Autopsy report for seabirds killed and returned from New Zealand fisheries, 1 October 2009 to 30 September 2010

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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 2009 and 30 September 2010 (the 2009/10 fishing year) a total of 281 specimens were returned for autopsy by on-board New Zealand Government fisheries observers. One specimen was identified as a skate skull and was omitted from all further analyses and reporting. The remaining 280 seabirds comprised 25 taxa. Birds were returned from longline, trawl and set net vessels. Seabirds returned during 2009/10 were dominated numerically by four species (white-capped albatross *Thalassarche steadi*, white-chinned petrel *Procellaria aequinoctialis*, sooty shearwater *Puffinus griseus* and Buller's albatross *T. bulleri bulleri*). Over half (54%) of birds returned from longline fisheries had injuries consistent with being hooked or entangled in the bill or throat, while most birds (78%) returned from trawl fisheries were killed through entanglement in the net. Warp interaction was the likely cause of death in 22% of trawl specimens. Mean fat scores were generally similar or higher in birds from 2009/10 than in the previous year, although this was not the case for gery petrel *Procellaria cinerea*. Seabirds returned from the 2009/10 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, set net

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 2009/10 fishing year (1 October 2009 to 30 September 2010) 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, 2010a, 2010b). 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).

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 280 seabirds were returned from 70 separate fishing trips undertaken by 50 different vessels (ten vessels returned birds from two separate trips, two vessels returned birds from three separate trips and two vessels returned birds from four separate trips) during the 2009/10 fishing year. One specimen, tentatively identified as an 'albatross skull' by the observer, was the remains of a skate skull and has not been considered further in this report.

Specimens were identified to one of 25 taxa (distinct species), with one specimen (an incomplete collection of wing bones and associated feathers only) identified to genus, and recorded as 'unidentified *Thalassarche* albatross' (Table 2). There were three species new to the autopsy programme during 2009/10: Fiordland crested penguin *Eudyptes pachyrhynchus*, fulmar prion *Pachyptila crassirostris* and Stewart Island shag *Phalacrocorax chalconotus*.

Seabirds returned during the 2009/10 fishing year were dominated numerically by four species, which combined accounted for 64% of all specimens: white-capped albatross *Thalassarche steadi* (51 birds, 18% of the total) was the most numerous species returned, followed by white-chinned petrel *Procellaria aequinoctialis* (50 birds, 18%), sooty shearwater *Puffinus griseus* (41 birds, 15%) and Buller's albatross *T. bulleri bulleri* (37 birds, 13%: Table 2). These four species, together with grey petrel *Procellaria cinerea* and Salvin's albatross *T. salvini*, the most numerous six species returned historically, accounted for (74%) of all returns (Table 2). All of the remaining species returned during the 2009/10 fishing year amounted to single figure totals, with the exception of black petrel *Procellaria parkinsoni*: 19 birds were returned (Table 2), representing the largest number from any fishing year for this species. Six species were represented by one specimen only (Table 2).

Three specimens were returned with uniquely-numbered metal bands: black petrel, band number H-32998, was banded as a chick at Great Barrier Island on 20/04/2002; Buller's albatross, band number M-54619, was banded as a breeding adult at Solander Island in 1996; Buller's albatross, band number M-70950, was banded as a chick at the Snares on 19/07/1997.

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. However, unlike the case for the 2008/09 fishing year, where the highest monthly total was achieved in February, with 132 specimens representing 34% of all birds returned, during the 2009/10 fishing year the highest monthly total was recorded in June, with 44 specimens returned representing only 16% of the total (Table 2). Overall, 61% of all specimens were returned during the period February to June (Table 2). This 'unevenness' in timing of returns is exemplified by the seven most numerous species returned (Figure 1): for example, 44% of all white-chinned petrel were returned in February alone, 92% of all Buller's albatross were returned in May and June and, unusually for sooty shearwater in the context of this project, 51% of all sooty shearwater were returned in October (Table 2; Figure 1).

In keeping with previous years' findings, the majority of birds returned were males (60% of all birds, and 62% of birds for which gender could be determined: Table 2). This pattern was again particularly strong for sooty shearwater, where males comprised 95% of birds returned, whereas females were more numerous than males in Buller's albatross (Table 2). There was a similarly strong bias in the age/status of birds returned, with 96% 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 (11 or 4% 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 115 birds (41% of total returns), with domestic vessels targeting tuna *Thunnus* species accounting for 62 (54%) of longline specimens (Table 3). Vessels targeting snapper *Pagrus auratus* and chartered vessels targeting tunas each accounted for approximately 20% of longline returns (Table 3). Target fisheries classified as 'other, longline' were bluenose *Hyperoglyphe antarctica* and ling *Genypterus blacodes*. Trawl fisheries combined returned 156 birds (56% of total returns), with boats targeting squid *Nototodarus* spp accounting for 48 birds, or 31% of all trawl returns (Table 3). Trawlers targeting hoki *Macruronus novaezelandiae* returned 46 birds (29% of all trawl returns). Trawlers targeting 'other' species returned 56 specimens, or 36% of the total trawl returns. Species targeted in this category were alfonsino *Beryx splendens* and long-finned beryx *Beryx decadactylus*, barracouta *Thyrsites atun*, common warehou *Seriolella brama*, elephant fish *Callorhinchus milii*, giant stargazer *Kathetostoma giganteum*, jack mackerel *Trachurus* spp., ling *Genypterus blacodes*, orange roughy *Hoplostethus atlanticus*, silver warehou *S. punctata*, smooth oreo *Pseudocyttus maculates*, southern blue whiting *Micromesistius australis*, spiny dogfish *Squalus acanthias*, tarakihi *Nemadactylus macropterus* and white warehou *S. caerulea*.

Nine birds (3% of all returns), including Fiordland crested penguin, yellow-eyed penguin *Megadyptes antipodes* and three species of shag *Phalacrocorax* spp. were returned from set net fisheries targeting butterfish *Odax pullus*, rig *Mustelus lenticulatus* and 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 14 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 14 vessels.

For the 2009/10 fishing year, six species were caught exclusively by longline fisheries (Antipodean wandering albatross *Diomedea antipodensis antipodensis*, black petrel, flesh-footed shearwater *Puffinus carneipes*, Gibson's wandering albatross *D. a. gibsoni*, grey-faced petrel *Pterodroma macroptera gouldi* and wandering albatross *D. exulans*: Table 3). Similarly, four species (Chatham albatross *Thalassarche eremita*, common diving petrel *Pelecanoides urinatrix*, fairy prion *Pachyptila turtur*, fulmar prion P. *crassirostris and norther royal albatross D. sanfordi*) were returned exclusively from trawl fisheries (Table 3). Remaining species were captured by both longline and trawl boats, with the exception of penguins and shags, which were only captured in set nets (Table 3).

In longline fisheries overall, albatross taxa made up 63% of returned birds, but this proportion increased to 87% and 84% in chartered and domestic tuna fisheries, respectively (Figure 3). The snapper longline fishery returned exclusively non-albatross taxa, primarily black petrel and flesh-footed shearwater (Table 3). In trawl

fisheries overall, non-albatross taxa made up 63% of all returns, rising to 77% of birds returned from the squid 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 (115) returned from all longline fisheries, 83 (72%) had injuries consistent with hook impalement or snood entanglement to some part of the body. Of these, the majority (75%) had injuries to the bill or throat. Albatrosses were more likely to exhibit hook injuries to the bill or throat (71% of 72 birds) compared to non-albatross taxa (19% of 43 birds). Ten (14%) albatross showed evidence (usually part of the abdomen was missing) of shark attack, whereas only one (2%) non-albatross specimen exhibited similar injuries. All but one of these 'shark attack' specimens was captured and returned from off the west coast of South Island.

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, Thompson 2009, 2010a, 2010b) returns from trawl fisheries exhibited a different set of predominant injuries. For example, of the 156 birds returned from trawl fisheries, 28% had broken or badly damaged wings, but the proportion of albatrosses with wing injuries (67% of 58 birds) was far greater than that in non-albatross taxa (4% of 98 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, 47% of birds exhibited grease on the plumage, whereas no non-albatross specimens were found with brown grease on the plumage. Overall, 54% of trawl returns showed no obvious injury: 21% of albatrosses fell into this category compared to 73% 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 54% of all cases, birds were hooked in the bill or throat, compared to 15% and 3% of birds which were hooked or entangled in the wing(s or body, respectively (Table 4). In the remaining 28% 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 (87% of birds in this category), whereas non-albatross taxa were more likely to be hooked or entangled in the wings (71%) or body (100%: 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 22% of 156 trawl specimens could be assigned to warp interaction, but of these birds all (100%) were albatrosses, primarily white-capped albatross and Salvin's albatross (Table 4). Conversely, 78% of all birds returned from trawl vessels 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 white-chinned petrel and sooty shearwater (Table 4). White-capped albatross trawl returns were as likely to have died as a result of interacting with the net (14 birds) compared to those interacting with a warp (13 birds).

All penguins, shags and a single sooty shearwater returned during 2009/10 died as a result of entanglement in set nets. 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 three of the most numerous six species returned historically were 3.0 or 3.1 in birds from the 2009/10 fishing year (Salvin's albatross, sooty shearwater and white-chinned petrel), and 2.7 to 2.9 in the remaining three species (Buller's albatross, grey petrel and white-capped albatross: Table 5). Overall, mean fat scores in these six species from 2009/10 were slightly higher than in birds from the 2008/09 and 2007/08 fishing years (Thompson 2010b), lower than in the 2006/07 and 2005/06 fishing years (Thompson 2009, 2010a), 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 20% of albatross and all (100%) of non-albatross taxa returned from the chartered tuna longline fishery. Bait was recorded in 33% of non-albatross taxa returned from the snapper longline fishery (Table 6). Discards (including offal) were recorded from a relatively low proportion

of birds returned from longline fisheries, reaching a maximum of 10% of birds in albatross taxa returned from chartered tuna longline boats and in non-albatross taxa returned from domestic 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 up to 59% of albatross stomachs (other trawl) and in up to 35% of stomachs from non-albatross taxa, both hoki and squid fisheries (Table 6). Natural food remains were recorded from returns from all categories of trawl fisheries for non-albatross taxa, but relatively rarely from trawlers for albatross taxa (Table 6).

Across all fisheries, empty stomachs made up 0-100% of albatross returns and 0-54% 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 (59%) of seabirds were identified correctly to species from the 2009/10 fishing year, with 24% of identifications inaccurate. Inaccurate identifications would fall to 19% if those defined as 'ID as correct spp. group' were excluded from the 'wrong' total (Table 7): 14 birds fell into this category – one Antipodean albatross, three Campbell albatross *Thalassarche impavida*, one Gibson's albatross, six southern cape petrel *Daption capense capense* and three white-capped albatross. A total of 24 birds (9%) were recorded as 'unidentified' within a generic grouping (petrel, prion, shag or penguin), and ten 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. Igor Debski and Kris Ramm provided the important link through the Department of Conservation to the Observer Programme, and helped with disentangling the occasional discrepancy with autopsy tag data. David Fisher (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**
Antipodean albatross	*Diomedea antipodensis antipodensis*
Black petrel	*Procellaria parkinsoni*
Buller's albatross	*Thalassarche bulleri bulleri*
Campbell albatross	*Thalassarche impavida*
Chatham albatross	*Thalassarche eremita*
Common diving petrel	*Pelecanoides urinatrix*
Fairy prion	*Pachyptila turtur*
Fiordland crested penguin	*Eudyptes pachyrhynchus*
Flesh-footed shearwater	*Puffinus carneipes*
Fulmar prion	*Pachyptila crassirostris*
Gibson's albatross	*Diomedea antipodensis gibsoni*
Grey petrel	*Procellaria cinerea*
Grey-faced petrel	*Pterodroma macroptera gouldi*
Northern royal albatross	*Diomedea sanfordi*
Pied shag	*Phalacrocorax varius*
Salvin's albatross	*Thalassarche salvini*
Sooty shearwater	*Puffinus griseus*
Southern cape petrel	*Daption capense capense*
Spotted shag	*Phalacrocorax punctatus*
Stewart Island shag	*Phalacrocorax chalconotus*
Wandering albatross	*Diomedea exulans*
Westland petrel	*Procellaria westlandica*
White-capped albatross	*Thalassarche steadi*
White-chinned petrel	*Procellaria aequinoctialis*
Yellow-eyed penguin	*Megadyptes antipodes*

Table 2. Species and numbers of seabirds killed and returned from observed fishing boats between 1 October 2009 and 30 September 2010, 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		
Antipodean albatross							1			1		2	2	2			1	3			4	1
Black petrel	3	1	1	9	1						1	3	11	8		5	14				19	7
Buller's albatross		2			16	18	1						15	21	1	9	28				37	13
Campbell albatross			1		1	1	1	1		1			5	1		1	1	1	1		6	2
Chatham albatross												3	1	2		2	1				3	1
Common diving petrel					2								2				2				2	1
Fairy prion	2												1	1			2				2	1
Fiordland crested penguin												1	1				1				1	<1
Flesh-footed shearwater				5	1							1	5	2		1	6				7	3
Fulmar prion	2													2			2				2	1
Gibson's albatross			1							1		2		4			2	2			4	1
Grey petrel							1		6				4	3			7				7	3
Grey-faced petrel	1												1					1			1	<1
Northern royal albatross			1										1				1				1	<1
Pied shag											1			1			1				1	<1
Salvin's albatross	1	4	1							2	2	10	8	11	1	3	14		3		20	7
Sooty shearwater		1	5	1	3		1			21	9		39	1	1	28	13				41	15
Southern cape petrel						3	3						2	4			6				6	2
Spotted shag		2										1	2	1				1	2		3	1
Stewart Island shag												2	2				2				2	1
Unidentified *Thalassarche* albatross						1									1		1				1	<1
Wandering albatross						1				1		1	2	1			3				3	1
Westland petrel						3	2						2	3		4	1				5	2
White-capped albatross	5	11	5		12	17				1			27	21	3	13	33		5		51	18
White-chinned petrel	1	22	11	5	3					7	1		36	14		15	35				50	18
Yellow-eyed penguin											1			1		1					1	<1

Total	15	43	26	20	39	44	10	1	6	35	15	26	169	103	8	82	179	8	11	280
% Total	5	15	9	7	14	16	4	<1	2	13	5	9	60	37	3	29	64	3	4	

Table 3. Species and numbers of seabirds killed and returned from observed fishing boats between 1 October 2009 and 30 September 2010, by target fishery.

Species	**Chartered tuna, longline**	**Domestic tuna, longline**	**Snapper, longline**	**Other, longline**	**Hoki, trawl**	**Scampi, trawl**	**Squid, trawl**	**Other, trawl**	**Set net**	**Total**
Antipodean albatross		4								4
Black petrel		5	13	1						19
Buller's albatross	11	20			2			4		37
Campbell albatross		4			1	1				6
Chatham albatross								3		3
Common diving petrel						2				2
Fairy prion								2		2
Fiordland crested penguin									1	1
Flesh-footed shearwater			7							7
Fulmar prion								2		2
Gibson's albatross		4								4
Grey petrel		1						6		7
Grey-faced petrel		1								1
Northern royal albatross					1					1
Pied shag									1	1
Salvin's albatross		1			4			15		20
Sooty shearwater			1	6	21		6	6	1	41
Southern cape petrel				1	3			2		6
Spotted shag									3	3
Stewart Island shag									2	2
Unidentified *Thalassarche* albatross		1								1
Wandering albatross		3								3
Westland petrel	1	2			2					5
White-capped albatross	9	15			6	3	11	7		51

White-chinned petrel	2	1		1	6		31	9		50
Yellow-eyed penguin									1	1
Total	23	62	21	9	46	6	48	56	9	280
% Total	8	22	8	3	16	2	17	20	3	

Table 4. Species, number, percentage within longline or trawl fisheries, and percentage albatrosses and other, non-albatross taxa returned between 1 October 2009 and 30 September 2010 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.

Species	Longline – Hook, Snood					Trawl		Set Net	Deckstrike
	Bill Throat	Wings	Legs Feet	Body	Not Obvious	Warp Interaction	Net		
Antipodean albatross	4								
Black petrel	3	7		1	8				
Buller's albatross	25	2			4	4	2		
Campbell albatross	3				1	2			
Chatham albatross						3			
Common diving petrel									2
Fairy prion									2
Fiordland crested penguin								1	
Flesh-footed shearwater					7				
Fulmar prion									2
Gibson's albatross	4								
Grey petrel	1						6		
Grey-faced petrel					1				
Northern royal albatross							1		
Pied shag								1	
Salvin's albatross	1					10	9		
Sooty shearwater	1	4		1	1		32	1	1
Southern cape petrel				1			5		
Spotted shag								3	
Stewart Island shag								2	
Unid. *Thalassarche* albatross					1				
Wandering albatross	3								
Westland petrel	1	1			1		2		
White-capped albatross	14	3			7	14	13		
White-chinned petrel	2			1	1		46		

Yellow-eyed penguin								1	
% of total longline or trawl	54	15	0	3	28	22	78		
Albatrosses (%)	87	29		0	41	100	22	0	0
Others (%)	13	71		100	59	0	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	0	12	21	4	0	0	37	2.8±0.6
Grey petrel	0	2	5	0	0	0	7	2.7±0.5
Salvin's albatross	0	3	12	4	0	1	20	3.1±0.6
Sooty shearwater	0	7	24	9	0	1	41	3.1±0.6
White-capped albatross	2	12	28	9	0	0	51	2.9±0.7
White-chinned petrel	1	6	37	6	0	0	50	3.0±0.6
Total	3	42	127	32	0	2	206	
% Total	1	20	62	16	0	1		

Table 6. Stomach (proventriculous) contents of seabirds killed and returned from observed fishing boats between 1 October 2009 and 30 September 2010, by target fishery. Contents values are percentages.

Stomach Contents	**Longline**				**Trawl**				**Set net**
	Chartered Tuna	**Domestic Tuna**	**Snapper**	**Other**	**Hoki,**	**Scampi**	**Squid**	**Other**	**All targets**
Albatross taxa									
No Stomach	5	13					18	3	
Empty	65	73			50	100	27	19	
Natural?		4						19	
Sludge									
Bait	20	8							
Bait + Natural									
Bait + Discards									
Discards	10	2			50		55	59	
Discards + Natural									
Bait + Discards + Natural									
Number of birds	20	52	0	0	14	4	11	27	0
Non-albatross taxa									
No Stomach		10					3	7	
Empty		30	33	44	50		54	48	22
Natural?		40	15	44	9	100	5	15	56
Sludge			15		3		3		11
Bait	100	10	33						
Bait + Natural				12					
Bait + Discards									
Discards		10	4		35		35	30	11
Discards + Natural					3				
Bait + Discards + Natural									
Number of birds	3	10	21	9	32	2	37	27	9

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 2009 and 30 September 2010. * excludes the single bird recorded as 'unidentified *Thalassarche* albatross'.

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**
Antipodean albatross		1	(1)	3				4
Black petrel	19							19
Buller's albatross	15	19		2			1	37
Campbell albatross	2	4	(3)					6
Chatham albatross	3							3
Common diving petrel	2							2
Fairy prion					2			2
Fiordland crested penguin					1			1
Flesh-footed shearwater	7							7
Fulmar prion					2			2
Gibson's albatross		1	(1)	3				4
Grey petrel	7							7
Grey-faced petrel	1							1
Northern royal albatross				1				1
Pied shag					1			1
Salvin's albatross	11	8					1	20
Sooty shearwater	32	4			1		4	41
Southern cape petrel		6	(6)					6
Spotted shag	1				2			3
Stewart Island shag					2			2
Wandering albatross	1			2				3
Westland petrel	2	3						5
White-capped albatross	29	16	(3)	2			4	51
White-chinned petrel	32	6			12			50
Yellow-eyed penguin					1			1
Total	164	68		13	24		10	279*
% Total	59	24		5	9		4	

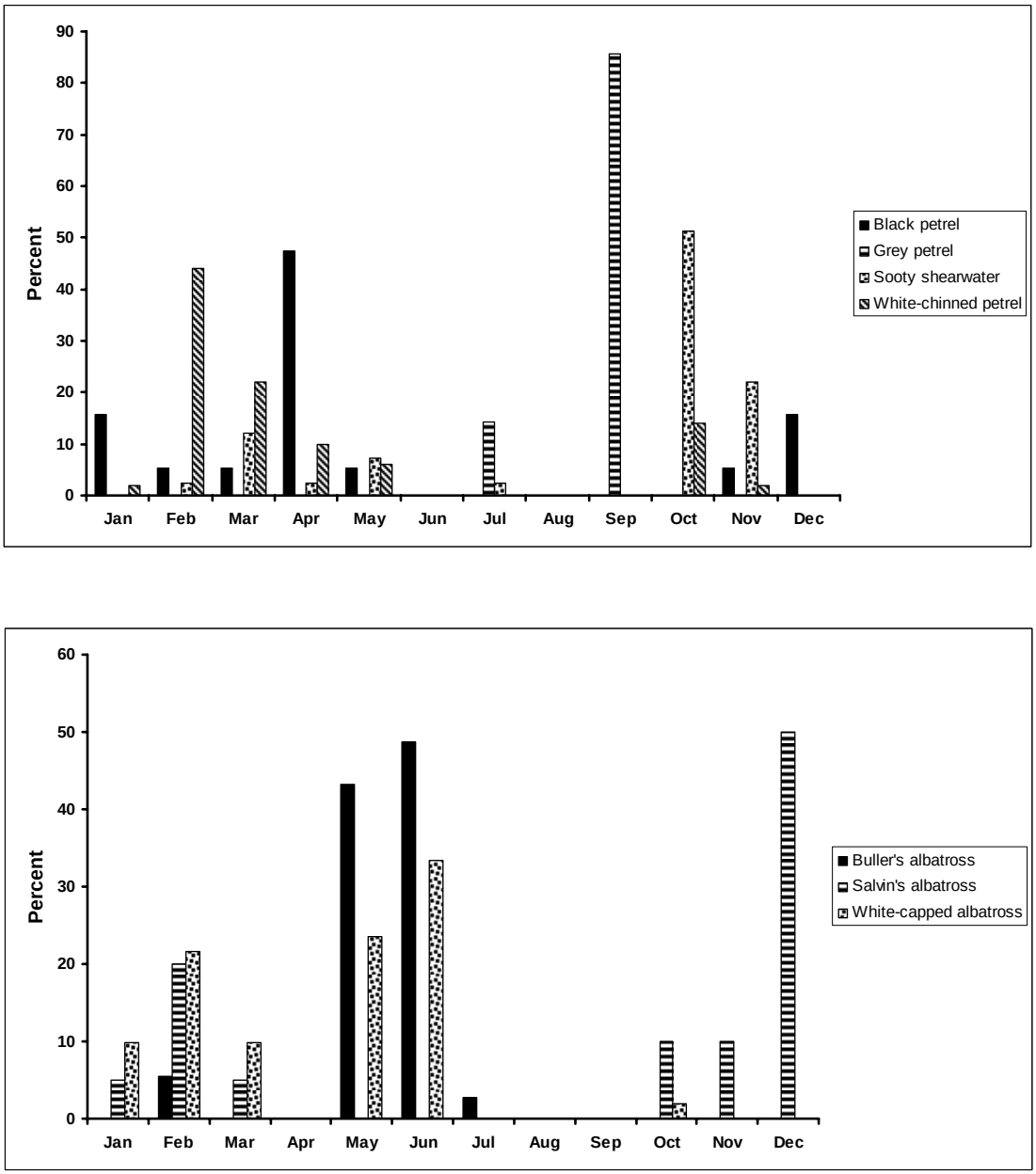

Figure 1. Plots of the proportions of black petrel, grey petrel, sooty shearwater and white-chinned petrel (upper) and Buller's albatross, Salvin's albatross and white-capped albatross (lower) killed and returned between 1 October 2009 and 30 September 2010, by month.

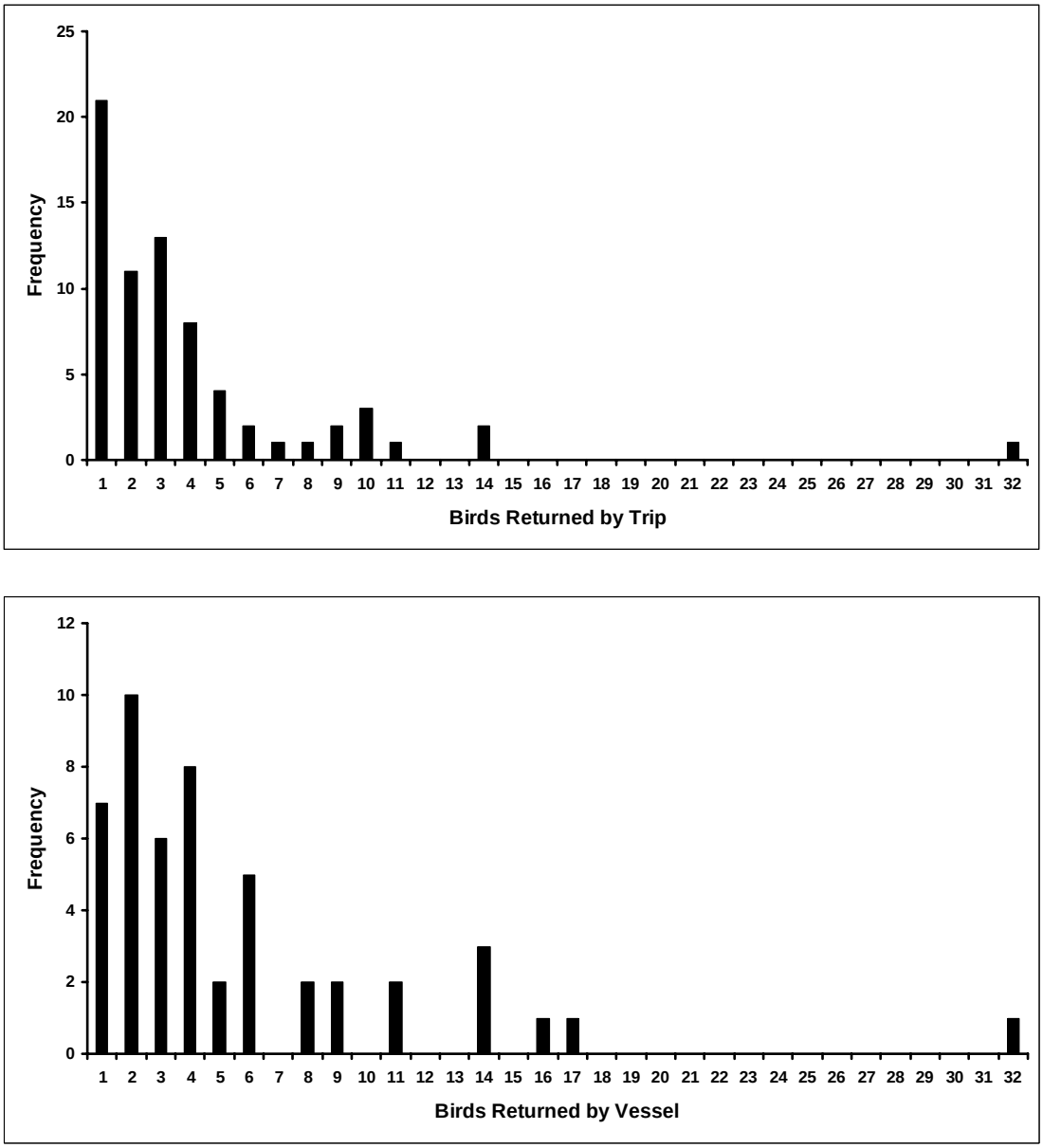

Figure 2. Frequency plots of the numbers of seabirds killed and returned by trip (upper) and by vessel (lower) between 1 October 2009 and 30 September 2010.

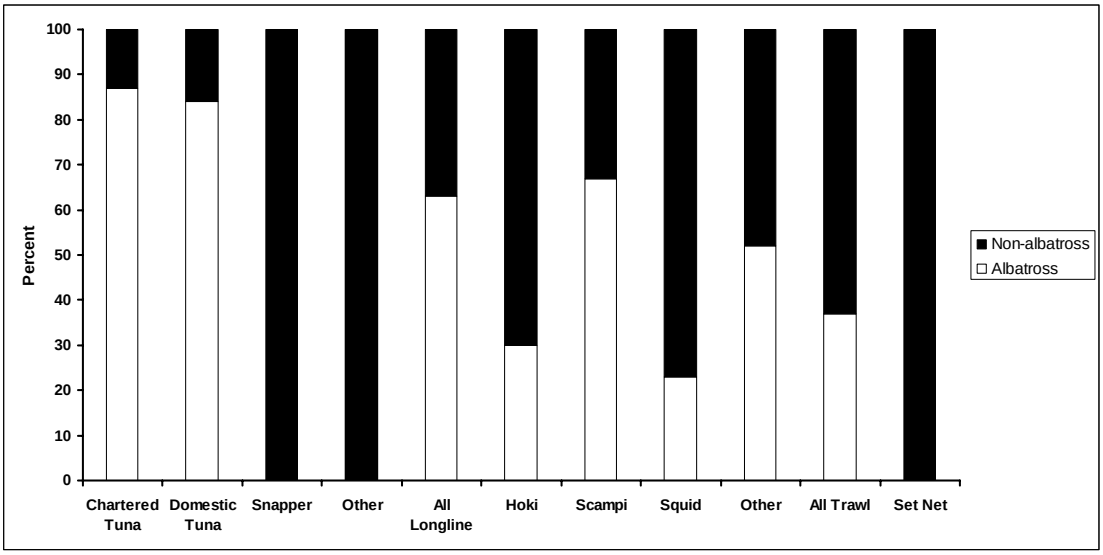

Figure 3. Proportions of albatross and non-albatross taxa killed and returned by target fishery between 1 October 2009 and 30 September 2010.