Level 1 risk assessment for incidental seabird mortality associated with fisheries in New Zealand's Exclusive Economic Zone

DOC MARINE CONSERVATION SERVICES SERIES 10

S. Rowe

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Abstract

A qualitative (Level 1) risk assessment was carried out to examine the potential impact of interactions with fisheries on seabirds in the New Zealand Exclusive Economic Zone (NZ-EEZ). A group of scientific and technical experts was established who assigned levels of exposure and consequence at a workshop. Uncertainty around the assessment was explicitly stated. In total, risk scores were assigned for 101 seabird taxa and 26 fishing methods. *Thalassarche* albatrosses (mollymawks), *Procellaria* petrels and large shearwaters were found to be at greatest national risk from fishing in the NZ-EEC. Other seabird species at risk from one or only a few fisheries included yellow-eyed penguins (*Megadyptes antipodes*), shag species, little blue penguins (*Eudyptula minor*), and Hutton's and fluttering shearwaters (*Puffinus huttoni* and *P. gavia*). The setnet fishery was found to be posing the greatest risk to seabirds, followed by all longline fisheries, although the risk from the latter was lower when mitigation measures were in place and being used correctly. The results of this assessment can be used to identify what additional information is needed to provide more robust assessments of fishing risks to seabirds, allowing fishing impacts to be better managed in the future.

Keywords: risk assessment, seabirds, fishing, bycatch

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1. Introduction

Risk assessment is the procedure by which the risks posed by hazards are estimated either quantitatively or qualitatively. Environmental risk arises from the impact of humans and human activity on the environment, and environmental risk assessment (ERA) is often used to aid decision making or to prioritise research areas. Major difficulties facing ERA are the complexity of the environment and, in particular, the availability of data and the uncertainty around those data that are available.

Hobday et al. (2007) described a general framework for ERA in a fisheries context, in which they identified three levels: Level 1—SICA (Scale, Intensity, Consequence Analysis); Level 2—PSA (Productivity Susceptibility Analysis); and Level 3—fully quantitative with uncertainty analysis. In a Level 1 risk assessment, there is often an absence of information, evidence or logical argument, so expert workshop participants assign scores based on best judgment, and document the rationale behind the assessment and decisions at each step of the methodology. A profile of each fishery being assessed must be scoped prior to starting the risk assessment, including the location and timing of fishing activities, and seabird species that may interact with the fishery (Hobday et al. 2007). It should be noted that the results of a Level 1 risk assessment are dependent on the knowledge and expertise of the workshop participants, and the timing of the assessment.

Fletcher et al. (2002) and Fletcher (2005) described a qualitative risk assessment methodology for prioritising fisheries management issues and its application to a range of Western Australian commercial fisheries. The process involves the examination of sources of risk, assessment of the consequences for each source and the likelihood of a particular level of consequence occurring. Five sets of consequences are considered, including the impact on protected species. This methodology was developed from the AS/NZS 4360 standard (Australian New Zealand Standards 1999), and used workshops with participants from government agencies, the fishing industry and other stakeholder groups. This method was found to be successful in identifying and prioritising fisheries management issues across the range of environmental impacts considered, and has since been used across a number of fisheries in Australia.

The aim of this study was to conduct a qualitative, or Level 1, risk assessment to examine the likelihood of fisheries effects on populations of New Zealand seabirds in the New Zealand Exclusive Economic Zone (NZ-EEZ), with explicit statement of the uncertainty around the assessment.

2. Methods

This Level 1 risk assessment used six levels of exposure to describe the likelihood of a seabird interacting with a fishing method, ranging from remote to likely. There were also six levels of consequence, ranging from negligible (virtually no impact; score = 1), to moderate (the highest acceptable level of consequence; score = 3), to intolerable (irreversible; score = 6). These were combined to arrive at a risk score for various seabird species and fisheries. Uncertainty around each risk score was also considered and stated.

The risk score is a critical first step in determining risk reduction objectives at a fishery level. However, a number of other steps are equally critical, including determining which fisheries are causing any unacceptable risk, and how reductions in risk can be monitored and/or mitigated. The cumulative impacts on any species across a number of fisheries must also be considered.

The Level 1 risk assessment was carried out at a workshop in August 2009, comprising invited scientific and technical experts with knowledge of fisheries practices and/or seabird biology. Seabird species and fisheries for which risk scores were determined are listed in Appendices 1 and 2, respectively, and species names of fish targeted by the fisheries are provided in Appendix 3.

2.1 Pre-workshop preparation

2.1.1 Score species vulnerability

The behavioural and life history characteristics that may render a seabird species vulnerable to fisheries mortality were identified, and documentation was provided to describe these characteristics for each species (see Appendix 1). This included assigning each species a score for behavioural susceptibility to capture, based on capture data and comments from fisheries observers (placed onboard fishing vessels to observe operations, including vessels' interactions with protected species), taking population size into consideration. Scores were circulated to participants prior to the workshop, and adjusted according to feedback. The following criteria were used to assess whether species were at risk from fisheries mortality (adapted from Phillips & Small 2007):

a) **Threat status of the species**

For the purposes of the workshop, the Department of Conservation's (DOC's) Threat Classification System list and associated nomenclature was used (Miskelly et al. 2008).

b) **Breeding population status**	**Score**
Rapid decline (> 2% per year)	3
Decline	2
Stable	1
Increase	0

c) **Behavioural susceptibility to capture**	**Score**
High	3
Medium	2
Low	1

d) **Life-history strategy**	**Score**
Biennial breeder, single egg clutch	3
Annual breeder, single egg clutch	2
Annual breeder, multiple egg clutch	1

The average of attributes b–d was used to calculate relative vulnerability for each seabird population. This method has previously been applied by the International Commission for the Conservation of Atlantic Tuna (ICCAT) and, where information was unknown or uncertain, the highest risk score was allocated so that risk scoring was precautionary (Phillips & Small 2007). Phillips & Small (2007) also scored the degree of overlap with the ICCAT area. For the present study, the spatial and temporal scale of fishing effort was assessed by participants during the workshop.

The score for each taxon was not used directly, but the analysis was used to make judgements about the consequence scores (see section 2.3.2).

2.1.2 Assess the spatial scale of the activity

Maps showing the number of fishing events by statistical area for each fishery during the 2007/08 fishing year were supplied to workshop participants. The 2007/08 fishing year was chosen because this represented the most recent, complete dataset available at the time of workshop preparation. It should be noted that fishing effort is likely to have changed since 2007/08, especially for inshore fisheries where area closures have been put in place through the Hector's Dolphin Threat Management Plan. For each fishery, the workshop participants assessed the number of fishing events undertaken in each statistical area to inform judgements about the level of exposure scores (see section 2.3.1).

2.1.3 Score the temporal scale of the activity

A table showing the number of fishing events per month for each fishery during the 2007/08 fishing year was supplied to the workshop participants, and used to inform judgements about the level of exposure scores (see section 2.3.1).

2.2 Workshop participants

Chair:

Johanna Pierre	DOC

Participants:

Suze Baird	National Institute of Water and Atmospheric Research (NIWA)
Dave Bilton	Ministry of Fisheries
Leigh Bull	Boffa Miskell
Chris Gaskin	Kiwi Wildlife Tours
Colin Miskelly	DOC
Geordie Murman	Fisherman
Stephanie Rowe	DOC
David Thompson	NIWA
Nathan Walker	Ministry of Fisheries
Richard Wells	DeepWater Group Ltd

The workshop participants worked through the steps outlined in the following sections for each species by fishery combination.

2.3 Workshop methods

2.3.1 Score the level of exposure

Participants scored the likelihood of each seabird species being exposed to, and interacting with, each fishery, where 'interaction' was defined as any interaction between a seabird and fishing gear leading to injury or mortality. Essentially, this score reflected the spatial overlap between the species and fishery and, where there was overlap, the likelihood that the inherent nature of the species would lead to an interaction. When calculating this score, consideration was given to the vulnerability scores (Appendix 1) and, in particular, the behaviour and at-sea distribution of each species. The workshop participants also considered the temporal and spatial scale of the fishery in question to decide whether each seabird species by fishery combination was likely to result in an interaction.

The exposure score was based on the probability of a particular species by fishery interaction actually occurring. The likelihood of an interaction between a seabird and fishery may range from rare to likely or frequent, and was determined using the exposure scores listed in Table 1. For example, while the consequences of a Magenta petrel (Chatham Island tāiko) capture in the southern blue whiting fishery is high, the likelihood of an individual of that species being exposed to the fishery is remote.

Table 1. Exposure scores for Level 1 risk assessment (modified from Fletcher 2005; Hobday et al. 2007).

SCORE	DESCRIPTOR	DESCRIPTION
0	Remote	The species will not interact directly with the fishery
1	Rare	Interactions may occur in exceptional circumstances
2	Unlikely	Evidence to suggest interactions possible
3	Possible	Evidence to suggest interactions occur, but are uncommon
4	Occasional	Interactions likely to occur on occasion
5	Likely	Interactions are expected to occur

2.3.2 Score the consequence of exposure

Consequence was only scored for those seabird species that had a species by fishery combination that resulted in an exposure score ≥ 1. Any species that scored 'remote' for a particular fishery, would not have interactions with that fishery (based on spatial overlap and/or species behaviour), so there could be no direct consequence to the population.

Having identified that a species may be exposed to a fishery and was likely to interact at some level (exposure scores 1–5), the workshop participants assessed the potential effect (or consequence) of that interaction on the species' population. Consideration was given to the extent of fishing effort, the timing and location of fishing effort, the fishing method used, and the population structure of the seabird species in question. For example, a particularly common species interacting with an isolated, low-scale fishery would likely be given a consequence score of 'negligible'. In contrast, a particularly rare species interacting with a widespread fishery may be given a consequence score of moderate or higher. The consequences of the impact (adverse effect to populations) were scored based on the levels identified in Table 2. The score was based on existing information and/or the expertise in the risk assessment workshop. In the absence of agreement or information, the workshop participants agreed on a score that they considered most plausible.

Table 2. Consequence scores for Level 1 risk assessment (modified from Fletcher 2005; Campbell & Gallagher 2007; Hobday et al. 2007).

LEVEL	SCORE	DESCRIPTION
Negligible	1	One or some individual(s) impacted, but no population impact.
Minor	2	Some individuals impacted, but minimal impact on population structure or dynamics. In the absence of further impact, rapid recovery would occur.
Moderate	3	The level of interaction/impact is at the maximum acceptable level that still meets an optimin sustainable population objective. In the absence of further impact, recovery is expected over years.
Major	4	Wider and longer term impacts; loss of individuals; and potential loss of genetic diversity. The level of impact is above the maximum acceptable level. In the absence of further impact, recovery is expected over multiple years.
Severe	5	Very serious impacts occurring; loss of seabird populations causing local extinction; decline in species with a single breeding population; and measurable loss of genetic diversity. In the absence of further impact, recovery is expected over years to decades
Intolerable	6	Widespread and permanent/irreversible damage or loss occurring; local extinction of multiple seabird populations; serious decline of a species with a single breeding population; and significant loss of genetic diversity. Even in the absence of further impact, the long-term recovery period to reach acceptable levels will be greater than decades or may never occur.

2.3.3 Record confidence/uncertainty

The confidence ratings reflect the levels of certainty or uncertainty for scores provided by workshop participants. Confidence for the exposure and consequence scores was rated as 1 (low confidence) or 2 (high confidence), with qualifiers identified (Table 3). The score was recorded and the rationale documented in order to inform management decisions.

Table 3. Description of confidence scores for consequences (from Hobday 2007).

CONFIDENCE RATING	SCORE	RATIONALE FOR CONFIDENCE SCORE
Low	1a	Data exist, but are considered poor or conflicting
	1b	No data exist
	1c	Agreement between experts, but with low confidence
	1d	Disagreement between experts
High	2a	Data exist and are considered sound
	2b	Consensus between experts
	2c	High confidence that exposure to impact cannot occur (e.g. no spatial overlap between fishing activity and at-sea seabird distribution

2.4 Post-workshop calculations

After the workshop, the following calculations were made to determine potential and optimised risk. These figures can be used to inform the management response for each fishery. It is important to note that workshop participants did not consider these values during the workshop, as they were determined by multiplying the exposure and consequence scores that were assigned during the workshop.

2.4.1 Calculate risk values

Exposure and consequence must be combined to determine risk. Exposure alone only indicates the likelihood of a species interacting with a particular fishery, rather than the population impact of any such interactions. Consequence alone indicates the impact on the population if interactions do occur, but does not account for the extent, or likelihood, of such interactions. For example, the likelihood, or exposure score, for a critically endangered species interacting with any fishery may be very low (only 0 to 1), given the behaviour and spatial distribution of the species; but the consequence for any interaction would still score 'intolerable' (6); the product of these two scores gives the risk score (range 0–6), which indicates that no intervention is necessary to manage this species by fishery combination. In contrast, the exposure of a common species to a fishery may be 'likely' (5) but the consequence of such interactions may be 'minor' (2) due to the size of the population, giving a risk score of 10. Note that the score for the common species is higher than that for the critically endangered species because of the greater likelihood of this species interacting with the fishery, despite the lower consequence of any interactions.

Potential risk values

Potential risk is the risk to seabirds in the absence of mitigation. Based on information discussed and agreed on at the workshop, each seabird species by fishery combination was assigned exposure and consequence scores. The potential risk value for each species by fishery combination was calculated as the mathematical product of these scores, producing possible risk values between 1 and 30 (from Fletcher 2005). To standardise the management outcomes determined by these risk analyses, the risk values were separated into five risk categories, ranging from negligible to extreme (Table 4). These categories identify the level of monitoring or reporting needed and, more importantly, whether direct management of the risk (e.g. introduction of mitigation techniques, collection of more data) is required.

Table 4. Risk categories (from Fletcher 2005).

RISK CATEGORY	VALUE	LIKELY MANAGEMENT RESPONSE
Negligible	1	No direct management needed
Low	2–6	No specific management actions needed, indirect management likely
Moderate	7–12	Specific management needed, some additions to current levels possible
High	13–20	Increases to current management activities probably needed
Extreme	21–30	Significant additional management activities needed

Optimised risk values

In some fisheries, mitigation devices and/or avoidance practices are in place through either regulatory or voluntary frameworks (see Appendix 2). Therefore, the workshop participants reassessed the exposure scores based on knowledge of mitigation devices required or documented as being used voluntarily. The resulting 'optimised risk' was scored on the assumption that mitigation was used throughout the fishery and deployed correctly.

Optimised risk was separated into the same five categories as potential risk (Table 4). By comparing potential risk scores with optimised risk scores, managers are able to determine whether further management is required in each fishery.

2.4.2 Assess relative effects

All species and fishing methods were scored and ranked to show which species of seabird are at highest relative risk and which fisheries are thought to pose the greatest relative risk to seabirds. These scores were determined for both the 'potential' and 'optimised' risk scores. An example of this is given in Table 5, which indicates that Fishery D has the highest impact across all taxa assessed and that petrel species have the highest relative risk scores of all taxa assessed.

Table 5. Example of cumulative risk scores by fishery and seabird species.

SPECIES	FISHERY				TOTAL
	A	B	C	D	
Penguin spp.	1	15	0	16	32
Albatross spp.	0	4	25	20	49
Petrel spp.	1	8	30	25	64
Shag spp.	1	20	0	12	33
Total all spp.	3	47	55	73	178

3. Results

3.1 Fishery assessments

3.1.1 Beach seine, drag net

Beach seining or drag-netting is usually carried out using a length of net and an additional length of warp (rope). The net and warp are laid out from, and back to, the shore, and are retrieved by hauling onto the shore. The net is similar to that used for set netting. Most fishing effort in this fishery targets trevally[1]. Relatively little effort is expended in this fishery, and most of this is in the Bay of Plenty and along the east coast of Northland. Small vessels (4–14 m in length) use this method, most of which also use other fishing methods, including bottom[2] longlining, potting and setnetting. Vessels in this fishery have never had onboard observers.

Further background to this method was provided by industry participants in the workshop, who indicated that the fishery is characterised by small catches, shallow fishing depths and a short fishing duration, with the net always attended. The workshop participants agreed that, under normal fishing conditions, an entangled bird would be noticed and, most likely, released alive and largely uninjured.

Given this information, there was evidence to suggest that interactions were possible for pied shags[3], as well as black-backed and red-billed gulls (Table 6). The participants also agreed that in exceptional circumstances interactions may occur for a number of other species, particularly gulls, terns, penguins and shags. Blue penguins were considered to be at lower risk, as they do not forage in close proximity to human activity.

Experts had low confidence in the exposure scores (1c—agreement between experts, but with low confidence due to limited evidence), but higher confidence in the consequence scores, i.e. the impacts to populations, should an interaction occur (2b—agreement between experts). All risk scores were low or negligible, implying that no specific management action is needed in this fishery.

As fishers often access this fishery from shore, a particular concern was the potential for human disturbance at bird nesting sites. While this threat is outside the scope of the risk assessment presented here, the workshop participants discussed the need for a code of practice to mitigate such disturbance, which could include education about coastal nesting species, as well as access considerations at different times of the year and during varying tidal heights.

Table 6. Seabird species potentially at risk from the beach seine, drag net fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Black-backed gull	2	1	2	Low
Red-billed gull	2	1	2	Low
Pied shag	2	3	6	Low
Australasian gannet	1	1	1	Negligible
Black-billed gull	1	1	1	Negligible
Caspian tern	1	2	2	Low
Fairy tern	1	3	3	Low
White-fronted tern	1	1	1	Negligible
Northern blue penguin	1	2	2	Low
Southern blue penguin	1	2	2	Low
Yellow-eyed penguin	1	2	2	Low
Spotted shag	1	1	1	Negligible
Stewart Island shag	1	1	1	Negligible
Little shag	1	1	1	Negligible
Little black shag	1	1	1	Negligible
Fluttering shearwater	1	1	1	Negligible

[1] See Appendix 3 for scientific names of target fish.

[2] Bottom = sea floor.

[3] See Appendix 1 for scientific names of seabirds.

3.1.2 Dahn line

A dahn line is a form of drop-line that is deployed vertically between surface buoys and a seabed weight. Its bottom section is rigged with hooked snoods (a trace line connecting the hook to the main line) and it is used to fish a specific depth range above the seabed. Multiple fish species are targeted by this method, but most effort targets hāpuku throughout the year in the North and South Islands, and bluenose throughout the year in the upper North Island; bass and ling are also important target species. Vessels range in length from 5 m to 21 m and have never had onboard observers.

Industry participants in the workshop explained that this method generally uses 5–20 large 'J' hooks and that fishing takes place on particular underwater features, so the deployment of lines needs to be accurate. However, the crew usually has good control of where the bait and hooks are. An individual vessel may have up to ten dahn lines and could potentially set lines every 20 minutes. Heavy anchors are attached to each dahn line so that the line sinks quickly. Therefore, the greatest risk to seabirds occurs during hauling and, even then, it is only the more aggressive birds that would be at risk, as lines are retrieved directly against the side of vessels. Any risk to other species is most likely to be caused by gear failure. Smaller vessels tend to process catch as they continue to fish, which is likely to attract birds. Large vessels looking for new fishing grounds also use this method, and these vessels were considered to be at greater risk of having interactions with seabirds due to their larger size, as fishers cannot easily chase birds away from the hauling area. This fishing method is common off the coast of Northland and in the Chatham Islands; however, it was noted that it is also used outside the NZ-EEZ.

Table 7. Seabird species potentially at risk from the dahn line fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Flesh-footed shearwater	3	2	6	Low
Black petrel	3	2	6	Low
Northern Buller's albatross	3	1	3	Low
Southern Buller's albatross	3	1	3	Low
Salvin's albatross	3	1	3	Low
White-capped albatross	3	1	3	Low
Antipodean albatross	2	1	2	Low
Gibson's albatross	2	1	2	Low
Southern royal albatross	2	1	2	Low
Wandering albatross	2	1	2	Low
Sooty shearwater	2	1	2	Low
Grey petrel	2	1	2	Low
Westland petrel	2	1	2	Low
White-chinned petrel	2	1	2	Low
Black-browed albatross	2	1	2	Low
Campbell albatross	2	1	2	Low
Chatham albatross	2	1	2	Low
Indian yellow-nosed albatross	2	1	2	Low
Northern giant petrel	2	1	2	Low
Southern giant petrel	2	1	2	Low
Northern royal albatross	1	1	1	Negligible
Grey-headed albatross	1	1	1	Negligible
Light-mantled albatross	1	1	1	Negligible
Buller's shearwater	1	1	1	Negligible
Fluttering shearwater	1	1	1	Negligible
Hutton's shearwater	1	1	1	Negligible
Brown skua	1	1	1	Negligible
Cape petrel	1	1	1	Negligible
Snares cape petrel	1	1	1	Negligible

Given the workshop participants' limited knowledge of dahn lining and other hook fisheries, confidence in the exposure scores was 1c and confidence in the consequence of interactions was 2b for all seabirds. From Table 7 it can be seen that all species that are known to approach hooks scored at least a 1 (rare) for exposure and species that are particularly hook aggressive scored 3 (possible); however, the nature of this method ensured that there were no 4 (occasional) or 5 (likely) scores for any species. Most species scored a 1 (negligible) for consequence, indicating that there would be no population impact from this method. Flesh-footed shearwaters and black petrels scored a consequence of 2 (minor), due to the location of this fishery, suggesting that some individuals would be impacted, but there would be minimal population impact from this fishery. These two species also had the highest risk scores, but none of the risk scores were above the level requiring management action.

3.1.3 Danish seine

Danish seining is used to encircle, herd and, finally, trap fish. A net bag that is similar in shape to a trawl bag is operated by long, weighted ropes that are fixed to each end. The two ropes are used to encircle the fish and also to haul the net in. Fishing effort occurs throughout the year and mostly targets flatfish (east and west coasts of the South Island), gurnard (North Island), and john dory and snapper (upper North Island). Vessels in this fishery range in length from 10 m to 24 m and have never had onboard observers.

Danish seining is carried out in relatively shallow water (maximum depth 180 m). The net sits on the bottom, and shooting and hauling is relatively quick. This method is similar to beach seining, except that it uses a larger net and takes place in deeper water. Vessels use mechanised ropes to herd fish into the net, where a light-weight codend with wings gathers them. Fishing is undertaken during the day, as the technique relies on fish seeing and reacting to the fishing gear. The presence of a codend presents some risk to seabirds, but there are no warps. Therefore, workshop participants agreed that this fishing method presented less risk to seabirds than trawling methods. Based on the description of this method, the workshop participants considered that seabird interactions with this fishery were likely to be rare or unlikely (Table 8).

Table 8. Seabird species potentially at risk from the Danish seine fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Sooty shearwater	2	1	2	Low
Northern blue penguin	2	1	2	Low
White-flippered blue penguin	2	2	4	Low
Black petrel	2	2	4	Low
Fluttering shearwater	2	1	2	Low
Hutton's shearwater	2	2	4	Low
Australasian gannet	1	1	1	Negligible
Black-backed gull	1	1	1	Negligible
Red-billed gull	1	1	1	Negligible
Flesh-footed shearwater	1	2	2	Low
Grey petrel	1	1	1	Negligible
Westland petrel	1	1	1	Negligible
White-chinned petrel	1	1	1	Negligible
King shag	1	4	4	Low
Spotted shag	1	2	2	Low

Participants agreed on exposure scores, but with low confidence due to a lack of data. Participants had greater confidence in the consequence scores and all agreed that the consequence of almost all interactions would be negligible or minor. The only species for which the consequence of interaction with this fishery was considered to be above an acceptable level in terms of adverse effects to the population was the king shag; this species has a small population and so it was considered that the loss of even one or two individuals from the population could have a high impact. All risk scores were low or negligible, implying that no specific management action is needed in this fishery.

3.1.4 Diving

Some commercial and recreational fishers dive for seafood; they are usually targeting pāua, but also collect rock lobsters, sea cucumbers and sea urchins. Vessels in this fishery have never had onboard observers.

The workshop participants agreed that there was no known or expected impact to any seabird species from this fishing method, so all species scored zero for exposure.

3.1.5 Dredge

Dredging involves fishing vessels towing rigid, steel-framed dredges along the sea floor. Most effort targets oysters and scallops, but deepwater tuatua, sea urchins, triangle shells and trough shells are also targeted. Dredging takes place throughout the year, with oysters targeted from January through to June and scallops targeted from July through to February. Most oyster dredging occurs in Foveaux Strait and Marlborough/Nelson; and most scallop dredging occurs in Foveaux Strait, with high levels of historic effort in Marlborough/Nelson. Vessels in this fishery range in length from 5 m to 22 m, and some vessels also employ other fishing methods, including bottom trawling, trapping, potting and trolling. Vessels in the dredging fishery have never had onboard observers.

The workshop participants with knowledge of this fishery indicated that birds do not follow dredging vessels and are generally not attracted to this method, as it is a slow, noisy operation. It was noted, however, that there is potential for a dredge to scoop up birds sitting on the sea surface as it is brought on board. However, despite some level of risk to seabirds being noted, the workshop participants agreed that there was no known impact to any seabird species; therefore, all species scored zero for exposure.

3.1.6 Fish traps and pots

Traps and pots are stationary gear used to trap fish, lobsters or crabs. The target can enter the trap or pot (usually enticed by bait) but cannot escape. Trapping targets paddle crabs in the Bay of Plenty and northern South Island; and hagfish in the northern North Island, and on the west coast of the North and South Islands. Pots are used to catch rock lobsters and blue cod, and are usually made from a steel frame covered with wire mesh; they are baited with fish and dropped from the boat on the end of a rope long enough to reach the bottom, the upper end of which is attached to a float. Fishing using traps or pots takes place throughout the year around mainland New Zealand and the Chatham Islands. Generally, fish traps are set and retrieved within a day, whereas pots are left out overnight for up to three nights. Vessels in this fishery have never had onboard observers.

Workshop participants with experience in this fishery indicated that shags are sometimes present when pots are being hauled or set. Buller's albatrosses are also known to attend rock lobster potting activities, especially when small fish are being discarded. It was thought that shags are likely to target the small, live fish inside pots and become trapped after swimming through the pots' apertures. Workshop participants agreed that there was higher risk of this closer to shore, as shags tend to forage on the bottom in near-shore areas. A known interaction occurred on the Chatham Islands when a fisherman set pots hard up against rocks and subsequently caught shags, and workshop participants also knew of shag captures in the Central East Fisheries Management Area on the east coast of the North Island. Spotted shags were also known to congregate around pots and there was greater concern for North Island populations of spotted shags; thus, while spotted shags as a species scored a 1 (rare) for exposure to pots, the North Island populations alone would score a 3 (interactions are uncommon), as they are of higher concern than South Island populations. The foraging techniques of penguins indicate that they may also be susceptible to potting or trapping and workshop participants agreed that mainland breeding penguins were a particular concern due to other anthropogenic threats also affecting these species.

Participants had high confidence and were in agreement for exposure and consequence scores (2b). In general, the assessment indicated that shags were at greatest risk of interacting with this fishery (Table 9), with greatest concern for the Pitt Island shag, for which interactions were considered likely to occur occasionally. There was also evidence to suggest that interactions are possible but uncommon for Chatham Island and pied shags, and possible but unlikely for king and Stewart Island shags. A further 11 seabird species were considered likely to interact with this fishery in exceptional circumstances.

Table 9. Seabird species potentially at risk from the fish trap and potting fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Pitt Island shag	4	4	16	High
Chatham Island shag	3	4	12	Moderate
Pied shag	3	1	3	Low
King shag	2	4	8	Moderate
Spotted shag	2	1	2	Low
Stewart Island shag	2	2	4	Low
Chatham Island blue penguin	1	2	2	Low
Fiordland crested penguin	1	2	2	Low
Northern blue penguin	1	1	1	Negligible
Southern blue penguin	1	2	2	Low
White-flippered blue penguin	1	2	2	Low
Yellow-eyed penguin	1	2	2	Low
Little shag	1	1	1	Negligible
Little black shag	1	1	1	Negligible
Black shag	1	1	1	Negligible
Fluttering shearwater	1	1	1	Negligible
Hutton's shearwater	1	1	1	Negligible

As a result of their exposure to this fishing method, three seabird species scored a consequence of major, indicating that the level of impact to the population would be above the maximum acceptable level. The risk scores indicated that Chatham Island shags and king shags were at moderate risk from the potting and trapping fishery, implying that some level of specific management is needed. Pitt Island shags scored a high potential risk value, suggesting that increases to current management are needed.

3.1.7 Hand gather

Seafood suitable for gathering by hand includes aquatic invertebrates such as molluscs, crustaceans and echinoderms, as well as aquatic plants. Most commercial effort in New Zealand targets cockles and pipi. Fishing is undertaken throughout the year, particularly over the summer months. Vessels in this fishery are less than 18 m in length, with some vessels using other methods, including dahn lining, diving, rock lobster potting and setnetting. Vessels in this fishery have never had onboard observers.

The workshop participants agreed that there was no known direct impact to any seabird species from hand gathering; therefore, all species scored zero for exposure. However, as was the case for beach seining, participants had concerns about indirect, site-based impacts and human disturbance. Of particular concern was the potential displacement of birds from foraging areas and breeding sites, and impacts related to disturbance by humans, dogs and vehicles on beaches, resulting in the need for 'no go' zones being discussed. It was also noted that the impact from recreational fishers was probably greater than that from commercial fishers.

3.1.8 Hand line

A hand line is a single fishing line, usually attached to a rod or reel, that is hand-held by one person. This method is mainly used by recreational fishers, but also by commercial fishers to target species such as blue cod, hāpuku, bass and snapper. Commercial fishing effort occurs throughout the year around the New Zealand mainland and the Chatham Islands. Vessels using hand lines range in length from 3 m to 36 m, and most use at least one other fishing method, including bottom longlining, bottom trawling, cod potting, setnetting, dahn lining, Danish seining, dredging, rock lobster potting, surface longlining and trolling. Vessels in this fishery have never had onboard observers.

Industry participants in the workshop provided further details about this fishery. When fishing for blue cod, two hooks and a sinker are used, whereas when snapper is the target, hand lines are not weighted, are set at twilight and drift behind the vessel. Some fishers will often hand line while a bottom longline is soaking (i.e. is deployed). It was noted that a small number of hooks are set on hand lines, so fishing efficacy would be very low if birds were caught often or in great numbers. Those who had fished in the Northland region considered hand-lining to be a greater risk to seabirds over summer, especially to black petrels, where the risk of capture is high if baits sink slowly. In general, recreational hand-lining was considered a greater risk, as burley is often used and bait is thrown into the water. It was agreed that there is a need to educate recreational fishers about the risk of catching seabirds with this method.

Participants agreed on all exposure and consequence scores, and had high confidence in these due to the direct or anecdotal knowledge of hand line risk (Table 10).

Table 10. Seabird species potentially at risk from the hand line fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Flesh-footed shearwater	5	2	10	Moderate
Black petrel	5	2	10	Moderate
Red-billed gull	3	1	3	Low
Sooty shearwater	3	1	3	Low
Northern Buller's albatross	3	1	3	Low
Southern Buller's albatross	3	1	3	Low
Black-backed gull	2	1	2	Low
Westland petrel	2	1	2	Low
White-chinned petrel	2	1	2	Low
Black-browed albatross	2	1	2	Low
Campbell albatross	2	1	2	Low
Chatham albatross	2	1	2	Low
Indian yellow-nosed albatross	2	1	2	Low
Salvin's albatross	2	1	2	Low
White-capped albatross	2	1	2	Low
Buller's shearwater	2	1	2	Low
Fluttering shearwater	2	1	2	Low
Cape petrel	2	1	2	Low
Northern giant petrel	2	1	2	Low
Snares cape petrel	2	1	2	Low
Southern giant petrel	2	1	2	Low
Australasian gannet	1	1	1	Negligible
Pied shag	1	1	1	Negligible
Grey-headed albatross	1	1	1	Negligible
Light-mantled albatross	1	1	1	Negligible
Hutton's shearwater	1	1	1	Negligible
Brown skua	1	1	1	Negligible

3.1.9 Inshore drift net

An inshore drift net is a type of gillnet that drifts with the current or tide. A number of species are targeted by this technique, including flatfish, grey mullet, kahawai, yellow belly flounder and yellow-eyed mullet. Fishing effort occurs throughout the year, especially over the summer months, in two areas: Hauraki Gulf (yellow belly flounder) and north of Taranaki (grey mullet, kahawai and yellow-eyed mullet). The few vessels that use this method are 4–5 m in length. Vessels in this fishery have never had onboard observers.

Workshop participants were informed that effort in this fishery is declining, largely as a result of area closures made under the Hector's Dolphin Threat Management Plan resulting in very few vessels using this method in recent years. Fishing activity occurs inside harbours and it was agreed that this method is likely to catch pied shags. However, fishing effort is likely to be too low to have a significant impact on shag populations—although, if effort in this fishery was greater, the consequence of catching pied shags would be increased to 4 (major). The method may also catch penguins, but they are rarely present inside harbours.

Workshop participants agreed on the exposure scores, but with low confidence due to the lack of known interactions (1c); in contrast, the consequence scores were agreed on with high confidence (2b). Twelve species were considered to be exposed to this fishery at varying levels (Table 11), with greatest concern for the pied shag, which had an exposure score of 4, indicating that interactions were likely to occur on occasion; other shag species were given an exposure score of 3 (uncommon interactions). All but two species were given a consequence score of 1, meaning that consequences were expected to be negligible in this fishery. The exceptions were northern blue penguins and pied shags, both of which scored 2 for consequence, indicating a minimal impact on populations. Only pied shags had a risk score that requires specific management to mitigate impacts.

Table 11. Seabird species potentially at risk from the inshore drift net fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Pied shag	4	2	8	Moderate
Little shag	3	1	3	Low
Little black shag	3	1	3	Low
Black shag	3	1	3	Low
Australasian gannet	2	1	2	Low
Black-backed gull	2	1	2	Low
Red-billed gull	2	1	2	Low
Northern blue penguin	2	2	4	Low
Spotted shag	2	1	2	Low
Fluttering shearwater	2	1	2	Low
Caspian tern	1	1	1	Negligible
White-fronted tern	1	1	1	Negligible

3.1.10 Purse seine

Purse seining is used to catch surface-dwelling species such as tuna, mackerel, kahawai and trevally. The purse seine net is laid in a circle around a school of fish and then 'pursed', whereby the bottom of the net is drawn in until it is closed and the fish are entrapped. Purse seining is carried out throughout the year, but particularly during the summer months, with most fishing effort in the upper North Island. Vessels range in length from 17 m to over 60 m, with most vessels only using the purse seining method, but a few also using Danish seining, handlining or surface longlining. There has been some onboard observer coverage of vessels in this fishery, with few seabird interactions being observed.

During the workshop, the discussion of purse seining focussed on the effect of lights in the pilchard purse seine fishery (discussed further below). In terms of direct interactions of protected seabirds with purse seine gear, workshop participants felt that there would need to be an exceptional event for capture to occur, although penguins were considered to have slightly higher risk, as they would be unable to fly out of the net. In general, seabirds are not interested in this method, and are more interested in the fish outside the net.

Workshop participants agreed with, and had high confidence in, all scores. Eight seabird species were considered likely to interact with purse seine gear, but only in exceptional circumstances (Table 12A). Three species scored a higher level of exposure (2), based on evidence that suggested interactions were possible. Of these three species, the king shag was considered to have the highest consequence level, with interactions expected to be at the highest level acceptable. Risk scores for all species were low or negligible, indicating that no management for direct impacts is required in this fishery.

Workshop participants felt that the most likely cause of death or injury to seabirds in this fishery would be through lights leading to deck strikes or captures, particularly in the pilchard purse seine fishery. Purse seining for pilchards takes place almost entirely at night and uses powerful, underwater lights. The pilchards are attracted to these lights and form a ball around them. However, these lights also increase the number of birds on the water and could therefore increase the risk of birds being dragged under on the deployment or retrieval of gear. Storm petrels in particular were considered to be at risk from this method of fishing. Consequently, workshop participants felt that the pilchard purse seine fishery would have a greater impact on seabirds than other purse seine fisheries because of the lights.

The scores in Table 12B relate to the effect of lights and have a confidence level of 1a (poor data). While all species listed in Table 12B scored 4 (occasional) or 5 (likely) in terms of exposure to this method, only New Zealand storm petrels had a consequence level greater than 2. The extreme

Table 12. Seabird species potentially at risk from A. the purse seine fishery directly and B. purse seine lights.

A

COMMON NAME	EXPOSURE	CONSEQUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Northern blue penguin	2	2	4	Low
King shag	2	3	6	Low
Spotted shag	2	2	4	Low
Australasian gannet	1	1	1	Negligible
Black-backed gull	1	1	1	Negligible
Red-billed gull	1	1	1	Negligible
Flesh-footed shearwater	1	1	1	Negligible
Sooty shearwater	1	1	1	Negligible
Black petrel	1	1	1	Negligible
Buller's shearwater	1	1	1	Negligible
Fluttering shearwater	1	1	1	Negligible

B

COMMON NAME	EXPOSURE LIGHTS	CONSEQUENCE LIGHTS	POTENTIAL RISK SCORE LIGHTS	RISK CATEGORY
Pycroft's petrel	5	2	10	Moderate
Northern diving petrel	5	1	5	Low
North Island little shearwater	5	2	10	Moderate
New Zealand white-faced storm petrel	5	2	10	Moderate
New Zealand storm petrel	5	6	30	Extreme
Fairy prion	5	1	5	Low
Cook's petrel	5	1	5	Low
Sooty shearwater	4	1	4	Low
Black petrel	4	2	8	Moderate
Grey-faced petrel	4	1	4	Low
Fluttering shearwater	4	1	4	Low
Flesh-footed shearwater	4	2	8	Moderate
Buller's shearwater	4	1	4	Low
Black-winged petrel	4	1	4	Low

risk category assigned to New Zealand storm petrels reflected the Data Deficient status of this species (Miskelly et al. 2008). Flesh-footed shearwaters, black petrels, New Zealand white-faced storm petrels, North Island little shearwaters and Pycroft's petrels were all in the moderate risk category for the impact of lights. The scores shown in Table 4 indicate that specific management is needed for these species and that significant additional management around the use of lights is required for New Zealand storm petrels.

3.1.11 Ring net

A ring net is defined as a gillnet that acts by enmeshing, entrapping or entangling fish. Ring nets are set for less than 1 hour and are continuously attended by the fisher. Most effort targets grey mullet in west coast North Island harbours. All vessels are very small, ranging in length from 3 m to 9 m; many also use setnetting, and a few also use surface longlining and trolling. There has been minimal onboard observer coverage of a few vessels in this fishery operating in west coast North Island harbours.

Industry workshop participants explained that ring netting needs to take place in a geographically confined space so that the school can be chased into the net. Fishing takes place in water that is 6–10 m deep, nets are continuously attended and fishing time is short. Seabirds tend to stay away because of the noise of the operation and the proximity of the boat to the net. Gannets and shags were considered the species most likely to interact with the fishery, but at low levels (Table 13).

Table 13. Seabird species potentially at risk from the ring net fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Pied shag	2	1	2	Low
Australasian gannet	1	1	1	Negligible
Caspian tern	1	1	1	Negligible
Black-backed gull	1	1	1	Negligible
Red-billed gull	1	1	1	Negligible
White-fronted tern	1	1	1	Negligible
Northern blue penguin	1	1	1	Negligible
Spotted shag	1	1	1	Negligible
Little shag	1	1	1	Negligible
Little black shag	1	1	1	Negligible
Black shag	1	1	1	Negligible
Fluttering shearwater	1	1	1	Negligible

The exposure and consequence scores were agreed on by the workshop participants with high confidence (2b). Of the 12 species likely to interact with this fishery, 11 were expected to do so only in exceptional circumstances; the exception was pied shags, which scored 2, indicating that there is evidence that interactions are possible. All consequence scores were negligible and all potential risk scores were low or negligible, implying that no management is required in this fishery.

3.1.12 Squid jig

Jigging is a method of catching squid by continuously lowering and retrieving lines from the fishing vessel. Fishing is generally carried out at night when squid are attracted by powerful lights on the vessel. There is minimal commercial squid jigging in New Zealand compared with squid trawling. Most effort is on the east and south coasts of the South Island over the summer months. In recent years, two vessels have been using this method, both of which are over 60 m long and have been exclusively using jigging. In 1998/99, 100 onboard observer days were achieved in this fishery off the Otago Coast; no seabirds were injured or captured during observed fishing operations (Burgess & Blezard 1999).

Workshop participants familiar with squid jigging described the use of short, barbless hooks and the absence of bait or offal in this fishery. They also mentioned that this fishing technique cannot be used in bad weather. Squid jiggers use lights as part of the gear to attract squid, and these are likely to also attract birds. Workshop participants scored interactions with gear and light interactions separately, but the scores were the same (Table 14). Because no bait or hooks are used, it was felt that only the most aggressive birds would be at risk while feeding on catch discards or escapees.

Confidence was low for the exposure scores (1a—poor or conflicting data), but high for the consequence scores (2b). All 44 species scored 1 for exposure to gear and exposure to light, indicating that interactions would only occur in exceptional circumstances. Consequence scores were all negligible or minor except for the Chatham petrel (Nationally Vulnerable), the Codfish Island South Georgian diving petrel (Nationally Critical) and the Magenta petrel (Nationally Critical). All risk scores were negligible or low, implying that no management action is required in this fishery.

Table 14. Seabird species potentially at risk from the squid jig fishery. (Note: exposure and consequence scores relating to interactions as a result of lights were identical.)

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Codfish Island South Georgian diving petrel	1	6	6	Low
Magenta petrel (Chatham Island tāiko)	1	6	6	Low
Chatham petrel	1	4	4	Low
Grey petrel	1	2	2	Low
White-chinned petrel	1	2	2	Low
Chatham albatross	1	2	2	Low
Grey-headed albatross	1	2	2	Low
Light-mantled albatross	1	2	2	Low
Antipodean albatross	1	1	1	Negligible
Gibson's albatross	1	1	1	Negligible
Southern royal albatross	1	1	1	Negligible
Wandering albatross	1	1	1	Negligible
Grey-faced petrel	1	1	1	Negligible
Soft-plumaged petrel	1	1	1	Negligible
White-headed petrel	1	1	1	Negligible
Sooty shearwater	1	1	1	Negligible
Westland petrel	1	1	1	Negligible
Black-browed albatross	1	1	1	Negligible
Northern Buller's albatross	1	1	1	Negligible
Southern Buller's albatross	1	1	1	Negligible
Campbell albatross	1	1	1	Negligible
Indian yellow-nosed albatross	1	1	1	Negligible
Salvin's albatross	1	1	1	Negligible
White-capped albatross	1	1	1	Negligible
Hutton's shearwater	1	1	1	Negligible
Antarctic prion	1	1	1	Negligible
Black-bellied storm petrel	1	1	1	Negligible
Blue petrel	1	1	1	Negligible
Broad-billed prion	1	1	1	Negligible
Cape petrel	1	1	1	Negligible
Chatham fulmar prion	1	1	1	Negligible
Cook's petrel	1	1	1	Negligible
Fairy prion	1	1	1	Negligible
Fulmar prion	1	1	1	Negligible
Grey-backed storm petrel	1	1	1	Negligible
Lesser fulmar prion	1	1	1	Negligible
Mottled petrel	1	1	1	Negligible
New Zealand white-faced storm petrel	1	1	1	Negligible
Northern giant petrel	1	1	1	Negligible
Snares cape petrel	1	1	1	Negligible
Southern diving petrel	1	1	1	Negligible
Southern giant petrel	1	1	1	Negligible
Subantarctic diving petrel	1	1	1	Negligible
Subantarctic little shearwater	1	1	1	Negligible

3.1.13 Troll

In trolling, baited hooks or lures are towed behind the fishing vessel and fish are pulled aboard when caught. This method is designed to target fast-moving, surface-swimming fish such as tuna, marlin and kingfish. The most common target in New Zealand is albacore tuna, which is targeted from January to March, with the majority of coverage on the west coasts of the South and North Islands. Vessels range in length from 5 m to 27 m. To date, only a few trips in this fishery have had onboard observers.

Industry workshop participants with knowledge of this fishery had witnessed or heard of seabird captures in the troll fishery. Albatrosses had been reported captured in the Chatham Islands, but it was noted that exposure scores should not be overly influenced by the knowledge of one person catching three albatrosses during a single trip. Black petrels and gannets were known to chase lures off East Cape, and gannets had been seen diving on lures, but they often missed and continued lunging onto lures repeatedly. Buller's shearwaters are also known to follow troll lures. As noted for other line fisheries with few hooks, vessels would not continue to work if they constantly caught birds, as this would mean that they were not catching fish.

Confidence scores in the troll fishery were 1a (low, poor or conflicting data) for exposure and 2b for consequence (Table 15). Australasian gannets had the highest exposure score (4), suggesting that interactions are likely to occur occasionally; in contrast, interactions were thought to be possible, but uncommon for black petrels and Buller's shearwaters, and rare (1) or unlikely (2) for all other species. Consequence scores were negligible or minor for all species exposed to the troll fishery, with the exception of black petrels. Overall, risk scores were low or negligible for all species except black petrels, for which the results imply that specific management is needed.

Table 15. Seabird species potentially at risk from the troll fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Australasian gannet	4	1	4	Low
Black petrel	3	3	9	Moderate
Buller's shearwater	3	1	3	Low
Black-backed gull	2	1	2	Low
Red-billed gull	2	1	2	Low
Flesh-footed shearwater	2	2	4	Low
Westland petrel	2	2	4	Low
White-chinned petrel	2	2	4	Low
Northern Buller's albatross	2	1	2	Low
Southern Buller's albatross	2	1	2	Low
Antipodean albatross	1	1	1	Negligible
Gibson's albatross	1	1	1	Negligible
Northern royal albatross	1	1	1	Negligible
Southern royal albatross	1	1	1	Negligible
Wandering albatross	1	1	1	Negligible
Sooty shearwater	1	1	1	Negligible
Grey petrel	1	2	2	Low
Black-browed albatross	1	1	1	Negligible
Campbell albatross	1	1	1	Negligible
Chatham albatross	1	1	1	Negligible
Indian yellow-nosed albatross	1	1	1	Negligible
Salvin's albatross	1	1	1	Negligible
White-capped albatross	1	1	1	Negligible

3.1.14 Trot line

Trot lines can be considered to be a combination of the bottom longline and the drop line fishing methods. For this method, a buoyed longline that is equipped with short dropper lines of 20–25 hooked, short snoods is suspended above the seabed. Trot lines are generally used to target bass, bluenose, hāpuku and school shark. This method receives very little commercial effort relative to other fishing methods, with coverage scattered throughout the year in the upper North Island, on the east coast of the South Island, on the south coast of the South Island and around the Chatham Islands. Vessels using trot lines range in length from 7 m to 22 m. The greatest number of trot line fishing events undertaken by any one vessel during 2007/08 was five, with many vessels using the method only once in the year examined. The primary fishing methods employed by these vessels include bottom longlining and surface longlining. Vessels in this fishery have never had onboard observers.

Trot line gear is more complicated than that used for other lining methods and, therefore, there is a greater opportunity for things to go wrong. The backbone is floated above the bottom with droplines hanging off, and hooks can be attached either to the droplines or on snoods from the backbone. All hooks are brought up in one group. Many fishers using this method discard offal while gear is being hauled.

Table 16. Seabird species potentially at risk from the trot line fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Flesh-footed shearwater	3	2	6	Low
Black petrel	3	2	6	Low
Northern Buller's albatross	3	1	3	Low
Southern Buller's albatross	3	1	3	Low
Salvin's albatross	3	1	3	Low
White-capped albatross	3	1	3	Low
Antipodean albatross	2	1	2	Low
Gibson's albatross	2	1	2	Low
Southern royal albatross	2	1	2	Low
Wandering albatross	2	1	2	Low
Sooty shearwater	2	1	2	Low
Grey petrel	2	1	2	Low
Westland petrel	2	1	2	Low
White-chinned petrel	2	1	2	Low
Black-browed albatross	2	1	2	Low
Campbell albatross	2	1	2	Low
Chatham albatross	2	1	2	Low
Indian yellow-nosed albatross	2	1	2	Low
Northern giant petrel	2	1	2	Low
Southern giant petrel	2	1	2	Low
Northern royal albatross	1	1	1	Negligible
Grey-headed albatross	1	1	1	Negligible
Light-mantled albatross	1	1	1	Negligible
Buller's shearwater	1	1	1	Negligible
Fluttering shearwater	1	1	1	Negligible
Hutton's shearwater	1	1	1	Negligible
Brown skua	1	1	1	Negligible
Cape petrel	1	1	1	Negligible
Snares cape petrel	1	1	1	Negligible

From Table 16 it can be seen that albatross species (particularly Buller's, Salvin's and white-capped albatrosses), flesh-footed shearwaters and black petrels are most likely to be exposed to this fishing method, but interactions are expected to be uncommon. The exposure level for all other species listed in Table 16 is rare or unlikely. The consequence of exposure was negligible for all species except flesh-footed shearwaters and black petrels, for which the consequence or impact is expected to be minor, with minimal impact on population structure or dynamics. The confidence score was 1c for exposure (agreement between experts but little supporting evidence) and 2b for consequence. Overall risk was low or negligible for all species that are likely to be exposed to this method, indicating that no management is necessary.

3.1.15 Bottom longline—vessels < 40 m in length

Longlining is a passive fishing method that involves luring fish to take baited hooks. The weighted line is set from a moving vessel and left for between 6 and 12 hours to fish on or near the bottom. Hooks may be baited by hand or by a baiting machine. Smaller bottom longline vessels target bass, bluenose, hāpuku, ling, school shark and snapper. Approximately 50 vessels, ranging in length from 4 m to 34 m, each fish at least 100 days a year around the coast of New Zealand. A few larger vessels in this fishery also fish on the Chatham Rise. There has, historically, been little onboard observer coverage of vessels in this fishery; however, despite this, seabird interactions have been reported.

The vessels in this category are generally domestic and use either hand-baiting or auto-baiting of some sort. Hand-baiters will set around 6000 hooks/day, whereas large-scale auto-baiters set 30 000–35 000 hooks/day. Small bottom longline vessels targeting snapper float their longlines over foul ground (where the sea bed is uneven and may snag a line), which may increase the risk of catching species such as black petrels, as the attachment of floats to the line slows the sink rate of baited hooks. Red-billed and black-backed gulls are also known to interact with the snapper fishery. When fishing for bluenose, gear is partially floated, and workshop participants agreed that this posed a high risk to albatrosses, especially for those species whose spatial distribution overlaps with this fishery, e.g. Antipodean albatross. It was noted that the bulk of sooty shearwaters nest south of where fishing effort occurs in this fishery. White-chinned petrels are particularly susceptible to this type of fishery and the New Zealand population is much smaller than previously thought (D. Thompson, NIWA, pers. obs.).

The unmitigated, or potential, risk was scored first by the workshop participants, with confidence levels of 2b (high, agreement between experts) for both exposure and consequence. Seventeen species scored the highest level of exposure, indicating that interactions are expected to occur (Table 17), and a further five species scored the second highest level, indicating that interactions are likely to occur occasionally; in addition, five species scored a 3 (possible) and six species scored a 2 (unlikely). For flesh-footed shearwaters, grey petrels and black petrels, the consequences of interacting with this fishery were assessed as being severe (5), with the potential for local extinctions or population decline requiring years to decades to recover. The risk scores for these species are therefore extreme, indicating that significant additional management is needed in this fishery. Consequence scores of 4 (major) were recorded for seven species (Antipodean albatrosses, Gibson's albatrosses, southern royal albatrosses, wandering albatrosses, Westland petrels, white-chinned petrels and Chatham albatrosses), with corresponding high risk scores, implying that further management is required to reduce risk. Three species (Salvin's albatrosses, and northern and southern giant petrels) were given a consequence score of 3 (moderate), but also had 'high' risk scores due to their high level of exposure.

When exposure scores were estimated with consideration for the mitigation measures required by legislation and the assumption that they are being used correctly (i.e. based on the use of line weighting, bird scaring or tori lines, and/or night setting), they were all reduced to 1 (rare) or 2 (unlikely). The confidence rating for this score was low (1a—data exist but are poor), because the low levels of onboard observer coverage from vessels in this fishery mean that it cannot be determined how widely or appropriately mitigation is being used. In turn, the optimised risk scores were also reduced to low for all species exposed to this bottom long-lining method, with the exception of ten species, whose risk status reduced from extreme or high to moderate (Table 17), indicating that some specific management is still needed.

Table 17. Seabird species potentially at risk from the bottom longline small vessel fishery.

COMMON NAME	EXPOSURE	CONSE-	POTENTIAL RISK		OPTIMISED	OPTIMISED RISK	
		QUENCE	SCORE	CATEGORY	EXPOSURE	SCORE	CATEGORY
Flesh-footed shearwater	5	5	25	Extreme	2	10	Moderate
Grey petrel	5	5	25	Extreme	2	10	Moderate
Black petrel	5	5	25	Extreme	2	10	Moderate
Westland petrel	5	4	20	High	2	8	Moderate
White-chinned petrel	5	4	20	High	2	8	Moderate
Chatham albatross	5	4	20	High	2	8	Moderate
Salvin's albatross	5	3	15	High	2	6	Low
Northern giant petrel	5	3	15	High	2	6	Low
Southern giant petrel	5	3	15	High	2	6	Low
Grey-faced petrel	5	2	10	Moderate	2	4	Low
Sooty shearwater	5	2	10	Moderate	2	4	Low
Black-browed albatross	5	2	10	Moderate	2	4	Low
Northern Buller's albatross	5	2	10	Moderate	2	4	Low
Southern Buller's albatross	5	2	10	Moderate	2	4	Low
Campbell albatross	5	2	10	Moderate	2	4	Low
White-capped albatross	5	2	10	Moderate	2	4	Low
Indian yellow-nosed albatross	5	1	5	Low	2	2	Low
Antipodean albatross	4	4	16	High	2	8	Moderate
Gibson's albatross	4	4	16	High	2	8	Moderate
Southern royal albatross	4	4	16	High	2	8	Moderate
Wandering albatross	4	4	16	High	2	8	Moderate
Buller's shearwater	4	2	8	Moderate	2	4	Low
Northern royal albatross	3	1	3	Low	2	2	Low
Grey-headed albatross	3	1	3	Low	2	2	Low
Light-mantled albatross	3	1	3	Low	2	2	Low
Fluttering shearwater	3	1	3	Low	2	2	Low
Hutton's shearwater	3	1	3	Low	2	2	Low
Australasian gannet	2	1	2	Low	1	1	Low
Black-backed gull	2	1	2	Low	1	1	Low
Red-billed gull	2	1	2	Low	1	1	Low
Brown skua	2	1	2	Low	1	1	Low
Cape petrel	2	1	2	Low	1	1	Low
Snares cape petrel	2	1	2	Low	1	1	Low

3.1.16 Bottom longline—vessels > 40 m in length

Larger bottom longline vessels mostly target ling and use automated baiting systems. Fishing effort occurs throughout the year, with most effort on the east coast of the North Island in June and July, on the Chatham Rise in August and September, off Southland in October and November, and in subantarctic areas from March to June. Vessels typically range in size from 46 m to > 50 m. There has been ongoing onboard observer coverage on vessels in this fishery, with 20–30% of fishing effort observed. Historically, large bycatch events have been reported from the fishery, leading to numerous mitigation techniques being introduced. Thus, although seabird mortalities are still reported, they are at much lower rates.

The workshop participants scored their confidence in exposure and consequence scores as 2b (high, agreement between experts) (Table 18). The potential risk from this fishery was assessed first. Exposure scores were similar to those for the smaller vessel bottom longline fishery (Table 17), with the exception of black petrels, flesh-footed shearwaters and grey-faced petrels, which do not overlap spatially with this fishery to the same extent as they do with the smaller vessel bottom longline fishery. Fourteen species scored an exposure level of 5, indicating that interactions are expected to occur (Table 18). Of these species, 12 had consequence scores of 3 or 4, giving high overall risk scores, while the remaining two species had moderate risk scores.

Four species had exposure scores of 4, indicating that interactions are likely to occur on occasion; the consequence scores for these species were all 3 (moderate), resulting in moderate risk scores. Consequently, there are 18 species exposed to this fishery for which some level of management is required. For all other species, the combinations of exposure and consequence scores were lower, placing them in negligible and low risk categories.

When the optimised exposure scores were considered, confidence was high (2a—data exist and are considered sound), due to the information obtained from onboard observers in this fishery. It was noted that these vessels still catch birds in low numbers despite the mitigation measures already in place. For most species, the optimised exposure scores dropped to 1 (rare) or 2 (unlikely), which mostly reduced the optimised risk scores to negligible or low. However, the optimised risk score for grey petrels, Westland petrels, white-chinned petrels and Salvin's albatrosses was moderate, indicating that some specific management is still required to further reduce interactions with these species. There was some general discussion about the consequence of this fishery on the white-chinned petrel population. It was also noted that yellow-nosed albatrosses are present in such small numbers in New Zealand that their consequence score should be high.

Table 18. Seabird species potentially at risk from the bottom longline deep sea ling fishery.

COMMON NAME	EXPOSURE	CONSE-	POTENTIAL RISK		OPTIMISED	OPTIMISED RISK	
		QUENCE	SCORE	CATEGORY	EXPOSURE	SCORE	CATEGORY
Grey petrel	5	4	20	High	3	12	Moderate
White-chinned petrel	5	4	20	High	3	12	Moderate
Chatham albatross	5	4	20	High	2	8	Moderate
Salvin's albatross	5	4	20	High	2	8	Moderate
Westland petrel	5	3	15	High	3	9	Moderate
Northern Buller's albatross	5	3	15	High	2	6	Low
Southern Buller's albatross	5	3	15	High	2	6	Low
Campbell albatross	5	3	15	High	2	6	Low
Indian yellow-nosed albatross	5	3	15	High	2	6	Low
White-capped albatross	5	3	15	High	2	6	Low
Northern giant petrel	5	3	15	High	1	3	Low
Southern giant petrel	5	3	15	High	1	3	Low
Sooty shearwater	5	2	10	Moderate	3	6	Low
Black-browed albatross	5	2	10	Moderate	2	4	Low
Antipodean albatross	4	3	12	Moderate	2	6	Low
Gibson's albatross	4	3	12	Moderate	2	6	Low
Southern royal albatross	4	3	12	Moderate	2	6	Low
Wandering albatross	4	3	12	Moderate	2	6	Low
Grey-faced petrel	3	2	6	Low	1	2	Low
Flesh-footed shearwater	3	2	6	Low	1	2	Low
Black petrel	3	2	6	Low	2	4	Low
Northern royal albatross	3	1	3	Low	1	1	Negligible
Grey-headed albatross	3	1	3	Low	1	1	Low
Light-mantled albatross	3	1	3	Low	1	1	Low
Buller's shearwater	2	2	4	Low	1	2	Low
Fluttering shearwater	2	1	2	Low	1	1	Low
Hutton's shearwater	2	1	2	Low	1	1	Low
Brown skua	2	1	2	Low	1	1	Low
Cape petrel	2	1	2	Low	1	1	Low
Snares cape petrel	2	1	2	Low	1	1	Low
Black-backed gull	1	1	1	Negligible	1	1	Negligible
Red-billed gull	1	1	1	Negligible	1	1	Negligible

3.1.17 Deep water bottom trawl

As for all trawl fisheries, in the deep water bottom trawl fishery a net is towed behind the vessel, generally on the bottom. Strong steel cables (referred to as warps) connect the net to the trawler and the mouth of the net is held open by two large trawl doors. Fish enter the net through the mouth and then make their way to the other end, called the 'codend'. This fishery mostly targets orange roughy, oreo species, cardinal fish, rubyfish and other deepwater fish stocks throughout the year. Most of the larger vessels operate on the Chatham Rise and in subantarctic areas, while smaller vessels operate in the upper North Island. Vessels range in length from c. 20 m to > 70 m. There has been ongoing onboard observer coverage of large vessels in this fishery, with some minimal coverage of smaller vessels. Seabird mortalities have been reported, but at lower rates than for other trawl fisheries. On larger vessels, there are often non-fishing, gear-related seabird interactions (e.g. birds striking the vessel's hull, superstructure or deck, often referred to as 'deck strikes').

Compared with other trawl fisheries, the warps are closer to the hull (transom) of the vessel, which nearly eliminates the risk of warp strike. Trawling events are also shorter than in other trawl fisheries.

Given the ongoing observer coverage in this fishery, experts were able to agree on scores with high confidence. All birds considered at risk of exposure to this fishery had exposure scores of 1 (remote) or 2 (unlikely), with the exception of the two Buller's albatross taxa, Salvin's albatrosses and white-capped albatrosses, which all scored 3 (interactions are uncommon) (Table 19). Consequence scores for all species were negligible or minor, resulting in all risk scores being in the negligible or low category, even without considering mitigation. The optimised risk scores were also negligible or low.

Table 19. Seabird species potentially at risk from the deep water bottom trawl fishery.

COMMON NAME	EXPOSURE	CONSE-	POTENTIAL RISK		OPTIMISED	OPTIMISED RISK	
		QUENCE	SCORE	CATEGORY	EXPOSURE	SCORE	CATEGORY
Northern Buller's albatross	3	2	6	Low	2	4	Low
Southern Buller's albatross	3	2	6	Low	2	4	Low
Salvin's albatross	3	2	6	Low	2	4	Low
White-capped albatross	3	2	6	Low	2	4	Low
Sooty shearwater	2	1	2	Low	2	2	Low
White-chinned petrel	2	1	2	Low	2	2	Low
Black-browed albatross	2	1	2	Low	1	1	Negligible
Campbell albatross	2	1	2	Low	1	1	Negligible
Chatham albatross	2	1	2	Low	1	1	Negligible
Antipodean albatross	1	1	1	Negligible	1	1	Negligible
Gibson's albatross	1	1	1	Negligible	1	1	Negligible
Northern royal albatross	1	1	1	Negligible	1	1	Negligible
Southern royal albatross	1	1	1	Negligible	1	1	Negligible
Wandering albatross	1	1	1	Negligible	1	1	Negligible
Grey petrel	1	1	1	Negligible	1	1	Negligible
Grey-headed albatross	1	1	1	Negligible	1	1	Negligible
Light-mantled albatross	1	1	1	Negligible	1	1	Negligible
Cape petrel	1	1	1	Negligible	1	1	Negligible
Northern giant petrel	1	1	1	Negligible	1	1	Negligible
Snares cape petrel	1	1	1	Negligible	1	1	Negligible
Southern giant petrel	1	1	1	Negligible	1	1	Negligible

3.1.18 Inshore trawl

Most small, inshore trawl vessels fish on the bottom. In some cases, two vessels are used (termed pair trawling), whereby one of the warps from the net is passed to a second trawler and the two boats tow the net in tandem, using the distance between them to assist in keeping the mouth of the net open, rather than using trawl doors. Prior to hauling the net in, the line is passed back to the first boat, and the net is hauled onto one boat. Small vessels using this trawl method target multiple species, with greatest effort being for flatfish, gurnard, john dory, lemon sole, red cod, snapper, tarakihi and trevally. Inshore trawl fishing is undertaken throughout the year, with over 100 vessels fishing for more than 100 days a year. Vessels range in length from 5 m to 30 m, and may also employ other fishing methods, including dredging, potting, dahn lining and trolling. Despite very low onboard observer coverage of vessels in this fishery, seabird catch rates are high compared with offshore trawl fisheries, especially on the east coast of the South Island.

There are no mitigation regulations in this fishery except for the few vessels over 28 m in length. However, some fishers have developed their own mitigation devices—mostly warp scarers in the South Island and baffler devices in the Auckland region. Based on onboard observer comments, offal discharge has been a major factor leading to warp strikes and there can also be substantial non-quota bycatch, which may be (and often is) discarded. While captures of albatrosses, petrels and shags have been reported from the South Island, net captures of gannets, flesh-footed shearwaters and black petrels have been reported from the North Island. Workshop participants with knowledge of the fishery were aware of gannets and gulls congregating behind nets in the Auckland and Northland region. Concern was also expressed for king shags in areas of the outer Marlborough Sounds, where small vessels targeting flatfish overlap with king shag foraging areas. The extent to which albatrosses or other seabirds are impacted by warps was considered.

Workshop participants agreed on all exposure and confidence scores with high confidence, with the exception of king shags and eastern rockhopper penguins: it was felt that further examination of fishing effort around breeding locations was required to increase the confidence in exposure scores for these two species. Nine seabird species received a score of 5 for exposure, indicating that they are expected to interact with the inshore trawl fishery (Table 20). Of these nine species, the consequences were considered to be major for black petrels and Salvin's albatrosses, and moderate for black-browed albatrosses, Campbell albatrosses and white-capped albatrosses. Thus, these five species all have a high risk score, implying that increases to current management are needed. Seven species (sooty shearwaters, white-chinned petrels, northern and southern Buller's albatrosses, flesh-footed petrels, spotted shags and Chatham albatrosses) are in the moderate risk category for this fishery, indicating that some specific actions to manage the risk to them is needed—while the consequence scores for these seven species were minor or moderate, the level of exposure ranged from 3 (interactions uncommon) through to 5 (interactions expected to occur). A further 20 species were given a risk score of low, and 12 were identified as having negligible risk scores. While the results imply that no specific management is required to mitigate impacts on these 32 species, Table 20 provides an indication of the large number of species that may interact with the inshore trawl fishery.

Table 20. Seabird species potentially at risk from the inshore trawl fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Black petrel	5	4	20	High
Salvin's albatross	5	4	20	High
Black-browed albatross	5	3	15	High
Campbell albatross	5	3	15	High
White-capped albatross	5	3	15	High
Sooty shearwater	5	2	10	Moderate
White-chinned petrel	5	2	10	Moderate
Northern Buller's albatross	5	2	10	Moderate
Southern Buller's albatross	5	2	10	Moderate
Flesh-footed shearwater	4	3	12	Moderate
Spotted shag	4	2	8	Moderate
Chatham albatross	3	3	9	Moderate
Westland petrel	3	2	6	Low
Northern giant petrel	3	1	3	Low
Southern giant petrel	3	1	3	Low
King shag	2	3	6	Low
Stewart Island shag	2	3	6	Low
Australasian gannet	2	1	2	Low
Black-backed gull	2	1	2	Low
Antipodean albatross	2	1	2	Low
Gibson's albatross	2	1	2	Low
Southern royal albatross	2	1	2	Low
Wandering albatross	2	1	2	Low
Grey-faced petrel	2	1	2	Low
Grey petrel	2	1	2	Low
Buller's shearwater	2	1	2	Low
Fluttering shearwater	2	1	2	Low
Hutton's shearwater	2	1	2	Low
Cape petrel	2	1	2	Low
Snares cape petrel	2	1	2	Low
Indian yellow-nosed albatross	1	6	6	Low
Chatham Island shag	1	3	3	Low
Red-billed gull	1	1	1	Negligible
Northern royal albatross	1	1	1	Negligible
Chatham Island blue penguin	1	1	1	Negligible
Eastern rockhopper penguin	1	1	1	Negligible
Fiordland crested penguin	1	1	1	Negligible
Northern blue penguin	1	1	1	Negligible
Snares crested penguin	1	1	1	Negligible
Southern blue penguin	1	1	1	Negligible
White-flippered blue penguin	1	1	1	Negligible
Yellow-eyed penguin	1	1	1	Negligible
Grey-headed albatross	1	1	1	Negligible
Light-mantled albatross	1	1	1	Negligible

3.1.19 Middle depth trawl—finfish

In middle depth trawling, nets are dragged at shallower depths than in bottom trawling (discussed above). This fishery targets the finfish hoki, hake, ling and warehou (but excludes southern blue whiting). Fishing effort is undertaken throughout the year around the New Zealand mainland, on the Chatham Rise and in subantarctic areas. Vessels range in length from 30 m to >100 m. Historically, around 15–20% of fishing effort in this fishery has had onboard observer coverage. Seabirds are known to be caught by middle depth trawl vessels targeting finfish,

including a number of albatross and petrel species (particularly Buller's albatrosses, Salvin's albatrosses, white-capped albatrosses, sooty shearwaters and white-chinned petrels).

It was noted that more offal is dumped in this fishery than in other middle depth trawl fisheries. Mitigation to reduce warp interactions is currently included in the fishery's regulations. Initiatives to manage offal continue, but the overall quantity of offal produced limits options for those vessels without onboard fishmeal plants. There are currently no direct mitigation measures in place to address net captures.

Potential, or unmitigated, risk was scored first and workshop participants agreed to all scores with high confidence. Four species (white-chinned petrels, Salvin's albatrosses, sooty shearwaters and white-capped albatrosses) scored a 5 for exposure, indicating that interactions are expected to occur (Table 21). The consequences of interacting with this fishery were ranked as 4 (major) for white-chinned petrels and Salvin's albatrosses, and 3 (moderate) for sooty shearwaters and white-capped albatrosses, placing all four species in the high risk category. A further four species are in the moderate risk category, implying that, in the absence of mitigation, specific management is needed. Fourteen species that are likely to interact with this fishery were given low or negligible risk scores.

To determine the optimised risk in this fishery, exposure scores for each species were reassessed in light of the mitigation regulations already in place. The score of 5 (interactions are expected to occur) for white-chinned petrels and sooty shearwaters did not change, as these species are generally caught in the net, for which no mitigation measures are currently in place. Similarly, the risk assessment for grey petrels did not change, as they are also more likely to be caught in the net. However, this reassessment meant that exposure scores for all other species in the high or moderate potential risk categories reduced. The observed change between potential and optimised risk indicates that further management actions are needed to ensure ongoing reduction of interactions in this fishery.

Table 21. Seabird species potentially at risk from the middle depth trawl finfish fishery.

COMMON NAME	EXPOSURE	CONSE-	POTENTIAL RISK		OPTIMISED	OPTIMISED RISK	
		QUENCE	SCORE	CATEGORY	EXPOSURE	SCORE	CATEGORY
White-chinned petrel	5	4	20	High	5	20	High
Salvin's albatross	5	4	20	High	3	12	Moderate
Sooty shearwater	5	3	15	High	5	15	High
White-capped albatross	5	3	15	High	3	9	Moderate
Black-browed albatross	4	3	12	Moderate	3	9	Moderate
Southern Buller's albatross	4	3	12	Moderate	3	9	Moderate
Chatham albatross	3	4	12	Moderate	2	8	Moderate
Grey petrel	3	3	9	Moderate	3	9	Moderate
Northern Buller's albatross	3	2	6	Low	2	4	Low
Campbell albatross	3	2	6	Low	2	4	Low
Northern giant petrel	3	1	3	Low	2	2	Low
Southern giant petrel	3	1	3	Low	2	2	Low
Antipodean albatross	2	2	4	Low	1	2	Low
Gibson's albatross	2	2	4	Low	1	2	Low
Southern royal albatross	2	2	4	Low	1	2	Low
Wandering albatross	2	2	4	Low	1	2	Low
Westland petrel	2	2	4	Low	2	4	Low
Cape petrel	2	1	2	Low	2	2	Low
Snares cape petrel	2	1	2	Low	2	2	Low
Northern royal albatross	1	1	1	Negligible	1	1	Negligible
Grey-headed albatross	1	1	1	Negligible	1	1	Negligible
Light-mantled albatross	1	1	1	Negligible	1	1	Negligible

3.1.20 Middle depth trawl—scampi

Scampi fishing takes place throughout the year in the upper North Island, on the Chatham Rise and in subantarctic areas. Vessels range in length from 18 m to >40 m. Historically, most onboard observer coverage of vessels in this fishery has been on boats fishing the Chatham Rise and subantarctic areas, with less coverage in the Auckland East and Central East fishery management areas. High rates of seabird captures have been reported from this fishery, with seabird species incidentally killed including Buller's albatrosses, Salvin's albatrosses, white-capped albatrosses, white-chinned petrels, flesh-footed shearwaters, sooty shearwaters, northern giant petrels and black-browed albatrosses.

Only one vessel in this fishery is >28 m in length and thus is required by regulation to use bird scaring devices, although some smaller vessels use warp scarers or other fisher-designed, non-mandatory devices. Typically, flesh-footed shearwater and black petrel captures have been reported from northern areas, while albatrosses and other petrel species are more likely to be caught in southern areas. In previous years, observer records showed a high strike rate in this trawl fishery compared with other mid-water trawl fisheries (Rowe 2009, 2010). It was also noted that a lot of waste fish is discarded in this fishery and that many vessels tow their nets in the water to clean them out after emptying, both of which may increase the chances of bird attraction and, hence, interactions.

Table 22. Seabird species potentially at risk from the middle depth trawl scampi fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Flesh-footed shearwater	5	3	15	High
Black petrel	4	3	12	Moderate
Sooty shearwater	4	2	8	Moderate
White-chinned petrel	3	2	6	Low
Black-browed albatross	3	2	6	Low
Northern Buller's albatross	3	2	6	Low
Southern Buller's albatross	3	2	6	Low
Campbell albatross	3	2	6	Low
Salvin's albatross	3	2	6	Low
White-capped albatross	3	2	6	Low
Northern giant petrel	3	1	3	Low
Chatham albatross	2	1	2	Low
Southern giant petrel	2	1	2	Low
Antipodean albatross	1	1	1	Negligible
Gibson's albatross	1	1	1	Negligible
Northern royal albatross	1	1	1	Negligible
Southern royal albatross	1	1	1	Negligible
Wandering albatross	1	1	1	Negligible
Grey petrel	1	1	1	Negligible
Grey-headed albatross	1	1	1	Negligible
Light-mantled albatross	1	1	1	Negligible
Cape petrel	1	1	1	Negligible
Snares cape petrel	1	1	1	Negligible

As most vessels in this fishery are not required to use mitigation, only potential risk was scored by the workshop participants (with a confidence of 2b for all scores). Flesh-footed shearwaters had an exposure score of 5 (interactions are expected to occur) and a consequence of 3 (moderate), giving this species a potential risk score of high, which implies that additional management actions are required (Table 22). Black petrels and sooty shearwaters both had exposure scores of 4 (interactions likely to occur on occasion), but the consequences were higher for black petrels (moderate) than for sooty shearwaters (minor); both species had a potential risk score of moderate, implying that specific management is needed. A further 20 species had potential risk scores of low or negligible; however, while these scores imply that management is not required, the number of birds likely to interact with this fishery needs to be considered.

3.1.21 Middle depth trawl—southern blue whiting

Fishing for southern blue whiting takes place from August to October in subantarctic waters around the Bounty Islands, Pukaki Rise and east of Campbell Island/Motu Ihupuku. Vessels range in length from 50 m to >100 m. Historically, around 20% of fishing trips have been covered by onboard observers. Seabirds, including a number of albatross and petrel species, are known to be caught by middle-depth trawl vessels targeting southern blue whiting, but in lower numbers than for other mid-water trawl fisheries.

Potential risk was scored first by workshop participants (confidence 2b), and all species were in the low or negligible risk categories. The species most likely to interact with this fishery (but with minimal impact on population structure or dynamics) were grey petrels, black-browed albatrosses, Campbell albatrosses, Salvin's albatrosses and white-capped albatrosses (Table 23).

The optimised risk scores were lower than the potential risk scores or remained at 1 (rare) for all species except grey petrels, sooty shearwaters and white-chinned petrels; these species are more likely to be caught in the net and there are currently no measures in place to mitigate net captures in this fishery. Low or negligible optimised risk scores imply that no direct management is required in this fishery.

Table 23. Seabird species potentially at risk from the middle depth trawl southern blue whiting fishery.

COMMON NAME	EXPOSURE	CONSE-	POTENTIAL RISK		OPTIMISED	OPTIMISED RISK	
		QUENCE	SCORE	CATEGORY	EXPOSURE	SCORE	CATEGORY
Grey petrel	3	2	6	Low	3	6	Low
Black-browed albatross	3	2	6	Low	2	4	Low
Campbell albatross	3	2	6	Low	2	4	Low
Salvin's albatross	3	2	6	Low	2	4	Low
White-capped albatross	3	2	6	Low	2	4	Low
Sooty shearwater	2	1	2	Low	2	2	Low
White-chinned petrel	2	1	2	Low	2	2	Low
Northern Buller's albatross	2	1	2	Low	1	1	Negligible
Southern Buller's albatross	2	1	2	Low	1	1	Negligible
Chatham albatross	2	1	2	Low	1	1	Negligible
Northern giant petrel	2	1	2	Low	1	1	Negligible
Southern giant petrel	2	1	2	Low	1	1	Negligible
Antipodean albatross	1	1	1	Negligible	1	1	Negligible
Gibson's albatross	1	1	1	Negligible	1	1	Negligible
Northern royal albatross	1	1	1	Negligible	1	1	Negligible
Southern royal albatross	1	1	1	Negligible	1	1	Negligible
Wandering albatross	1	1	1	Negligible	1	1	Negligible
Grey-headed albatross	1	1	1	Negligible	1	1	Negligible
Light-mantled albatross	1	1	1	Negligible	1	1	Negligible
Cape petrel	1	1	1	Negligible	1	1	Negligible
Snares cape petrel	1	1	1	Negligible	1	1	Negligible

3.1.22 Middle depth trawl—squid

Squid trawl effort occurs in three main areas: on the east coast of the South Island, the south coast of the South Island (mainly Snares Shelf) and near the subantarctic Auckland Islands. Vessels targeting squid range in length from 15 m (inshore vessels) to >100 m. Historically, most onboard observer effort in this fishery has been in Southland and around the Auckland Islands, with little effort for vessels on the east coast of the South Island, despite high seabird capture rates in this area. High levels of seabird bycatch have been reported in this fishery, especially captures of white-capped albatrosses in warps, and sooty shearwaters and white-chinned petrels in nets.

Bird scaring devices to mitigate warp strikes are mandatory in this fishery, but there are currently no direct net capture mitigation measures in place. Consequently, relatively high numbers of sooty shearwaters and white-chinned petrels are caught in squid nets, with sooty shearwater captures being particularly high in April and May on the east coast of the South Island. The number of albatross interactions with warps has been reduced by the introduction of warp strike mitigation measures and the retention of offal during shooting and hauling; however, albatrosses still get caught in the net.

Potential risk in the squid fishery was scored first by workshop participants, who had high confidence in the exposure scores (2a—data exist and are considered sound) and also agreed on all consequence scores with high confidence. Four species had high exposure scores (5) and thus were expected to interact with the squid fishery: white-chinned petrels, Salvin's albatrosses, sooty shearwaters and white-capped albatrosses (Table 24). The consequences of white-chinned petrels and Salvin's albatrosses interacting with this fishery in the absence of mitigation measures was considered to be major (4), with wider and longer term population impacts expected. In contrast, the consequence of sooty shearwaters and white-capped albatrosses interacting with this fishery was considered to be minor (3). For all four species, the potential risk was assessed as high. A further four species had moderate potential risk scores—black-browed albatrosses, southern

Table 24. Seabird species potentially at risk from the middle depth trawl squid fishery.

COMMON NAME	EXPOSURE	CONSE-	POTENTIAL RISK		OPTIMISED	OPTIMISED RISK	
		QUENCE	SCORE	CATEGORY	EXPOSURE	SCORE	CATEGORY
White-chinned petrel	5	4	20	High	5	20	High
Salvin's albatross	5	4	20	High	3	12	Moderate
Sooty shearwater	5	3	15	High	5	15	High
White-capped albatross	5	3	15	High	3	9	Moderate
Black-browed albatross	4	3	12	Moderate	3	9	Moderate
Southern Buller's albatross	4	3	12	Moderate	3	9	Moderate
Chatham albatross	3	4	12	Moderate	2	8	Moderate
Grey petrel	3	3	9	Moderate	3	9	Moderate
Northern Buller's albatross	3	2	6	Low	2	4	Low
Campbell albatross	3	2	6	Low	2	4	Low
Northern giant petrel	3	1	3	Low	2	2	Low
Southern giant petrel	3	1	3	Low	2	2	Low
Antipodean albatross	2	2	4	Low	1	2	Low
Gibson's albatross	2	2	4	Low	1	2	Low
Southern royal albatross	2	2	4	Low	1	2	Low
Wandering albatross	2	2	4	Low	1	2	Low
Cape petrel	2	1	2	Low	2	2	Low
Snares cape petrel	2	1	2	Low	2	2	Low
Northern royal albatross	1	1	1	Negligible	1	1	Negligible
Grey-headed albatross	1	1	1	Negligible	1	1	Negligible
Light-mantled albatross	1	1	1	Negligible	1	1	Negligible

Buller's albatrosses, Chatham albatrosses and grey petrels—while 13 species had low or negligible risk scores, indicating that these species may interact with this fishery, but with impacts that are expected to be less significant than for other species.

The exposure scores were re-examined in light of the mitigation and offal management practices presently in place in the squid fishery to determine optimised risk to seabird species. The exposure scores for white-chinned petrels, sooty shearwaters and grey petrels did not change, as these species are most likely to be caught in the net, for which no mitigation measures are in place; consequently, the optimised risk remained high for white-chinned petrels and sooty shearwaters, and moderate for grey petrels. However, the exposure score for Salvin's albatrosses and white-capped albatrosses reduced from 5 (likely) to 3 (uncommon), and hence the optimised risk scores for these species reduced to moderate. Similarly, the exposure scores for black-browed albatrosses, southern Buller's albatrosses and Chatham albatrosses each reduced by one; this meant that the optimised risk remained at moderate for southern Buller's and Chatham albatrosses, but was reduced from high to moderate for white-capped albatrosses. The results indicate that further management is required in this fishery, as eight species had optimised risk scores of moderate or high.

3.1.23 Pelagic mackerel trawl

Pelagic trawlers target jack mackerel, English mackerel and barracouta throughout the year, mostly on the west coasts of the North and South Islands, and the east coast of the South Island. Vessels targeting these stocks range in length from c. 15 m to >100 m. Onboard observer coverage has been ongoing in this fishery, generally covering 15–20% of fishing effort. Seabird interactions have been reported in this fishery, including the deaths of Buller's albatrosses, common diving petrels, fairy prions, sooty shearwaters, white-capped albatrosses and white-chinned petrels.

Seabird interactions are considered to be lower in this fishery than in other trawl fisheries, with most birds being caught in the Southland region. Vessels operating in this fishery are required to use bird scaring devices to mitigate warp interactions.

Potential risk was scored first by workshop participants, who agreed on and had high confidence in all scores (Table 25). Sooty shearwaters were given an exposure score of 4 (interactions likely to occur on occasion) because of their tendency to be caught in trawl nets; however, the impact of this fishery on populations of sooty shearwaters was considered to be minor, so that, overall, the potential risk to sooty shearwaters was ranked as moderate. Four species were given exposure scores of 3 (interactions are uncommon), but the consequences of interactions were considered minor in this fishery, giving low potential risk scores. A further 22 species were assigned exposure scores of 2 (unlikely) or 1 (rare) and, in all cases, the consequence of impact at the population level was considered to be low or negligible.

Optimised risk was not reduced for sooty shearwaters or the other petrel species likely to be caught in the net. Across the 27 species likely to interact to some degree with this fishery, optimised risk was assigned as low or negligible for all species except sooty shearwaters. These assessments indicate that specific management is required to mitigate sooty shearwater interactions with this fishery.

Table 25. Seabird species potentially at risk from the pelagic trawl fishery.

COMMON NAME	EXPOSURE	CONSE-	POTENTIAL RISK		OPTIMISED	OPTIMISED RISK	
		QUENCE	SCORE	CATEGORY	EXPOSURE	SCORE	CATEGORY
Sooty shearwater	4	2	8	Moderate	4	8	Moderate
White-chinned petrel	3	2	6	Low	3	6	Low
Southern Buller's albatross	3	2	6	Low	2	4	Low
Salvin's albatross	3	2	6	Low	2	4	Low
White-capped albatross	3	2	6	Low	2	4	Low
Westland petrel	2	1	2	Low	2	2	Low
Black-browed albatross	2	1	2	Low	1	1	Low
Northern Buller's albatross	2	1	2	Low	1	1	Negligible
Campbell albatross	2	1	2	Low	1	1	Negligible
Chatham albatross	2	1	2	Low	1	1	Negligible
Cape petrel	2	1	2	Low	2	2	Low
Northern giant petrel	2	1	2	Low	1	1	Negligible
Snares cape petrel	2	1	2	Low	2	2	Low
Southern giant petrel	2	1	2	Low	1	1	Negligible
Antipodean albatross	1	1	1	Negligible	1	1	Negligible
Gibson's albatross	1	1	1	Negligible	1	1	Negligible
Northern royal albatross	1	1	1	Negligible	1	1	Negligible
Southern royal albatross	1	1	1	Negligible	1	1	Negligible
Wandering albatross	1	1	1	Negligible	1	1	Negligible
Flesh-footed shearwater	1	1	1	Negligible	1	1	Negligible
Grey petrel	1	1	1	Negligible	1	1	Negligible
Black petrel	1	1	1	Negligible	1	1	Negligible
Grey-headed albatross	1	1	1	Negligible	1	1	Negligible
Light-mantled albatross	1	1	1	Negligible	1	1	Negligible
Buller's shearwater	1	1	1	Negligible	1	1	Negligible
Fluttering shearwater	1	1	1	Negligible	1	1	Negligible
Hutton's shearwater	1	1	1	Negligible	1	1	Negligible

3.1.24 Setnet

Setnetting is the most common form of netting. Most setnets have a series of floats at the top and a series of weights at the bottom that keep the net upright in the water. Fish are caught as they swim into the net, and the size of the mesh in the setnet determines the size and species of fish caught. Surface nets are used in shallow water, or where the targeted fish feed on the surface. Bottom setnets, which are similar in design to surface nets, use lighter floats and heavier weights so that the net sinks to the bottom. Multiple species are targeted by setnetting, with greatest fishing effort for butterfish, flatfish, grey mullet, school sharks, rig, tarakihi and yellow-belly flounders. Setnet fishing takes place throughout the year around the North and South Islands and the Chatham Islands. Set net fishing vessels range in length from 2 m to 20 m and sometimes employ other fishing methods, including bottom trawling, trolling, hand-lining, potting and dahn lining. Despite low levels of onboard observer coverage on vessels in this fishery, a number of seabird species have been observed incidentally killed in setnets, including spotted and pied shags, fluttering shearwaters, sooty shearwaters, and yellow-eyed penguins.

The different types of risk posed by this fishery were discussed by the workshop participants. Species such as yellow-eyed penguins are more likely to become entangled while the net is soaking (i.e. fishing). In contrast, petrels and albatrosses are more likely to become entangled during setting or hauling, as these species may dive on the net for 'stickers', or target fish. Those familiar with this fishery noted that large albatrosses are often abundant around setnet vessels in Foveaux Strait; that the likelihood of shag captures increases if gear is left out overnight; that crayfish operators often setnet for bait in the 'far south'; and that fishers on the Chatham Islands are known to net for bait. There was some discussion about setnet use around the Snares Islands/

Tini Keke and the potential impact of this on Snare's crested penguins; however, whether the few vessels that operate in the Snares area actually use setnets is not yet known. It was also noted that there are published records of hundreds of Hutton's and fluttering shearwaters being caught in recreational setnets (particularly in the Kaikoura region and Hauraki Gulf, respectively).

There are currently no seabird mitigation regulations in place in this fishery, but many fishers process fish on the way back to port, thereby eliminating offal discharge during shooting or hauling. However, only potential risk was assessed by the workshop participants. When scoring exposure, it was noted that the confidence scores differed between species, being particularly low for some (e.g. shags) due to a lack of data; consequently, the confidence scores are included in Table 26. In contrast, the workshop participants agreed that consequence scores could be given with high confidence. Sixteen species of seabird were expected to interact with the setnet

Table 26. Seabird species potentially at risk from the setnet fishery.

COMMON NAME	EXPOSURE	CONFIDENCE	CONSE-QUENCE	POTENTIAL RISK SCORE	RISK CATEGORY
Chatham Island shag	5	1b	6	30	Extreme
King shag	5	1b	6	30	Extreme
Pitt Island shag	5	1b	6	30	Extreme
Yellow-eyed penguin	5	2b	5	25	Extreme
Stewart Island shag	5	1b	4	20	High
Hutton's shearwater	5	2b	4	20	High
Sooty shearwater	5	2b	3	15	High
Northern blue penguin	5	2b	3	15	High
White-flippered blue penguin	5	2b	3	15	High
Pied shag	5	2b	3	15	High
Spotted shag	5	2b	3	15	High
Little black shag	5	1b	3	15	High
Fluttering shearwater	5	2b	3	15	High
Southern blue penguin	5	2b	2	10	Moderate
Black shag	5	1b	2	10	Moderate
Little shag	5	1b	2	10	Moderate
Fiordland crested penguin	4	1b	4	16	High
Chatham Island blue penguin	3	1b	3	9	Moderate
Flesh-footed shearwater	3	2b	2	6	Low
Australasian gannet	3	2b	1	3	Low
Codfish Island South Georgian diving petrel	2	1b	6	12	Moderate
Snares crested penguin	2	1b	2	4	Low
Caspian tern	2	2b	1	2	Low
White-fronted tern	2	2b	1	2	Low
Northern Buller's albatross	2	2b	1	2	Low
Southern Buller's albatross	2	2b	1	2	Low
Salvin's albatross	2	2b	1	2	Low
White-capped albatross	2	2b	1	2	Low
Buller's shearwater	2	2b	1	2	Low
Northern diving petrel	2	2b	1	2	Low
Northern giant petrel	2	2b	1	2	Low
Snares cape petrel	2	2b	1	2	Low
Southern diving petrel	2	2b	1	2	Low
Southern giant petrel	2	2b	1	2	Low
Black-backed gull	1	2b	1	1	Negligible
Red-billed gull	1	2b	1	1	Negligible
Antipodean albatross	1	2b	1	1	Negligible
Gibson's albatross	1	2b	1	1	Negligible
Southern royal albatross	1	2b	1	1	Negligible
Wandering albatross	1	2b	1	1	Negligible
Black-browed albatross	1	2b	1	1	Negligible
Campbell albatross	1	2b	1	1	Negligible

fishery (exposure score 5). The consequence of interaction was considered to be extreme (6) for Chatham Island shags, king shags and Pitt Island shags, indicating that such interactions were expected to lead to widespread and permanent damage, with local extinction or serious population decline; however, it should be noted that confidence in the exposure scores was low for these three species. For yellow-eyed penguin populations, the consequences of interacting with this fishery were expected to be severe (5). Stewart Island shags and Hutton's shearwaters scored a consequence level of 4 (major) and all other species with an exposure level of 5 had moderate consequence levels. The Fiordland crested penguin was assigned an exposure score of 4 (interactions likely to occur on occasion) and, because other pressures are known to impact on populations of this species, a consequence score of 4 (major), resulting in this species being placed in the high risk category. Unlike any of the other fisheries assessed, the setnet fishery has the potential to severely impact on a significant number of seabird species, with four species being assigned to the extreme risk category, ten species to the high risk category and five species to the moderate risk category. These assessments indicate that some level of additional management is required to mitigate interactions between the 19 highest-scoring seabird species and the setnet fishery. A further 23 seabird species were assessed as being at low or negligible risk.

3.1.25 Surface longline—vessels < 50 m in length

A surface longline consists of a main line that can be many kilometres long and is supported in the water by a series of floats. Attached to this main line are branch lines. Each branch line carries a baited hook, and there can be up to 3000 hooks on a longline. Most surface longline fishing effort targets bigeye tuna in northern New Zealand waters, southern bluefin tuna on the west coast of the South Island and the east coast and northern regions of the North Island, and swordfish, mostly in the Kermadec Islands region to the north of New Zealand; other tuna stocks are also targeted but to a lesser degree. Vessels in this fishery range in length from 12 m to 29 m. Onboard observer coverage on vessels in this fishery has ranged between 4% and 8% in recent years. A number of albatross and petrel species have been reported as being incidentally killed in this fishery.

The workshop participants discussed the differences between the smaller, domestic vessels and the larger, charter vessels, both of which target tuna in New Zealand waters. The domestic fleet also targets swordfish in the Kermadec region and there has been one observed fishing trip in this area during which over 50 seabirds were caught. The domestic fleet is generally vessel owner-operated and fishes year round. Snoods are around 18 m in length. Surface longliners are required to use tori lines as well as either line weighting or night setting as mitigation against seabird captures.

Potential risk scores were determined with a confidence rating of 2b (high, agreement between experts). Fifteen seabird species were expected to interact regularly with domestic surface longliners (exposure score 5), while one species was likely to interact occasionally (exposure score 4) (Table 27). Thirteen of the species with high exposure scores had consequence scores of 4 (major) or 3 (moderate), placing these birds in the high risk category. A further five species were in the moderate risk category, one of which is the Indian yellow-nosed albatross; while New Zealand is probably on the outer range for Indian yellow-nosed albatrosses, two breeding pairs were known to be resident in New Zealand and, if these were treated as the New Zealand population, then the impact would be high. A further seven species were in the low risk category.

Since mitigation devices are required to be used in this fishery, the optimised exposure scores were reduced to 3 (interactions are uncommon), resulting in no optimised risk scores being greater than moderate. However, these results imply that specific management actions are needed, with some additions to current levels of mitigation required to reduce risk levels.

Table 27. Seabird species potentially at risk from the surface longline small vessel fishery.

COMMON NAME	EXPOSURE	CONSE-QUENCE	POTENTIAL RISK		OPTIMISED EXPOSURE	OPTIMISED RISK	
			SCORE	CATEGORY		SCORE	CATEGORY
Antipodean albatross	5	4	20	High	3	12	Moderate
Gibson's albatross	5	4	20	High	3	12	Moderate
Wandering albatross	5	4	20	High	3	12	Moderate
Grey petrel	5	4	20	High	3	12	Moderate
Black petrel	5	4	20	High	3	12	Moderate
White-chinned petrel	5	4	20	High	3	12	Moderate
Southern royal albatross	5	3	15	High	3	9	Moderate
Westland petrel	5	3	15	High	3	9	Moderate
Black-browed albatross	5	3	15	High	3	9	Moderate
Northern Buller's albatross	5	3	15	High	3	9	Moderate
Southern Buller's albatross	5	3	15	High	3	9	Moderate
Salvin's albatross	5	3	15	High	3	9	Moderate
White-capped albatross	5	3	15	High	3	9	Moderate
Sooty shearwater	5	2	10	Moderate	3	6	Low
Campbell albatross	5	2	10	Moderate	3	6	Low
Flesh-footed shearwater	4	3	12	Moderate	3	9	Moderate
Chatham albatross	3	3	9	Moderate	2	6	Low
Grey-faced petrel	3	2	6	Low	2	4	Low
Light-mantled albatross	3	2	6	Low	2	4	Low
Northern giant petrel	3	1	3	Low	2	2	Low
Southern giant petrel	3	1	3	Low	2	2	Low
Indian yellow-nosed albatross	2	6	12	Moderate	1	6	Low
Northern royal albatross	2	1	2	Low	1	1	Negligible
Buller's shearwater	2	1	2	Low	1	1	Negligible
Grey-headed albatross	1	2	2	Low	1	2	Low

3.1.26 Surface longline—vessels > 50 m in length

The larger surface longline vessels set a greater number of hooks and mostly target bigeye tuna and southern bluefin tuna. This fishery generally consists of around four chartered Japanese vessels that come to fish off the west coast of the South Island before heading up to northeast New Zealand. The fishery operates in New Zealand for around 3 months of the year. Compared with smaller (< 50 m long) domestic surface longliners, where snoods are 18 m long, snoods in this fishery are around 40 m long. Generally, at least 50% onboard observer coverage has been achieved on vessels in the larger surface longline fishery in recent years. This fishery historically has had high captures of seabirds, including a variety of albatrosses and petrels.

As with the smaller domestic longline vessels, larger surface longline vessels are required to use tori lines and either weight lines or set them at night. The charter vessels in this fishery also have a code of practice, so will often use danglers, water canons and other methods of scaring birds away from their sterns. It was noted, however, that even when vessels follow the regulations, they are still known to catch birds, particularly during the full moon. Workshop participants also discussed the impact of large surface longline vessels operating just outside the NZ-EEZ, which are also likely to have an impact on New Zealand seabirds.

Workshop participants scored potential risk in this fishery with high confidence for both exposure and consequence scores, and it was acknowledged that good data exist for the assessment of exposure scores. The potential exposure scores were essentially the same as for the smaller vessel domestic surface longline fishery, but consequence scores differed slightly reflecting differences in fishing effort (Table 28). Consequence scores in the larger vessel surface longline fishery were higher for Chatham and white-capped albatrosses. Overall, 14 species were in the high category, 4 were in the moderate category and 7 were in the low category for potential risk.

As in the smaller vessel surface longline fleet, exposure scores reduced for all species when the mitigation practices in place were taken into account. However, despite these reductions in risk, 15 seabird species continued to be in the moderate category for optimised risk, which indicates that further specific management is required to reduce interactions between seabirds and this fishery.

Table 28. Seabird species potentially at risk from the surface longline large vessel fishery.

COMMON NAME	EXPOSURE	CONSE-	POTENTIAL RISK		OPTIMISED	OPTIMISED RISK	
		QUENCE	SCORE	CATEGORY	EXPOSURE	SCORE	CATEGORY
Antipodean albatross	5	4	20	High	3	12	Moderate
Gibson's albatross	5	4	20	High	3	12	Moderate
Wandering albatross	5	4	20	High	3	12	Moderate
Grey petrel	5	4	20	High	3	12	Moderate
Black petrel	5	4	20	High	3	12	Moderate
White-chinned petrel	5	4	20	High	3	12	Moderate
White-capped albatross	5	4	20	High	3	12	Moderate
Southern royal albatross	5	3	15	High	3	9	Moderate
Westland petrel	5	3	15	High	3	9	Moderate
Black-browed albatross	5	3	15	High	3	9	Moderate
Northern Buller's albatross	5	3	15	High	3	9	Moderate
Southern Buller's albatross	5	3	15	High	3	9	Moderate
Salvin's albatross	5	3	15	High	3	9	Moderate
Sooty shearwater	5	2	10	Moderate	3	6	Low
Campbell albatross	5	2	10	Moderate	3	6	Low
Flesh-footed shearwater	4	3	12	Moderate	3	9	Moderate
Chatham albatross	3	5	15	High	2	10	Moderate
Grey-faced petrel	3	2	6	Low	2	4	Low
Light-mantled albatross	3	2	6	Low	2	4	Low
Northern giant petrel	3	1	3	Low	2	2	Low
Southern giant petrel	3	1	3	Low	2	2	Low
Indian yellow-nosed albatross	2	6	12	Moderate	1	6	Low
Northern royal albatross	2	1	2	Low	1	1	Negligible
Buller's shearwater	2	1	2	Low	1	1	Negligible
Grey-headed albatross	1	2	2	Low	1	2	Low

3.2 Relative assessments across all fisheries

3.2.1 Seabirds

To assess which seabird species are at greatest risk of interacting with fisheries throughout the NZ-EEZ, potential and optimised risk scores were summed across all fishing methods investigated. The results were split into species that were at high–moderate risk (total score > 30) and low or no risk (total score < 30)[4].

Seabirds species with a high to moderate risk of interacting with New Zealand fisheries

Table 29 lists the individual seabird species considered to be at high to moderate potential risk of interacting with New Zealand fisheries, while Table 30 shows the proportion (percentage) that each fishery contributes to that potential risk score for each species. The workshop participants agreed that *Thalassarche* albatrosses (mollymawks), *Procellaria* petrels and large shearwaters are at greatest national risk from interactions with fishing activities (Table 29). This conclusion is supported by observer records (Rowe 2009, 2010). *Diomedea* albatrosses are also at high risk, but

[4] This score was chosen to indicate a reasonable division between higher and lower risk scores.

Table 29. Species of seabirds for which there is a high to moderate potential risk that New Zealand fisheries will have an impact on their population.

SPECIES	SCORE
Salvin's albatross	161
White-chinned petrel	159
White-capped albatross	141
Black petrel	139
Sooty shearwater	126
Grey petrel	123
Southern Buller's albatross	123
Flesh-footed shearwater	117
Black-browed albatross	114
Chatham albatross	114
Northern Buller's albatross	107
Campbell albatross	97
Antipodean albatross	89
Gibson's albatross	89
Wandering albatross	89
Westland petrel	89
Southern royal albatross	79
Northern giant petrel	62
Southern giant petrel	61
Indian yellow-nosed albatross	58
King shag	48
Pitt Island shag	46
Chatham Island shag	45
Hutton's shearwater	37
Pied shag	35
Fluttering shearwater	34
Grey-faced petrel	31
Spotted shag	31
Stewart Island shag	31
Light-mantled albatross	30
Yellow-eyed penguin	30

because of the birds' less aggressive natures, they are at lower risk that the smaller *Thalassarche* species. Species with high risk scores are typically caught as bycatch in a number of fisheries, which increases their ranking in the table. Other species—in particular yellow-eyed penguins, shags, little blue penguins, and Hutton's and fluttering shearwaters—had high scores even though they are likely to interact with only a few fisheries, or even only one fishery.

When the mitigation measures in place across all longline and most trawl fisheries were taken into account, the number of species in the high ro moderate risk range reduced from 31 (Table 29) to 29 (Table 31). In general, the same species appeared at the top of this list, but in a slightly different order (Table 31). The lack of fully effective mitigation measures for trawl net captures probably influenced the petrel species' movement up the list. It is also worth noting that some species, particularly shags and penguins, had no change in score in this list, as the fisheries that affect them have no mitigation measures in place.

Seabird species with a low or no risk of interacting with New Zealand fisheries

The seabird species listed in Table 32 are either less likely to interact with fisheries or are only at risk of interacting with a few fisheries (as shown in Table 33). Nevertheless, some species in these tables have high threat classifications, so the consequences to them of interacting with any fishery would be high; for example, Fiordland crested penguins, Codfish Island South Georgian diving petrels, Magenta petrels (Chatham Island tāiko), Chatham petrels, fairy terns and New Zealand storm petrels.

When the mitigation measures that are in place in fisheries were taken into account, two species (grey-faced petrels and light mantled sooty albatrosses) had lower levels of optimised risk (Table 34).

Table 30. Percentage contribution of each fishery to the risk scores of seabird species for which there is a high to moderate potential risk that fisheries will have an impact on their population. (BS = beach seine, DL = dahn line, DS = Danish seine, PT = pots and traps, HL = hand line, IDN = inshore drift net, RN = ring net, SJ = squid jig, TO = troll, TL= trot line, PS = purse seine, BLS = bottom longline small vessel, BLL = bottom longline large vessel, DWT = deep water trawl, IT = inshore trawl, FIN = middle depth finfish, SCI = middle depth trawl scampi, SBW = middle depth trawl southern blue whiting, SQU = middle depth trawl squid, PT = pelagic trawl, SET = setnet, SLS = surface longline small vessel, SLL = surface longline large vessel.)

SPECIES	BS	DL	DS	PT	HL	IDN	RN	SJ	TO	TL	PS	BLLS	BLL	DWT	IT	FIN	SCI	SBW	SQU	PT	SET	SLS	SLL
Antipodean albatross		2.2						1.1	1.1	2.2		18.0	13.5	1.1	2.2	4.5	1.1	1.1	4.5	1.1	1.1	22.5	22.5
Black petrel		4.3	2.9		7.1				6.4	4.3	0.7	17.9	4.3		14.3		8.6			0.7		14.3	14.3
Black-browed albatross		1.8			1.8			0.9	0.9	1.8		8.8	8.8	1.8	13.2	10.5	5.3	5.3	10.5	1.8	0.9	13.2	13.2
Campbell albatross		2.1			2.1			1.0	1.0	2.1		10.3	15.5	2.1	15.5	6.2	6.2	6.2	6.2	2.1	1.0	10.3	10.3
Chatham albatross		1.8			1.8			1.8	0.9	1.8		17.5	17.5	1.8	7.9	10.5	1.8	1.8	10.5	1.8		7.9	13.2
Chatham Island shag				26.7											6.7						66.7		
Flesh-footed shearwater		5.1	1.7		8.5				3.4	5.1		21.4	5.1		10.3		12.8			0.9	5.1	10.3	10.3
Fluttering shearwater	2.9	2.9	5.7	2.9	5.7	5.7	2.9			2.9	2.9	8.6	5.7		5.7					2.9	42.9		
Gibson's albatross		2.2						1.1	1.1	2.2		18.0	13.5	1.1	2.2	4.5	1.1	1.1	4.5	1.1	1.1	22.5	22.5
Grey petrel		1.6	0.8					1.6	1.6	1.6		20.3	16.3	0.8	1.6	7.3	0.8	4.9	7.3	0.8		16.3	16.3
Grey-faced petrel								3.2				32.3	19.4		6.5		0.0					19.4	19.4
Hutton's shearwater		2.7	10.8	2.7	2.7			2.7		2.7		8.1	5.4		5.4					2.7	54.1		
Indian yellow-nosed albatross		3.4			3.4			1.7	1.7	3.4		8.6	25.9		10.3							20.7	20.7
King shag			7.4	14.8							11.1				11.1						55.6		
Light-mantled albatross		3.3			3.3			6.7		3.3		10.0	10.0	3.3	3.3	3.3	3.3	3.3	3.3	3.3		20.0	20.0
Northern blue penguin	6.7		6.7	3.3		13.3	3.3				13.3				3.3						50.0		
Northern Buller's albatross																							
Northern giant petrel		3.2			3.2			1.6		3.2		24.2	24.2	1.6	4.8	4.8	4.8	3.2	4.8	3.2	3.2	4.8	4.8
Pied shag	17.1			8.6	2.9	22.9	5.7														42.9		
Pitt Island shag				34.8																	65.2		
Salvin's albatross		1.9			1.2			0.6	0.6	1.9		9.3	12.4	3.7	12.4	12.4	3.7	3.7	12.4	3.7	1.2	9.3	9.3
Sooty shearwater		1.6	1.6		2.4			0.8	0.8	1.6		7.9	7.9	1.6	7.9	11.9	6.3	1.6	11.9	6.3	11.9	7.9	7.9
Southern Buller's albatross		2.4			2.4			0.8	1.6	2.4		8.1	12.2	4.9	8.1	9.8	4.9	1.6	9.8	4.9	1.6	12.2	12.2
Southern giant petrel		3.3			3.3			1.6		3.3		24.6	24.6	1.6	4.9	4.9	3.3	3.3	4.9	3.3	3.3	4.9	4.9
Southern royal albatross		2.5						1.3	1.3	2.5		20.3	15.2	1.3	2.5	5.1	1.3	1.3	5.1	1.3	1.3	19.0	19.0
Spotted shag	2.9		5.7	5.7		5.7	2.9				11.4				22.9						42.9		
Stewart Island shag	3.2			12.9											19.4						64.5		
Wandering albatross		2.2						1.1	1.1	2.2		18.0	13.5	1.1	2.2	4.5	1.1	1.1	4.5	1.1	1.1	22.5	22.5
Westland petrel		2.2	1.1		2.2			1.1	4.5	2.2		22.5	16.9		6.7	4.5				2.2		16.9	16.9
White-capped albatross		2.1			1.4			0.7	0.7	2.1		7.1	10.6	4.3	10.6	10.6	4.3	4.3	10.6	4.3	1.4	10.6	14.2
White-chinned petrel		1.3	0.6		1.3			1.3	2.5	1.3		12.6	12.6	1.3	6.3	12.6	3.8	1.3	12.6	3.8		12.6	12.6
Yellow-eyed penguin	6.7			6.7											3.3						83.3		

Table 31. Seabirds for which there is a high to moderate optimised risk that New Zealand fisheries will have an impact on their population.

SEABIRD	SCORE
White-chinned petrel	123
Sooty shearwater	108
black petrel	106
Salvin's albatross	106
White-capped albatross	94
Flesh-footed shearwater	92
Southern Buller's albatross	85
Grey petrel	84
Black-browed albatross	80
Northern Buller's albatross	72
Chatham albatross	71
Campbell albatross	66
Westland petrel	59
Antipodean albatross	55
Gibson's albatross	55
Wandering albatross	55
Southern royal albatross	49
King shag	48
Pitt Island shag	46
Chatham Island shag	45
Pied shag	35
Hutton's shearwater	35
Northern giant petrel	35
Indian yellow-nosed albatross	34
Southern giant petrel	34
Fluttering shearwater	32
Spotted shag	31
Stewart Island shag	31
Yellow-eyed penguin	30

Table 32. Seabirds for which there is a low or no potential risk that New Zealand fisheries will have an impact on their population.

SPECIES	SCORE
Buller's shearwater	28
Northern blue penguin	26
Cape petrel	22
Grey-headed albatross	22
Snares cape petrel	22
White-flippered blue penguin	22
Little black shag	21
Northern royal albatross	20
Fiordland crested penguin	19
Codfish Island South Georgian diving petrel	18
Australasian gannet	17
Black-backed gull	16
Little shag	16
Red-billed gull	16
Black shag	15
Southern blue penguin	15
Chatham Island blue penguin	12
Brown skua	7
Caspian tern	6
Magenta petrel	6
Snares crested penguin	5
White-fronted tern	5
Chatham petrel	4
Fairy tern	3
Southern diving petrel	3
Northern diving petrel	2
Antarctic prion	1
Black-bellied storm petrel	1
Black-billed gull	1
Blue petrel	1
Broad-billed prion	1
Chatham fulmar prion	1
Cook's petrel	1
Eastern rockhopper penguin	1
Fairy prion	1
Fulmar prion	1
Grey-backed storm petrel	1
Lesser fulmar prion	1
Mottled petrel	1
New Zealand white-faced storm petrel	1
Soft-plumaged petrel	1
Subantarctic diving petrel	1
Subantarctic little shearwater	1
White-headed petrel	1
Antarctic tern	0
Auckland Island shag	0
Australian white-faced storm petrel	0
Black-fronted tern	0
Black-winged petrel	0
Bounty Island shag	0
Campbell Island shag	0
Common noddy	0
Erect-crested penguin	0
Grey ternlet	0
Kermadec little shearwater	0
Kermadec petrel	0
Kermadec white-faced storm petrel	0
Masked booby	0
New Zealand storm petrel	0
Norfolk Island little shearwater	0
North Island little shearwater	0
Pycroft's petrel	0
Red-tailed tropicbird	0
Sooty tern	0
Southern white-fronted tern	0
Wedge-tailed shearwater	0
White tern	0
White-bellied storm petrel	0
White-capped noddy	0
White-necked petrel	0

Table 33. Percentage contribution of each fishery to the risk scores for seabird species for which there is a low or no potential risk that New Zealand fisheries will have an impact on their population. (BS = beach seine, DL = dahn line, DS = Danish seine, PT = pots and traps, HL = hand line, IDN = inshore drift net, RN = ring net, SJ = squid jig, TO = troll, TL = trot line, PS = purse seine, BLS = bottom longline small vessel, BLL = bottom longline large vessel, DWT = deep water trawl, IT = inshore trawl, FIN = middle depth finfish, SCI = middle depth trawl scampi, SBW = middle depth trawl southern blue whiting, SQU = middle depth trawl squid, PT = pelagic trawl, SET = setnet, SLS = surface longline small vessel, SLL = surface longline large vessel.)

SPECIES	BS	DL	DS	PT	HL	IDN	RN	SJ	TO	TL	PS	BLS	BLL	DWT	IT	FIN	SCI	SBW	SQU	PT	SET	SLS	SLL
Antarctic prion								100															
Antarctic tern																							
Auckland Island shag																							
Australasian gannet	5.6		5.6		5.6	11.1	5.6		22.2		5.6	11.1			11.1						16.7		
Australian white-faced storm petrel																							
Black shag				6.7		20.0	6.7														66.7		
Black-backed gull	11.8		5.9		11.8	11.8	5.9		11.8		5.9	11.8	5.9		11.8						5.9		
Black-bellied storm petrel								100															
Black-billed gull	100																						
Black-winged petrel																							
Blue noddy																							
Blue petrel								100															
Bounty Island shag																							
Broad-billed prion								100															
Brown skua	14.3			14.3					14.3		28.6	28.6											
Buller's shearwater	3.4			6.9				10.3	3.4	3.4	27.6	13.8		6.9					3.4	6.9	6.9	6.9	
Campbell Island shag																							
Cape petrel	4.5			9.1			4.5		4.5		9.1	9.1	4.5	9.1	9.1	4.5	4.5	9.1	9.1	9.1			
Caspian tern	33.3					16.7	16.7														33.3		
Chatham fulmar prion								100															
Chatham Island blue penguin				16.7											8.3						75.0		
Chatham petrel								100															
Codfish Island South Georgian diving petrel								33.3													66.7		
Cook's petrel								100															
Eastern rockhopper penguin															100								
Erect-crested penguin																							
Fairy prion								100															
Fairy tern	100																						
Fiordland crested penguin				10.5											5.3						84.2		
Fulmar prion								100															
Grey-backed storm petrel								100															
Grey-headed albatross	4.5			4.5			9.1		4.5		13.6	13.6	4.5	4.5	4.5	4.5	4.5	4.5	4.5		9.1	9.1	

Continued on next page

Table 33—continued

SPECIES	BS	DL	DS	PT	HL	IDN	RN	SJ	TO	TL	PS	BLS	BLL	DWT	IT	FIN	SCI	SBW	SQU	PT	SET	SLS	SLL
Kermadec little shearwater																							
Kermadec petrel																							
Kermadec white-faced storm petrel																							
Lesser fulmar prion																							
Little black shag	6.3			6.3		18.8	6.3														62.5		
Little shag	4.8			4.8		14.3	4.8														71.4		
Magenta petrel								100															
Masked booby																							
Mottled petrel								100															
New Zealand storm petrel																							
New Zealand white-faced storm petrel								100															
Norfolk Island little shearwater																							
North Island little shearwater																							
Northern diving petrel																					100		
Northern royal albatross		5.0							5.0	5.0		15.0	15.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		10.0	10.0
Pycroft's petrel																							
Red-billed gull	11.8		5.9		17.6	11.8	5.9		11.8		5.9	11.8	5.9		5.9						5.9		
Red-tailed tropicbird																							
Snares cape petrel		4.5			9.1			4.5		4.5		9.1	9.1	4.5	9.1	9.1	4.5	4.5	9.1	9.1	9.1		
Snares crested penguin															20.0						80.0		
Soft-plumaged petrel								100															
Sooty tern																							
Southern blue penguin	13.3			13.3											6.7						66.7		
Southern diving petrel								33.3													66.7		
Southern white-fronted tern																							
Subantarctic diving petrel								100															
Subantarctic little shearwater								100															
Wedge-tailed shearwater																							
White tern																							
White-bellied storm petrel																							
White-capped noddy																							
White-flippered blue penguin			18.2	9.1											4.5						68.2		
White-fronted tern	20.0					20.0	20.0														40.0		
White-headed petrel								100															
White-necked petrel																							

Table 34. Seabirds species for which there is a low or no optimised risk of New Zealand fisheries having an impact on their population.

SEABIRD	SCORE
Northern blue penguin	26
Light-mantled albatross	23
White-flippered blue penguin	22
Little black shag	21
Buller's shearwater	20
Cape petrel	20
Snares cape petrel	20
Fiordland crested penguin	19
Grey-headed albatross	19
Codfish Island South Georgian diving petrel	18
Grey-faced petrel	17
Australasian gannet	16
Little shag	16
Black-backed gull	15
Red-billed gull	15
Northern royal albatross	15
Southern blue penguin	15
Black shag	15
Chatham Island blue penguin	12
Caspian tern	6
Magenta petrel	6
White-fronted tern	5
Snares crested penguin	5
Brown skua	5
Chatham petrel	4
Fairy tern	3
Southern diving petrel	3
Northern diving petrel	2
Black-billed gull	1
Soft-plumaged petrel	1
White-headed petrel	1
Eastern rockhopper penguin	1
Antarctic prion	1
Black-bellied storm petrel	1
Blue petrel	1
Broad-billed prion	1
Chatham fulmar prion	1
Cook's petrel	1
Fairy prion	1
Fulmar prion	1
Grey-backed storm petrel	1
Lesser fulmar prion	1
Mottled petrel	1
New Zealand white-faced storm petrel	1
Subantarctic diving petrel	1
Subantarctic little shearwater	1
Masked booby	0
Antarctic tern	0
Black-fronted tern	0
Grey ternlet	0
Sooty tern	0
White tern	0
Southern white-fronted tern	0
Common noddy	0
White-capped noddy	0
Wedge-tailed shearwater	0
Erect-crested penguin	0
Auckland Island shag	0
Bounty Island shag	0
Campbell Island shag	0
Australian white-faced storm petrel	0
Black-winged petrel	0
Kermadec little shearwater	0
Kermadec petrel	0
Kermadec white-faced storm petrel	0
New Zealand storm petrel	0
Norfolk Island little shearwater	0
North Island little shearwater	0
Pycroft's petrel	0
Red-tailed tropicbird	0
White-bellied storm petrel	0
White-necked petrel	0

3.2.2 Fisheries

The potential and optimised risk posed to seabirds was summed for all fisheries (Table 35). The fishery posing the greatest risk to seabirds was the setnet fishery followed by all longline fisheries. However, longline fisheries move down the list when current mitigation measures are in place and being used correctly (Table 35B). When considering the mitigation measures currently in use across all longline and trawl fisheries, inshore trawl presents the second-highest risk relative to other fisheries.

Of particular interest is the potential risk of hand-lining, inshore drift-netting, potting and trapping techniques, and trolling. All fisheries pose some level of direct risk to seabirds, with the exception of diving, dredging and hand gathering. However, the extent to which the indirect effects of disturbance associated with diving and hand gathering affects seabirds was also discussed by the workshop participants.

Table 35. Cumulative A. potential and B. optimised risk scores for each fishery. (BLL = bottom longline, SLL = surface longline, MDT = middle depth trawl, SBW = southern blue whiting, BT = bottom trawl.)

A

FISHERY	POTENTIAL RISK	NO. SEABIRDS INTERACTING
Setnet	37442	
BLL—small	35433	
SLL—charter	31325	
BLL—large	31132	
SLL—domestic	30225	
Inshore trawl	22544	
MDT—finfish	16022	
MDT—squid	15621	
MDT—scampi	9423	
Hand line	6827	
Pelagic trawl	6327	
Squid jig	6244	
Dahn line	6129	
Pots, traps	6117	
Trot line	6129	
MDT—SBW	5321	
Troll	5023	
Deep water BT	4621	
Inshore drift net	3312	
Danish seine	3215	
Beach seine	2916	
Purse seine	2211	
Ring net	1312	
Diving	00	
Dredge	00	
Hand gather	00	

B

FISHERY	OPTIMISED RISK	NO. SEABIRDS INTERACTING
Setnet	37442	
Inshore trawl	22544	
SLL—charter	19125	
SLL—domestic	18425	
BLL—small	15433	
BLL—large	13932	
MDT—finfish	12222	
MDT—squid	11821	
MDT—scampi	9423	
Hand line	6827	
Squid jig	6244	
Dahn line	6129	
Pots, traps	6117	
Trot line	6129	
Pelagic trawl	5127	
Troll	5023	
MDT—SBW	4021	
Deep water BT	3521	
Inshore drift net	3312	
Danish seine	3215	
Beach seine	2916	
Purse seine	2211	
Ring net	1312	
Diving	00	
Dredge	00	
Hand gather	00	

4. Discussion

During the workshop assessment process, exposure, consequence and confidence scores were assigned to each seabird species by fishery combination. Following the workshop, the potential and optimised risk scores were then calculated by the author. Thus, workshop participants did not discuss the resulting risk scores but instead were asked to provide comment on the overall results. Comments relating to management in the discussion below are derived directly from Table 4 and are given to provide guidance to managers around levels of risk.

4.1 Fishery assessments

Fisheries are listed in order of optimised risk score (Table 35B), from highest to lowest.

4.1.1 Setnet

The setnet fishery scored the highest potential risk of all the fisheries examined. The different types of risk posed to seabirds by this fishery included entanglement while the net is soaking (submerged) and entanglement during setting or hauling of the net. As there are currently no seabird mitigation measures in place in this fishery, only potential risk was assessed. The consequence of interacting with setnet fisheries was considered extreme for Chatham Island shags, king shags and Pitt Island shags, the implication being that interactions are expected to lead to widespread and permanent damage, with local extinctions or serious population decline. However, the confidence scores for exposure were low for all three of these species due to the lack of data. Interactions between yellow-eyed penguins and this fishery were expected to have severe consequences for populations. Other species of particular concern included Stewart Island shags, Hutton's shearwaters and Fiordland crested penguins. In total, 19 species had risk scores above acceptable levels, implying that some level of additional management is required for these species to mitigate interactions with this fishery. With an additional 23 species assigned to the low or negligible risk categories, a total of 43 species were considered to be at some level of risk from setnet fisheries.

4.1.2 Inshore trawl

There are no regulations around mitigation measures in the inshore trawl fishery, although some fishers have developed their own mitigation devices, including warp scarers in the South Island and baffler devices in the Auckland region. Based on comments from onboard observers, the discharge of offal and waste fish (as a result of a sometimes substantial non-quota bycatch) has been a major factor leading to warp strikes. Nine seabird species are expected to have interactions with this fishery, of which the consequences were thought to be major for black petrels and Salvin's albatrosses, and moderate for black-browed albatrosses, Campbell albatrosses and white-capped albatrosses. All five of these species had high potential risk scores, and a further seven were assessed as being at moderate risk (sooty shearwaters, white-chinned petrels, northern and southern Buller's albatrosses, flesh-footed petrels, spotted shags, and Chatham albatrosses), implying that some specific management is needed. A further 32 species may interact with this fishery to a lesser degree. While no specific management is required to mitigate impacts on these species, the workshop assessment highlighted the large number of seabird species that may interact with inshore trawl fisheries.

4.1.3 Surface longline—vessels > 50 m in length

The potential risk to seabirds from this fishery was third highest relative to all other fisheries assessed. The potential exposure scores were essentially the same as for the smaller vessel, domestic surface longline fishery (see below). However, consequence scores varied slightly between the two fisheries as a result of differences in fishing effort. Overall, 14 seabirds species were in the high category, 4 were in the moderate category and 7 were in the low category for potential risk from the larger vessel surface longline fishery.

When current mitigation practices were taken into account, exposure scores reduced for all species in this fishery (as was also seen in the smaller surface longline fishery; see below). However, despite these reductions in risk, 15 species continued to be in the moderate category of optimised risk, indicating that further specific management is required to reduce seabird interactions with the larger vessel surface longline fishery.

4.1.4 Surface longline—vessels < 50 m in length

The smaller vessel surface longline fishery posed the fifth-highest potential risk to seabirds relative to all other fishing methods assessed. When considering potential risk, 15 seabird species were expected to interact with smaller domestic surface longliners and one species was thought likely to interact occasionally. Given the expected impact on seabird populations, 13 of these species were assessed as being in the high category and five were in the moderate category for potential risk.

The smaller surface longliners are required to use tori lines and either line weighting or night setting. The use of mitigation devices in this fishery resulted in all seabird species having their optimised risk scores reduced to moderate or less. However, there were still 14 species in the 'moderate' category for optimised risk, implying that specific management is needed in addition to the mitigation practices currently in place.

4.1.5 Bottom longline—vessels < 40 m in length

This fishery scored the second-highest cumulative potential risk score across all fisheries. The vessels in this category were generally domestic and used either hand baiting or some type of auto baiting. Seventeen species scored the highest possible level of exposure, indicating that interactions were expected to occur, and an additional five species scored the second highest level. In addition, the consequences of interacting with this fishery were assessed as being severe to high for many species and, as such, the risk scores for these species were extreme, indicating that significant additional management is needed.

Although optimised risk scores were assessed, there was some discussion around the lack of information on the extent to which mitigation measures already prescribed by regulation were actually being applied in this fishery. The optimised risk scores were lower than the potential scores for all species, but the results indicated that specific management is required in addition to the mitigation measures currently in place for ten species.

4.1.6 Bottom longline—vessels > 40 m in length

This fishery ranked fourth highest for its potential risk to seabirds. Historically, the large vessels operating in this fishery have had large captures of seabirds, but a code of practice and effective, mandatory mitigation is now in place. Not surprisingly, potential risk from the fishery was assessed as high for a number of seabird species, particularly *Thalassarche* albatrosses, *Procellaria* petrels, giant petrels and larger shearwaters.

During the process of determining the optimised risk scores, it was noted that the vessels in this fishery still catch birds in low numbers despite the mitigation measures in place. The optimised risk scores reduced to negligible or low for most species, with the exception of grey petrels, Westland petrels, white-chinned petrels and Salvin's albatrosses, which all scored moderate optimised risk. This indicated that some specific management is still required to reduce interactions between the fishery and these species.

4.1.7 Middle depth trawl—finfish

In this fishery, potential risk was high for white-chinned petrels, Salvin's albatrosses, sooty shearwaters and white-capped albatrosses, and moderate for an additional four species. Therefore, in the absence of mitigation, specific management is required in this fishery.

For middle-depth trawlers over 28 m in length, mitigation regulations are in place to reduce warp interactions, and initiatives to manage offal continue, although the quantity of offal produced limits options in many cases. There are currently no effective mitigation measures in place to address net captures, however. Therefore, the optimised risk scores for white-chinned petrels, sooty shearwaters and grey petrels did not reduce, as these species are generally caught in the net. The optimised scores for all other seabird species in the high or moderate potential risk categories dropped. The difference between potential and optimised risk indicated that further management actions are needed to reduce seabird interactions with this fishery.

4.1.8 Middle depth trawl—squid

Potential risk in the squid fishery was high for white-chinned petrels, Salvin's albatrosses, sooty shearwaters and white-capped albatrosses, and moderate for black-browed albatrosses, southern Buller's albatrosses, Chatham albatrosses and grey petrels. A further 13 seabird species had low or negligible risk scores, indicating that these species may sometimes interact with this fishery.

When the mitigation and offal management practices in place in the squid fishery were taken into account, the risk to white-chinned petrels, sooty shearwaters and grey petrels did not change, as these species are most likely to be caught in the net. The optimised risk for those albatrosses previously at high potential risk reduced to moderate, however. Eight species had moderate or high optimised risk scores, indicating that further management is required in this fishery, particularly to address net captures.

4.1.9 Middle depth trawl—scampi

Only one vessel in this fishery was over 28 m in length and thus required to use bird scaring devices, although some smaller vessels were known to use warp scarers or other fisher-designed devices. Therefore, since most vessels in this fishery were not required to use mitigation measures, only potential risk was scored. Flesh-footed shearwaters, black petrels and sooty shearwaters had the highest potential risk scores in this fishery, and a further 20 species had low or negligible risk scores, indicating the large number of species likely to interact with this fishery. Overall, the results indicated that some specific management is required in this fishery, particularly for net captures.

4.1.10 Hand line

Hand-lining was the tenth highest fishery on the list, and of particular concern with respect to black petrels and flesh-footed shearwaters. The moderate potential risk scores for these two species indicated that some additional management is needed in this fishery. The impact of recreational hand liners on seabirds also needs to be considered.

4.1.11 Squid jig

This fishery was assessed as having the eleventh-highest threat to seabirds. Since this fishery works without baits or barbed hooks, only the most aggressive seabirds are expected to interact directly with squid jig fishing gear, and such interactions are only expected to occur in exceptional circumstances. All risk scores were negligible or low, indicating that no management action is required in this fishery.

4.1.12 Dahn line

This fishery ranked twelth overall, indicating that it posed a moderate to low risk to seabirds. The workshop participants agreed that all seabird species known to interact with hook fisheries could potentially interact with dahn lining. For most species, such interactions were expected to occur only in exceptional circumstances, but the likelihood of interactions was considered slightly higher for black petrels and flesh-footed shearwaters. Overall, all species assessed were assigned a risk score of low or negligible, which implies that no specific management is required in this fishery.

4.1.13 Fish traps and pots

The potting and trapping fishery was ranked thirteenth on the list of 26 fisheries; however, many seabird species thought to interact with this fishery would not necessarily interact with any other fishery. Of particular concern were Pitt and Chatham Island shags, which are both threatened and known to associate with potting activities. Given their exposure to this fishing method, three species were assigned a consequence score of major, indicating that the impact on the population would be above the maximum acceptable level. This implies that increases to current management are required to reduce the moderate or high potential risk this fishery poses to Chatham Island, king and Pitt Island shags.

4.1.14 Trot line

Trot lining was described as a combination of dahn lining and longlining, although the level of risk to seabirds associated with trot lining was assessed as being lower than for either of the other two methods. The species most likely to be exposed to this fishery were albatrosses (particularly Buller's, Salvin's and white-capped), flesh-footed shearwaters and black petrels, with interactions expected to be uncommon. The consequence of exposure was negligible for all species except flesh-footed shearwaters and black petrels, and the impact on these two species was expected to be minor, with minimal impact on population structure or dynamics. For all species likely to be exposed to this method, overall risk was low or negligible, implying that no management is necessary.

4.1.15 Pelagic mackerel trawl

The likelihood of seabird interactions with this fishery was considered to be lower than for some other trawl fisheries, with most birds having been caught in the Southland region where effort in the fishery was low. Sooty shearwaters had a moderate potential risk score and an additional 26 species had low or negligible scores.

As for other trawlers over 28 m in length, vessels operating in this fishery are required by regulation to use bird scaring devices to mitigate warp interactions, but there are no regulations

around the use of mitigation for nets. Consequently, optimised risk was not reduced for sooty shearwaters or other petrel species likely to be caught in the net. Across the 27 species assessed as being likely to interact to some degree with this fishery, only sooty shearwaters scored a level of risk that indicated a need for specific management to reduce interactions.

4.1.16 Troll

Workshop participants with knowledge of trolling had witnessed or heard about seabird captures in this fishery. Species considered to have the highest level of exposure to trolling were Australasian gannets, black petrels and Buller's shearwaters. Confidence levels in scoring exposure were low due to the poor data available to assess this fishery. Overall, risk scores were low or negligible for all species except black petrels, where the category of moderate implied that some specific management is needed.

4.1.17 Middle depth trawl—southern blue whiting

The species most likely to interact with this fishery were grey petrels, black-browed albatrosses, Campbell albatrosses, Salvin's albatrosses and white-capped albatrosses, but with minimal impact on population structure or dynamics in each case. Potential risk was low for all species that may interact with this fishery, and the optimised risk scores reduced or remained at the lowest score for all species except grey petrels, sooty shearwaters and white-chinned petrels, which are more likely to be caught in the net. The results implied that no further direct management is required in this fishery (as optimised risk scores were all low or negligible) but, as for other trawl fisheries, consideration should be given to addressing the impacts associated with net captures.

4.1.18 Deep water bottom trawl

The risk to seabird species from deep water bottom trawlers was considered to be lower than for other offshore trawl fisheries, which was illustrated by this fishery having the lowest potential risk score of all the trawl fisheries assessed. The potential risk to seabirds from this fishery was expected to be remote or rare for all species except the two Buller's albatrosses, Salvin's albatrosses and white-capped albatrosses, for which interactions were expected to be uncommon. Since the consequences of interactions with this fishery were considered to be low or negligible, potential risk scores were also in the low or negligible category, even without considering mitigation measures. The optimised risk scores were also low or negligible, indicating that no management action is required in this fishery.

4.1.19 Inshore drift net

Shag species were considered to be at greatest risk in this fishery. However, of the 12 seabird species with the potential to interact with this fishery, only pied shags were thought to require specific management action.

4.1.20 Danish seine

Danish seining ranked twentieth of the 26 fisheries assessed. Seabird interactions with this fishery were considered to be rare or unlikely, but concern was raised about the potential impact of this fishery on king shag populations, where the loss of only a few individuals could have long-term impacts; however, the likelihood of exposure for this species was considered to be low. Overall, all species that could potentially interact with this fishery were assigned to the low or negligible risk categories.

4.1.21 Beach seine, drag net

Beach seining and drag netting ranked twenty-first on the list of 26 fisheries, indicating that these fishing methods posed a low risk to seabirds. One reason for the lower ranking of this fishery was that any entangled seabirds would likely be released alive, as nets are rarely left unattended. The species assessed as being of greatest concern in this fishery were pied shags, red-billed gulls and black-backed gulls. As the workshop participants thought interactions leading to death or injury were unlikely, or likely to occur only in exceptional circumstances, risk scores for this fishery were all low or negligible, and no management was thought to be needed to mitigate direct impacts of the fishery. The need for education about the threats to nesting birds at particular times of the year and during varying tidal heights was noted, however.

4.1.22 Purse seine

The workshop participants agreed that there would need to be an exceptional event for a seabird to be caught on the optimum purse seine fishing gear. Of those species that may interact directly with this fishery, king shags were of greatest concern because of their small population size. All risk scores were in the low or negligible categories, indicating that no management is required for direct impacts associated with this fishery.

In the pilchard purse seine fishery, large underwater lights are used to attract fish. It is likely that these lights increase the number of birds on the water and, therefore, the risk of birds being dragged under on the deployment or retrieval of gear. Storm petrels were considered to be at particular risk from this method of fishing. Workshop participants thought that this fishery would have a greater impact on seabirds because of the lights, but confidence was low given the lack of data.

4.1.23 Ring net

Ring netting ranked twenty-third on the list of fisheries. Seabirds would interact with this fishery only in exceptional circumstances and entangled birds are generally expected to be released alive, as nets are continuously attended. Pied shags were considered most likely to interact with this fishery, but the consequences of any interactions were considered to be negligible. All potential risk scores for this fishery were low or negligible.

4.1.24 Diving

As there is no known impact to seabird species from this method, no management is indicated.

4.1.25 Dredge

The numbers of birds known to associate with dredging activities were low, so this fishery scored zero for all species assessed. While some level of risk was noted, there was no information to suggest interactions would occur in this fishery.

4.1.26 Hand gather

The workshop participants agreed that there was no known direct impact to any seabird species from hand gathering. However, there was concern about indirect, site-based disturbance associated with people, dogs, vehicles, etc. This indicated that some management of indirect impacts is required for both commercial and recreational hand gathering, including site restrictions at certain times of the year.

4.2 Relative assessments across all fisheries

4.2.1 Seabirds

This study showed that four seabird species (Salvin's albatrosses, white-chinned petrels, white-capped albatrosses and black petrels) are particularly susceptible to impacts from a number of New Zealand fisheries and with potentially high consequences. This information matches what is already known from autopsy and observer records (CSP 2008; Rowe 2009, 2010). Therefore, particular attention needs to be paid to the fisheries with which these birds interact so that appropriate management actions can be applied to them. It should be noted, however, that the scores arrived at in this study were determined from potential risk. When optimised risk is examined, the species at highest risk are the same, but the ranking of *Thalassarche* albatrosses drops relative to that of petrels, as the latter are more likely to be caught in trawl nets for which there is currently no effective direct mitigation known of or in place. Potential and optimised risk scores were the same for species such as shags and penguins, as they are impacted by fisheries that have no mitigation measures in place.

The second highest risk grouping of birds includes sooty shearwaters, grey petrels, southern Buller's albatrosses, flesh-footed shearwaters, black-browed albatrosses, Chatham albatrosses and northern Buller's albatrosses. These species are at high risk of interacting with commercial fishing operations, although actual interactions will be reduced by the mitigation measures that are in place in some of the fisheries.

While some species had relatively high risk scores because they interact with a number of fisheries, other species with high threat statuses, localised foraging areas and specific fisheries with which they may interact were also identified as needing close attention. Examples include yellow-eyed penguins in setnets, Chatham and Pitt Island shags in pots, king shags with a small number of fishing methods, and the potential for Hutton's and fluttering shearwaters to be caught in large numbers in setnets. As such, the overall scores for seabirds do not give a complete picture of risk, as individual fisheries also need to be examined.

4.2.2 Fisheries

Twenty-three of the 26 fisheries assessed were considered to pose some level of risk to seabirds in the NZ-EEZ. The setnet fishery scored highest relative to all other fishing methods and, considering no mitigation methods are currently in place in this fishery, should be a priority for research and management. The inshore (smaller vessel) trawl fishery posed the second highest risk to seabirds. Therefore, the development of mitigation methods for inshore trawl fisheries should also be a priority, and should build on knowledge gained from the mitigation methods used on larger trawl vessels and the innovations already in place on some inshore trawlers.

Despite mitigation requirements on all longline vessels and trawlers over 28 m in length, most of these fisheries still ranked among the top ten fisheries in terms of risk to seabirds, although variations in the number of species likely to interact with these fisheries and the smaller extent of fishing effort for some methods relative to others does need to be taken into account in these assessments. Nevertheless, further work is still required to reduce interactions in these fisheries.

Results indicate that further knowledge about interactions is required for a number of fisheries that have never had onboard observers on their fishing vessels in order to determine necessary levels of management. This comment particularly applies to potting and trapping, hand-lining and trolling. While other fisheries may have risk scores that are comparable with these fisheries, these often reflect the number of species likely to interact with them as opposed to the optimised risk scores for individual species.

Two fisheries—beach seine / drag-netting and hand gathering—were identified as requiring some level of indirect management to reduce human disturbance at breeding and foraging sites. The workshop participants discussed the concept of terrestrial 'no go' zones aimed at reducing at-site disturbance from fishers accessing fishing locations.

For 7 of the 26 fisheries assessed, the results indicated that no management action is necessary to mitigate direct impacts of the fisheries on seabirds, and a further 3 fisheries were assessed as having no impact at all on seabird populations.

5. Acknowledgements

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Appendix 1

Threat classifications, vulnerability scores and fishing methods where captures have been reported for all seabird species assessed

DOC threat classifications have been taken from Miskelly et al. (2008) and include the classification pathways (e.g. B (1/1))—see Miskelly et al. (2008) for further details.

DOC qualifiers are as follows: CD = Conservation Dependent, De = Designated, DP = Data Poor, EF = Extreme Fluctuations, IE = Island Endemic, Inc = Increasing, OL = One Location, PD = Partial Decline, RR = Range Restricted, RF = Recruitment Failure, SO = Secure Overseas, Sp = Sparse, St = Stable, TO = Threatened Overseas. Those species assessed as Near Threatened (NT) by IUCN are also identified.

See section 2.1.1 for details on the breeding population status, behavioural susceptibility to capture and life history strategy scoring, and calculation of the average.

BLL = bottom longline, TRW = trawl, SLL = surface longline, SN = setnet.)

SPECIES GROUP	COMMON NAME	SCIENTIFIC NAME	DOC THREAT CLASSIFICATION	DOC QUALIFIER	BREEDING POPULATION STATUS	BEHAVIOURAL SUSCEPTIBILITY TO CAPTURE	LIFE-HISTORY STRATEGY	AVERAGE	FISHING METHODS WITH OBSERVED CAPTURES
Gannets	Australasian gannet	*Morus serrator*	Not Threatened	De Inc SO	0	2	1	1.00	BLL
Gannets	Masked booby	*Sula dactylatra fullageri*	Nationally Endangered B (1/1)	RR St TO	1	1	1	1.00	
Gulls & terns	Common noddy	*Anous stolidus pileatus*	Coloniser	OL SO	1	1	1	1.00	
Gulls & terns	White-capped noddy	*Anous tenuirostris minutus*	Naturally Uncommon	RR SO	1	1	1	1.00	
Gulls & terns	Black-fronted tern	*Chlidonias albostriatus*	Nationally Endangered C (1/1)	DP	1	1	1	1.00	
Gulls & terns	White tern	*Gygis alba royana*	Nationally Critical A	OL SO	3	1	1	1.67	
Gulls & terns	Black-billed gull	*Larus bulleri*	Nationally Endangered E	De	2	1.5	1	1.50	
Gulls & terns	Black-backed gull	*Larus dominicanus dominicanus*	Not Threatened	SO	0	1.5	1	0.83	TRW
Gulls & terns	Red-billed gull	*Larus novaehollandiae scopulinus*	Nationally Vulnerable E (1/1)		2	1.5	1	1.50	
Gulls & terns	Caspian tern	*Hydroprogne caspia*	Nationally Vulnerable B (1/1)	SO	1	1	1	1.00	
Gulls & terns	Sooty tern	*Onychoprion fuscata kermadeci*	Naturally Uncommon	DP RR	1	1	2	1.33	
Gulls & terns	Fairy tern	*Sternula nereis davisae*	Nationally Critical A	CD RR	3	1	1.5	1.83	
Gulls & terns	White-fronted tern	*Sterna striata*	Declining B (1/1)	DP	2	1	1.5	1.50	
Gulls & terns	Antarctic tern	*Sterna vittata bethunei*	Recovering A	RR	0	1	1.5	0.83	
Gulls & terns	Southern white-fronted tern	*Sterna striata aucklandorna*	Nationally Vulnerable B (1/1)	DP RR	1	1	1	1.00	
Large albatrosses	Antipodean albatross	*Diomedea antipodensis antipodensis*	Naturally Uncommon	IE RR	1	3	3	2.33	SLL, TRW
Large albatrosses	Gibson's albatross	*Diomedea antipodensis gibsonii*	Nationally Vulnerable D (1/1)	IE RR	2	3	3	2.67	SLL, TRW
Large albatrosses	Southern royal albatross	*Diomedea epomophora epomophora*	Naturally Uncommon	RR	1	2.5	3	2.17	BLL, SLL, TRW
Large albatrosses	Wandering albatross	*Diomedea exulans*	Migrant	TO	1	3	3	2.33	BLL, SLL, TRW
Large albatrosses	Northern royal albatross	*Diomedea epomophora sanfordi*	Naturally Uncommon	RR	1	2	3	2.00	SLL, TRW
Large *Pterodroma* petrels	White-headed petrel	*Pterodroma lessonii*	Not Threatened	De RR SO	0	2	2	1.33	SLL, TRW
Large *Pterodroma* petrels	Grey-faced petrel	*Pterodroma macroptera*	Not Threatened	De Inc RR	0	2	2	1.33	BLL, SLL, TRW
Large *Pterodroma* petrels	Soft-plumaged petrel	*Pterodroma mollis*	Coloniser	Inc OL SO	1	1	2	1.33	
Large shearwaters	Flesh-footed shearwater	*Puffinus carneipes*	Declining B (1/1)	RR TO	2	3	2	2.33	BLL, SLL, TRW
Large shearwaters	Sooty shearwater	*Puffinus griseus*	Declining C (1/1)	SO(NT)	3	3	2	2.67	BLL, SLL, SN, TRW
Large shearwaters	Wedge-tailed shearwater	*Puffinus pacificus*	Relict B	RR SO	1	2	2	1.67	
Penguins	Eastern rockhopper penguin	*Eudyptes filholi*	Nationally Critical C	TO	3	1	1	1.67	

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Appendix 1—continued

SPECIES GROUP	COMMON NAME	SCIENTIFIC NAME	DOC THREAT CLASSIFICATION	DOC QUALIFIER	BREEDING POPULATION STATUS	BEHAVIOURAL SUSCEPTIBILITY TO CAPTURE	LIFE-HISTORY STRATEGY	AVERAGE	FISHING METHODS WITH OBSERVED CAPTURES
Penguins	Fiordland crested penguin	*Eudyptes pachyrhynchus*	Nationally Vulnerable C (1/1)	Sp	2	1	1	1.33	
Penguins	Snares crested penguin	*Eudyptes robustus*	Naturally Uncommon	IE OL	1	1	1	1.00	
Penguins	Erect-crested penguin	*Eudyptes sclateri*	Naturally Uncommon	RR	1	1	1.5	1.17	
Penguins	White-flippered blue penguin	*Eudyptula minor albosignata*	Nationally Vulnerable B	De RR	1	2	1	1.33	
Penguins	Chatham Island blue penguin	*Eudyptula minor chathamensis*	Naturally Uncommon	IE RR	1	2	1	1.33	
Penguins	Northern blue penguin	*Eudyptula minor iredalei*	Declining A (1/1)	DP EF	2	2	1	1.67	
Penguins	Southern blue penguin	*Eudyptula minor minor*	Declining A (1/1)	DP	2	2	1	1.67	
Penguins	Yellow-eyed penguin	*Megadyptes antipodes*	Nationally Vulnerable B (1/1)	EF	1	3	1	1.67	SN
Procellaria petrels	White-chinned petrel	*Procellaria aequinoctialis*	Declining C (1/1)	RR TO	3	3	2	2.67	BLL, SLL, SN, TRW
Procellaria petrels	Grey petrel	*Procellaria cinerea*	Declining B (1/1)		2	3	2	2.33	BLL, SLL, TRW
Procellaria petrels	Black petrel	*Procellaria parkinsoni*	Nationally Vulnerable B (1/1)	RR	1	3	2	2.00	BLL, SLL, TRW
Procellaria petrels	Westland petrel	*Procellaria westlandica*	Naturally Uncommon	OL St	1	2	2	1.67	BLL, SLL, SN, TRW
Shags	Campbell Island shag	*Leucocarbo campbelli*	Naturally Uncommon	DP IE OL	1	2	1	1.33	
Shags	King shag	*Leucocarbo carunculatus*	Nationally Endangered B (1/1)		1	2	1	1.33	
Shags	Stewart Island shag	*Leucocarbo chalconotus*	Nationally Vulnerable B (1/1)		1	2	1	1.33	
Shags	Auckland Island shag	*Leucocarbo colensoi*	Nationally Vulnerable B (1/1)	IE RR St	1	2	1	1.33	
Shags	Pitt Island shag	*Stictocarbo featherstoni*	Nationally Endangered A (1/1)	IE RR	2	2	1	1.67	
Shags	Chatham Island shag	*Leucocarbo onslowi*	Nationally Endangered B (1/1)	DP IE RR	1	2	1	1.33	
Shags	Spotted shag	*Stictocarbo punctatus punctatus*	Not Threatened		0	2	1	1.00	SN, TRW
Shags	Bounty Island shag	*Leucocarbo ranfurlyi*	Nationally Critical A	IE OL	3	2	1	2.00	
Shags	Pied shag	*Phalacrocorax varius varius*	Nationally Vulnerable C (1/1)		2	2	1	1.67	BLL, SN
Shags	Black shag	*Phalacrocorax carbo novaehollandiae*	Naturally Uncommon	SO Sp	1	2	1	1.33	
Shags	Little shag	*Phalacrocorax melanoleucos brevirostris*	Naturally Uncommon	Inc	1	2	1	1.33	
Shags	Little black shag	*Phalacrocorax sulcirostris*	Naturally Uncommon	RR	1	2	1	1.33	
Small albatrosses	Light-mantled albatross	*Phoebetria palpebrata*	Declining B (1/1)	DP RR SO(NT)	2	3	2	2.33	SLL
Small albatrosses	Buller's albatross (northern)	*Thalassarche* nov. sp.	Naturally Uncommon	RR	1	3	2	2.00	BLL, SLL, TRW
Small albatrosses	Buller's albatross (southern)	*Thalassarche bulleri*	Naturally Uncommon	RR	1	3	2	2.00	BLL, SLL, TRW

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Appendix 1—continued

SPECIES GROUP	COMMON NAME	SCIENTIFIC NAME	DOC THREAT CLASSIFICATION	DOC QUALIFIER	BREEDING POPULATION STATUS	BEHAVIOURAL SUSCEPTIBILITY TO CAPTURE	LIFE-HISTORY STRATEGY	AVERAGE	FISHING METHODS WITH OBSERVED CAPTURES
Small albatrosses	Indian yellow-nosed albatross	*Thalassarche carteri*	Coloniser	TO	1	3	2	2.00	BLL
Small albatrosses	Grey-headed albatross	*Thalassarche chrysostoma*	Nationally Critical C	DP OL TO	3	3	2	2.67	
Small albatrosses	Chatham albatross	*Thalassarche eremita*	Naturally Uncommon	IE OL	1	3	2	2.00	BLL, SLL, TRW
Small albatrosses	Campbell albatross	*Thalassarche impavida*	Naturally Uncommon	IE OL	1	3	2	2.00	SLL, TRW
Small albatrosses	Black-browed albatross	*Thalassarche melanophrys*	Coloniser	TO	1	3	2	2.00	BLL, SLL, TRW
Small albatrosses	Salvin's albatross	*Thalassarche salvini*	Nationally Vulnerable D (1/1)	DP RR TO	2	3	2	2.33	BLL, SLL, TRW
Small albatrosses	White-capped albatross	*Thalassarche steadi*	Declining C (1/1)	DP RR	3	3	3	3.00	BLL, SLL, TRW
Small shearwaters	Buller's shearwater	*Puffinus bulleri*	Naturally Uncommon	OL St	1	2	2	1.67	BLL, TRW
Small shearwaters	Fluttering shearwater	*Puffinus gavia*	Relict B	RR	1	2	2	1.67	BLL, SN, TRW
Small shearwaters	Hutton's shearwater	*Puffinus huttoni*	Declining C (1/1)	OL	3	2	2	2.33	
Other birds	Brown skua	*Catharacta antarctica lonnbergi*	Naturally Uncommon	Sp	1	1	1	1.00	
Other birds	Snares cape petrel	*Daption capense australe*	Naturally Uncommon	RR	1	2.5	2	1.83	BLL, TRW
Other birds	Cape petrel	*Daption capense capense*	Migrant	SO	1	2.5	2	1.83	BLL, SLL, SN, TRW
Other birds	White-bellied storm petrel	*Fregetta grallaria grallaria*	Nationally Endangered B (1/1)	DP	1	1.5	2	1.50	
Other birds	Black-bellied storm petrel	*Fregetta tropica*	Not Threatened	De RR	0	1.5	2	1.17	TRW
Other birds	Grey-backed storm petrel	*Garrodia nereis*	Relict B	RR SO	1	1.5	2	1.50	TRW
Other birds	Blue petrel	*Halobaena caerulea*	Migrant	SO	1	1	2	1.33	
Other birds	Southern giant petrel	*Macronectes giganteus*	Migrant	SO(NT)	1	2	2	1.67	BLL, SLL, TRW
Other birds	Northern giant petrel	*Macronectes halli*	Naturally Uncommon	RR SO(NT)	1	2	2	1.67	BLL, SLL, TRW
Other birds	New Zealand storm petrel	*Oceanites maorianus*	Data Deficient	DP	2	1	2	1.67	
Other birds	Fulmar prion	*Pachyptila crassirostris crassirostris*	Naturally Uncommon	RR St	1	1	2	1.33	
Other birds	Lesser fulmar prion	*Pachyptila crassirostris flemingi*	Naturally Uncommon	OL SO St	1	1	2	1.33	
Other birds	Chatham fulmar prion	*Pachyptila crassirostris pyramidalis*	Naturally Uncommon	IE RR	1	1	2	1.33	
Other birds	Antarctic prion	*Pachyptila desolata*	Naturally Uncommon	RR SO	1	2	2	1.67	TRW
Other birds	Fairy prion	*Pachyptila turtur*	Relict B	RR SO	1	2	2	1.67	TRW
Other birds	Broad-billed prion	*Pachyptila vittata*	Relict B	RR SO	1	2	2	1.67	BLL, TRW
Other birds	Kermadec white-faced storm petrel	*Pelagodroma albiclunis*	Nationally Critical A	IE OL	3	1	2	2.00	
Other birds	Australian white-faced storm petrel	*Pelagodroma marina dulciae*	Vagrant B	SO	1	1	2	1.33	

Continued on next page

Appendix 1—continued

SPECIES GROUP	COMMON NAME	SCIENTIFIC NAME	DOC THREAT CLASSIFICATION	DOC QUALIFIER	BREEDING POPULATION STATUS	BEHAVIOURAL SUSCEPTIBILITY TO CAPTURE	LIFE-HISTORY STRATEGY	AVERAGE	FISHING METHODS WITH OBSERVED CAPTURES
Other birds	New Zealand white-faced storm petrel	*Pelagodroma marina maoriana*	Relict B	RR	1	1	2	1.33	
Other birds	Codfish Island South Georgian diving petrel	*Pelecanoides georgicus "Codfish Island"*	Nationally Critical A	IE OL	3	1	2	2.00	
Other birds	Southern diving petrel	*Pelecanoides urinatrix chathamensis*	Relict B	RR	1	1.5	2	1.50	
Other birds	Subantarctic diving petrel	*Pelecanoides urinatrix exsul*	Not Threatened	De RR SO	0	1.5	2	1.17	
Other birds	Northern diving petrel	*Pelecanoides urinatrix urinatrix*	Relict B	Inc RR SO	1	1.5	2	1.50	
Other birds	Red-tailed tropicbird	*Phaethon rubricauda*	Nationally Endangered B (1/1)	RR SO St	1	1	2	1.33	
Other birds	Grey ternlet	*Procelsterna cerulea albivittata*	Naturally Uncommon	RR	1	1	2	1.33	
Other birds	Chatham petrel	*Pterodroma axillaris*	Nationally Vulnerable A (1/1)	CD IE Inc OL	0	1	2	1.00	
Other birds	White-necked petrel	*Pterodroma cervicalis*	Relict B	OL	1	1	2	1.33	
Other birds	Cook's petrel	*Pterodroma cookii*	Relict B	Inc RR	1	1	2	1.33	
Other birds	Mottled petrel	*Pterodroma inexpectata*	Relict B	Inc RR	1	1	2	1.33	
Other birds	Magenta petrel (Chatham Island tāiko)	*Pterodroma magentae*	Nationally Critical A	CD IE Inc OL	3	1	2	2.00	
Other birds	Kermadec petrel	*Pterodroma neglecta*	Relict A	SO	1	1	2	1.33	
Other birds	Black-winged petrel	*Pterodroma nigripennis*	Not Threatened	De Inc RR	0	1	2	1.00	
Other birds	Pycroft's petrel	*Pterodroma pycrofti*	Recovering B	Inc RR	0	1	2	1.00	
Other birds	Norfolk Island little shearwater	*Puffinus assimilis assimilis*	Vagrant B	SO	1	1	2	1.33	
Other birds	North Island little shearwater	*Puffinus assimilis haurakiensis*	Recovering B	Inc RR	0	1	2	1.00	
Other birds	Kermadec little shearwater	*Puffinus assimilis kermadecensis*	Relict B	IE RR	1	1	2	1.33	
Other birds	Subantarctic little shearwater	*Puffinus elegans*	Naturally Uncommon	RR	1	1	2	1.33	

Appendix 2

Mitigation devices known to be in use for each fishery examined

FISHERY	MITIGATION DEVICES
Beach seine, drag net	Unknown
Bottom longline inshore	Line weighting, tori lines, bait and discard management, acoustic or physical deterrents
Bottom longline deep sea	Line weighting, tori lines, bait and discard management, acoustic or physical deterrents
Dahn line	Unknown
Danish seine	Unknown
Deep water bottom trawl	Bird scaring devices, offal management
Diving	Unknown
Dredge	Unknown
Fish traps	Unknown
Hand gather	Unknown
Hand line	Unknown
Inshore drift net	Unknown
Inshore trawl	Bird scaring devices, offal management
Middle depth trawl—finfish	Bird scaring devices, offal management
Middle depth trawl—scampi	Bird scaring devices, offal management
Middle depth trawl—southern blue whiting	Bird scaring devices, offal management
Middle depth trawl—squid	Bird scaring devices, offal management
Pelagic mackerel trawl	Bird scaring devices, offal management
Pots	Unknown
Purse seine	Unknown
Ring net	Unknown
Setnet	Offal management
Squid jig	Unknown
Surface longline <50 m	Tori lines, bait and discard management, line weighting, night setting
Surface longline >50 m	Tori lines, bait and discard management, line weighting, night setting
Troll	Unknown
Trot line	Unknown

Appendix 3

Target fish species mentioned in the text

COMMON NAME	SCIENTIFIC NAME
Albacore tuna	*Thunnus alalunga*
Barracouta	*Thyrsites atun*
Bass	*Polyprion americanus*
Bigeye tuna	*Thunnus obesus*
Blue cod	*Parapercis colias*
Bluenose	*Hyperoglyphe antarctica*
Butterfish	*Odax pullus*
Cardinal fish	*Epigonus telescopus*
Cockle	*Austrovenus stutchburyi*
Deepwater tuatua	*Paphies donacina*
English mackerel	*Scomber australasicus*
Flatfish	*Colistium nudipinnis, C. guntheri, Pelotretis flavilatus, Peltorhamphus novazeelandiae, Rhombosolea retiaria, R. plebeian, R. leporine, R. tapirina*
Grey mullet	*Mugil cephalus*
Gurnard	*Chelidonichthys kumu*
Hagfish	*Eptatretus cirrhatus*
Hake	*Merluccius australis*
Hāpuku	*Polyprion oxygeneios*
Hoki	*Macruronus novaezelandiae*
Jack mackerel	*Trachurus declivis, T. murphyi, T. novaezelandiae*
John dory	*Zeus faber*
Kahawai	*Arripis trutta, A. xylabion*
Kingfish	*Seriola lalandi*
Lemon sole	*Pelotretis flavilatus*
Ling	*Genypterus blacodes*
Marlin	Istiophoridae (family)

COMMON NAME	SCIENTIFIC NAME
Orange roughy	*Hoplostethus atlanticus*
Oreo species	Oreosomatidae (family)
Oyster	*Ostrea chilensis*
Paddle crab	*Ovalipes catharus*
Pāua	*Haliotis iris*
Pipi	*Paphies australis*
Red cod	*Pseudophycis bachus*
Rig	*Mustelus lenticulatus*
Rock lobster	*Jasus edwardsii*
Rubyfish	*Plagiogeneion rubiginosum*
Scallop	*Pecten novaezelandiae*
Scampi	*Metanephrops challengeri*
School shark	*Galeorhinus galeus*
Sea cucumber	*Stichopus mollis*
Sea urchin	*Pseudechinus* spp.
Snapper	*Pagrus auratus*
Southern blue whiting	*Micromesistius australis*
Southern bluefin tuna	*Thunnus maccoyii*
Squid	*Nototodarus sloanii, N. gouldi*
Swordfish	*Xiphias gladius*
Tarakihi	*Nemadactylus macropterus*
Trevally	*Pseudocaranx dentex*
Triangle shell	*Spisula aequilatera*
Trough shell	*Mactra discors*
Tuatua	*Paphies subtriangulata*
Tuna species	*Thunnus* spp.
Warehou species	*Seriolella* spp.
Yellow belly flounder	*Rhombosolea leporina*
Yellow-eyed mullet	*Aldrichetta forsteri*