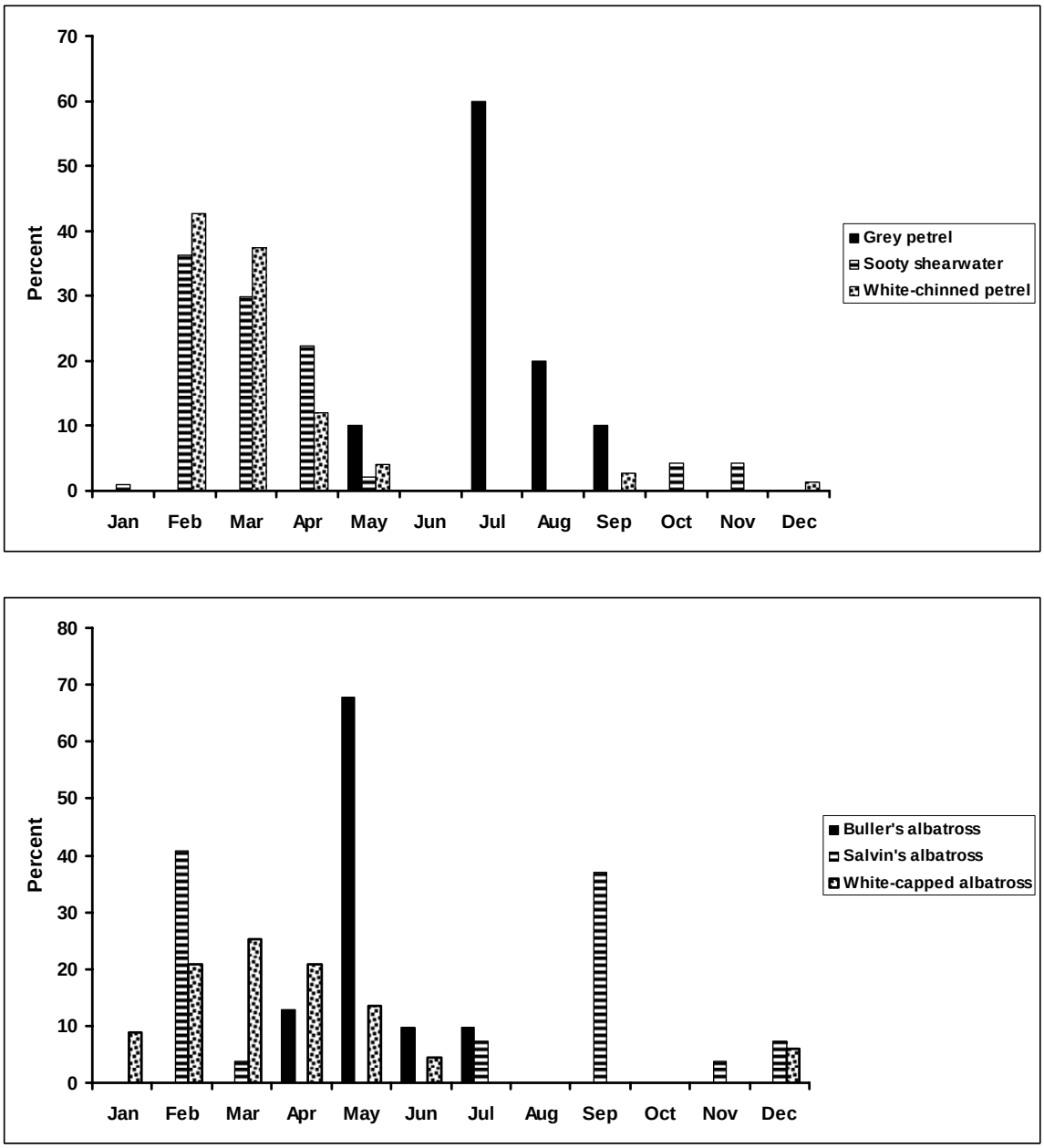
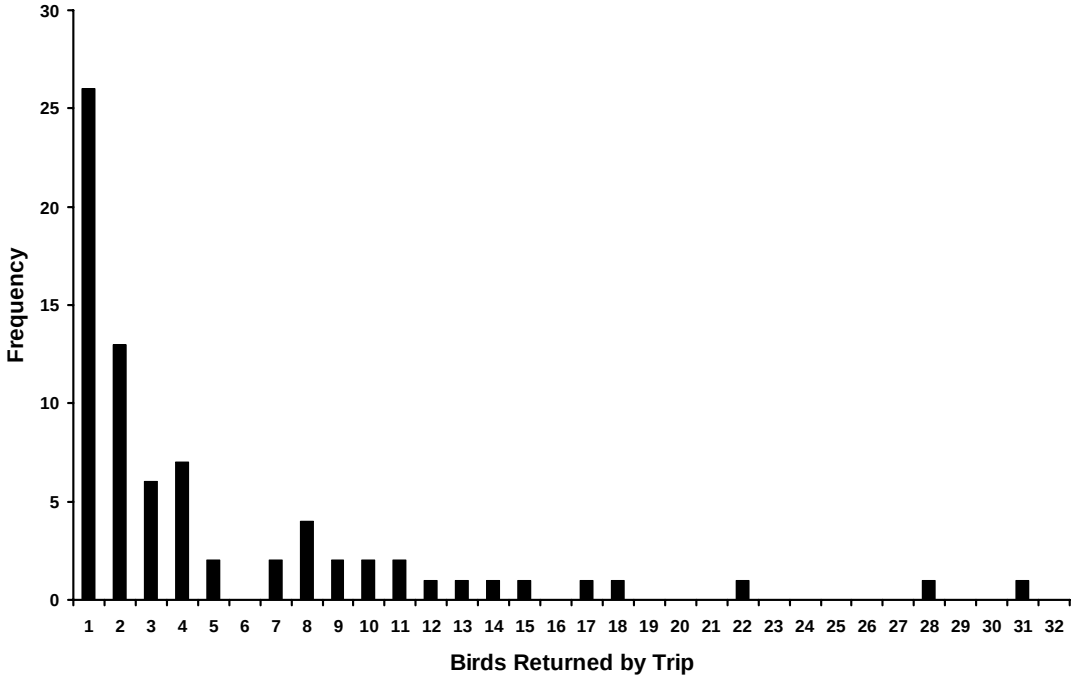


Figure 1. Plots of the proportions of grey petrel, sooty shearwater and white-chinned petrel (upper) and Buller's albatross, Salvin's albatross and white-capped albatross (lower) killed and returned between 1 October 2008 and 30 September 2009, by month.



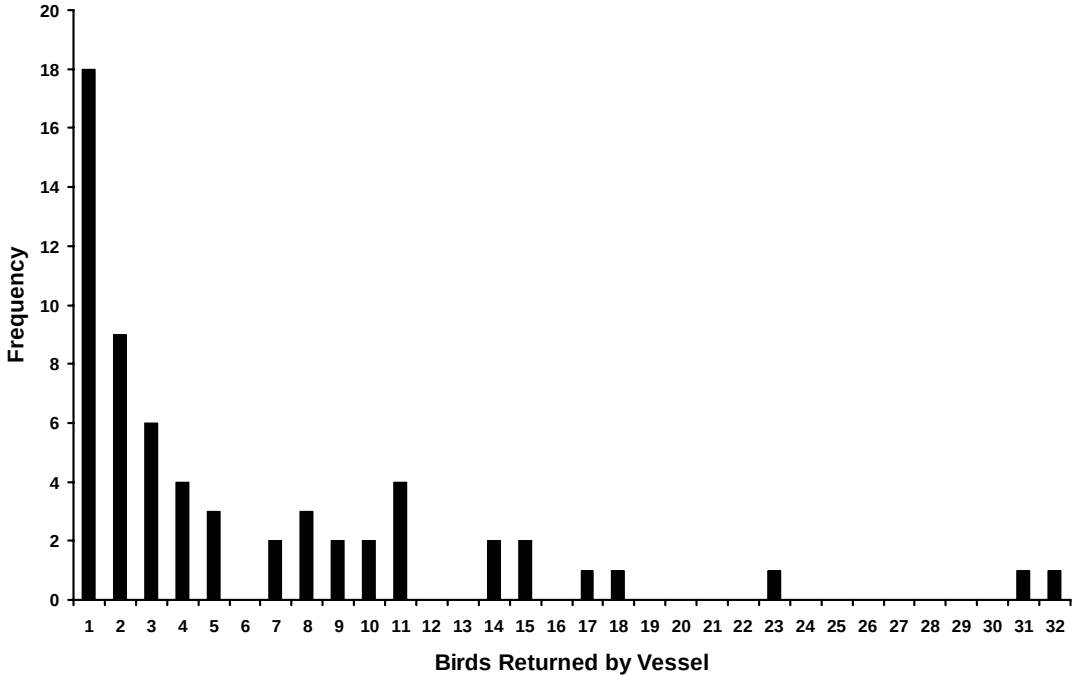


Figure 2. Frequency plots of the numbers of seabirds killed and returned by trip (upper) and by vessel (lower) between 1 October 2008 and 30 September 2009.

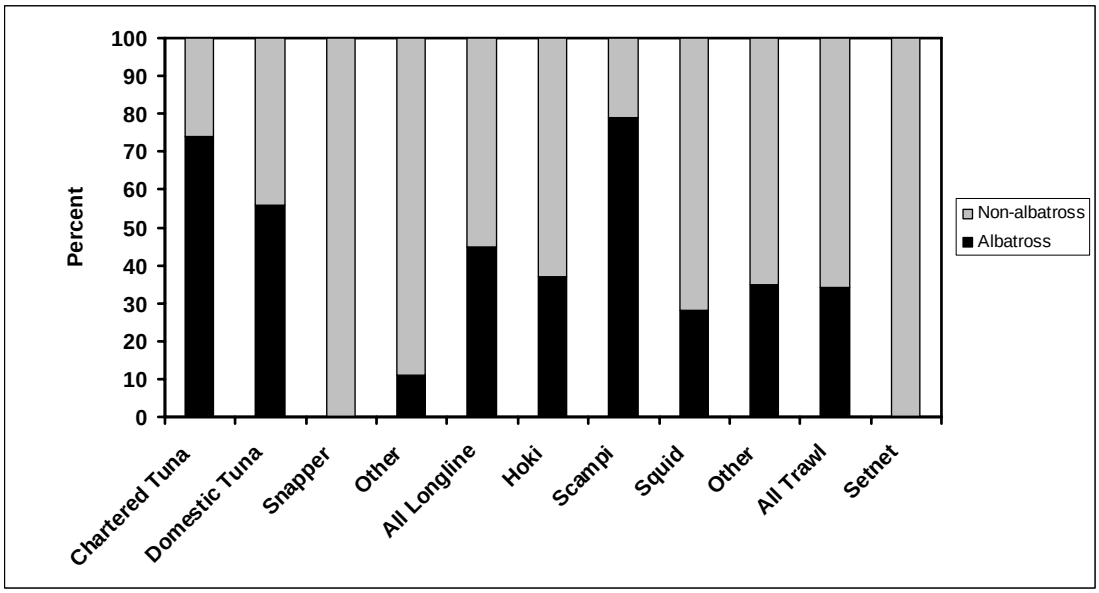


Figure 3. Proportions of albatross and non-albatross taxa killed and returned by target fishery between 1 October 2008 and 30 September 2009.