Ministry for Primary Industries
Manatū Ahu Matua

A qualitative review of New Zealand's 2013 level two risk assessment for seabirds

New Zealand Fisheries Science Review 2015/1

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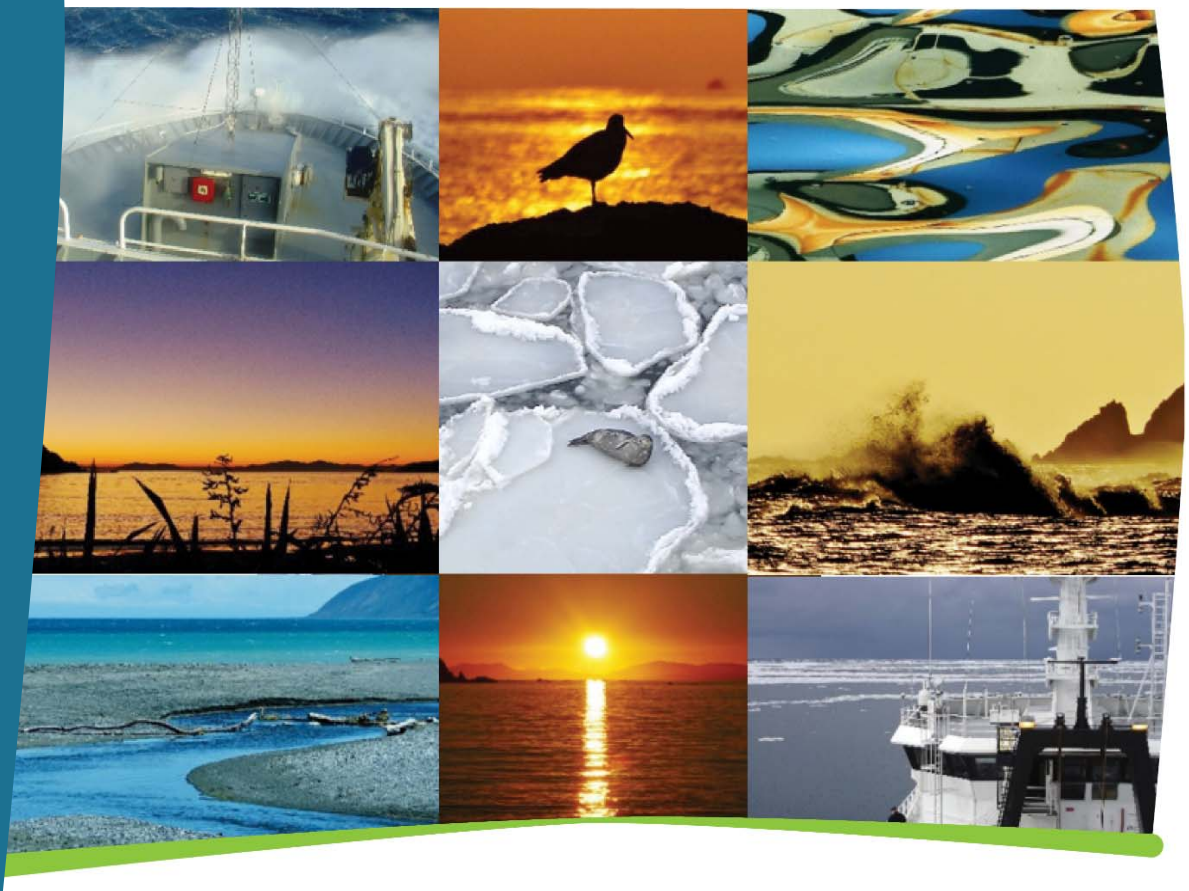

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Preface

The Ministry for Primary Industries and its predecessor, the Ministry of Fisheries, have conducted fully-independent expert reviews of stock assessments, research methodologies and research programmes since 1998. We also run specialist technical review workshops to further advance fisheries and other marine science methodologies and techniques. These fully-independent reviews and technical workshops are separate from, but complementary to, the annual Science Working Group processes that are used to ensure the objectivity and reliability of most of our scientific research and analyses.

A new publication series, Fisheries Science Reviews, has been initiated in 2015 to ensure that reports from these reviews are readily accessible. The series will include all recent and new fully-independent reviews and technical workshop reports, and will also incorporate as many historical reports as possible, as time allows. In order to avoid confusion about when the reviews were actually conducted, all titles will include the year of the review. They may also include appendices containing the Terms of Reference, a list of participants, and a bibliography of supporting documents, where these have not previously been incorporated. Other than this, there will be no changes made to the original reports composed by the independent experts or workshop participants.

Fisheries Science Reviews (FSRs) contain a wealth of information that demonstrates the utility of the processes the Ministry uses to continually improve the scientific basis for managing New Zealand's fisheries.

Walker, N.; Smith, N.; Sharp, B.; Cryer, M. (2015). A qualitative review of New Zealand's 2013 level two risk assessment for seabirds.
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The Ministry for Primary Industries convened an expert workshop on 19–20 November 2013 to review the level two seabird risk assessment results from "Risk of commercial fisheries to New Zealand seabird populations", a research report conducted by Dragonfly Science under contract to the Ministry for Primary Industries.

The workshop systematically reviewed the input data and other available information for the 26 seabird taxa with the highest risk ratios as assessed by the level two risk assessment. In summary, the results of the workshop are that:

- risk appeared to be overestimated for fourteen taxa, including black petrel;
- risk appeared to be reasonably estimated for nine taxa;
- risk appeared to be underestimated for three taxa: New Zealand king shag and Gibson's and Antipodean albatrosses.

A general preponderance of overestimated risk is acceptable in a risk assessment framework so long as results are used carefully. Risk assessments are generally designed to be precautionary in order to highlight gaps in information to direct future research accordingly. In contrast, any persistent significant underestimation of risk across many species is more problematic as a species may then not be subject to the additional research or management intervention required. Note however that the spatially explicit risk assessment framework is used not only to identify which species are potentially at risk, but also to inform choices about the likely effectiveness of various management options to reduce that risk, and to prioritize further research. In this context over-estimated risk scores for a particular species, fishery group, or area may lead to sub-optimal prioritization, and ultimately delay risk reduction interventions for those species genuinely at risk. For this reason, modification to improve the level two risk assessment consistent with the recommendations of this workshop is a high priority for all at-risk species, regardless of whether those modifications are expected to produce a decrease or an increase in overall species-level risk.

Where current risk estimates were thought to be biased in either direction, this workshop did not seek to replace or modify the existing estimates for each taxon, but rather gave advice on how to improve the risk assessment at the next iteration under the existing framework, and made recommendations for further research. In general, workshops like this should be seen as an important part of the risk assessment framework.

Where the workshop determined that the risk ratio (potential fatalities divided by PBR_1) was likely to have been overestimated, a change in the risk category (e.g., high, medium, low) for that species is not necessarily required at this stage, but it does indicate that such a change may be likely when the level two risk assessment is updated consistent with the workshop recommendations. It is difficult at this stage to predict to what extent the estimated risk ratios are likely to change, or whether there will be any corresponding change to risk category, based on recommendations from this workshop, without a complete re-run of the level two risk assessment. Managers should be aware that in the next iteration of the level two risk assessment, the estimated risk ratio estimates can be expected to change for some species.

1. INTRODUCTION

1.1 Purpose of workshop:

The core purpose of this workshop was to review the inputs and associated output of the level two seabird risk assessment for the taxa with the highest risk ratio as assessed by the level two seabird risk assessment in "Risk of commercial fisheries to New Zealand seabird populations", a research report conducted by Dragonfly Science under contract to the Ministry for Primary Industries (Richard & Abraham 2013b). The workshop specifically sought to determine whether the assessment of each species provides a reasonable representation of risk. Underlying this is the intent to ensure that the prioritisation of further work and resources on seabirds in fisheries is most appropriately targeted where needed.

For each species:

- where there are data to suggest that the representation of risk may not be appropriate, the workshop aimed to document that information and suggest future work necessary to address the identified issues and modify the level two assessment accordingly; and
- if possible, in the context of the existing level two risk assessment framework, identify replacement input parameters or the imposition of Bayesian constraints on outputs consistent with the other data sources identified, to be implemented in the next iteration of the level two assessment.

As with all MPI fisheries science reviews, this review workshop was fundamentally about science quality assurance.

1.2 Scope of workshop

This review workshop was a scientific peer review of the output of the level two seabird risk assessment for the 26 seabird taxa with the highest risk ratios as assessed by the current implementation of the level two risk assessment (Richard & Abraham 2013b), including the biological parameters and spatial distributions used to generate the outputs. The underlying method of risk assessment was out of scope for the workshop.

The workshop reviewed output for the 26 seabird taxa assessed to have the highest estimated risk ratios in the level two risk assessment (Figure 1 in Appendix 1 below Richard & Abraham 2013b); on the basis of these estimates these 26 seabird taxa were categorised at very high, high, medium or low fisheries-associated risk. Taxa categorised as being at negligible risk were not considered.

1.3 Context

More seabird species breed in New Zealand than anywhere else in the world. New Zealand seabirds should have the opportunity to thrive in New Zealand waters and around the world without pressure from fishing-related mortality. The National Plan of Action (NPOA) - Seabirds 2013 (MPI 2013) recognises New Zealand's unique place in the world for seabirds and our desire to be at the leading edge of international seabird conservation.

The long term objective of the NPOA-Seabirds 2013 is that: "New Zealand seabirds thrive without pressure from fishing related mortalities, New Zealand fishers avoid or mitigate against seabird captures and New Zealand fisheries are globally recognised as seabird friendly."

The NPOA-Seabirds 2013 sets out 5-year objectives to guide management of incidental seabird catch in New Zealand fisheries. The current management approach will see the objectives achieved through integration into MPI's fisheries planning process.

Research and information underpin management of seabird interactions with fisheries. MPI and the Department of Conservation contract independent research providers to deliver analyses and reports as required. This research remit includes seabird interactions with fisheries, population/demographic studies and mitigation research. International information resources include Agreement on the Conservation of Albatross and Petrel (ACAP) species profiles, best practice mitigation guidelines and the International Union for Conservation of Nature (IUCN) Red List on population status.

Information about seabird interactions with fisheries comes from a variety of sources. Some is opportunistic (for example, a researcher making an ad-hoc observation of seabirds caught in a set net washed up on a beach), but most is collected in organised observer programmes designed to describe the nature and extent of seabird captures in New Zealand fisheries. Many of New Zealand's commercial fisheries have Ministry for Primary Industries (MPI) observer coverage, which provides robust data on the nature and extent of seabird interactions with New Zealand fisheries. All commercial fishers are also required by law to provide data about their fishing activities on standardised forms. In combination these data sources are used to describe the nature and extent of seabird captures in fisheries. A database of seabird capture information, including associated fishing activity and observer data, is maintained online. It can be used to produce annual fishery sector or individual species summaries over one or many years (http://data.dragonfly.co.nz/psc/). The methods used for the bycatch estimation within the online database follows those described in technical reports on bycatch estimation for seabirds (Abraham & Thompson 2011, Abraham et al. 2013).

A key step in using this information, and critical to the NPOA-Seabirds 2013, is risk assessment. The New Zealand spatially explicit risk assessment approach is used to determine management priorities, and to inform the design of management interventions and/or additional research to achieve those priorities. The five year biological risk objective in the NPOA Seabirds 2013 is that "Incidental mortality of seabirds in New Zealand fisheries is at or below a level that allows for the maintenance at a favourable conservation status or recovery to a more favourable conservation status for all New Zealand seabird populations".

Richard & Abraham (2013b) provided the most recent implementation of the risk assessment framework which underpins the NPOA Seabirds 2013. The study builds on a series of increasingly sophisticated analyses since 2008 (Waugh et al. 2009, Richard et al. 2011, Richard et al. 2012, Richard & Abraham 2013b) and estimated risk for most of the seabird species that breed in the New Zealand region associated with mortalities in commercial trawl, longline and setnet fishing. Risk was assessed by comparing an estimate of the annual potential fatalities (APF), from incidental fisheries captures, with a modified index of population productivity derived from population modelling (Richard & Abraham 2013a) but designed to closely replicate the Potential Biological Removals, or PBR, of Wade (1998). The annual potential fatalities include an estimate of the cryptic fatalities, seabirds that may be killed by the fishing activity but not brought on board the vessel and counted among observable captures observed. In a departure from usual practice, Richard & Abraham (2013b) did not include a recovery factor (FR, typically between 0.1 and 0.5) in their estimates of PBR and called them PBR_1. This approach was designed to separate risk treatment issues (especially appetite for risk) from risk assessment issues.

An index of the risk to seabird populations from fisheries bycatch was calculated as the ratio APF/PBR, including explicit estimation of uncertainty; PBR_1, a risk index distribution that extends to values greater than one indicates that the potential fatalities are likely to exceed the productive capacity of the population. The risk index was estimated for 70 seabird species (or subspecies) that breed in the New Zealand region (Table 1, Figure 1 in Appendix 1 below). From this index, the risk was assigned the following categories:

- Very high: median risk index greater than 1, or upper 95% confidence level greater than 2,

- High: median risk index greater than 0.3, or upper 95% confidence level greater than 1,
- Medium: median risk index greater than 0.1, or upper 95% confidence level greater than 0.3,
- Low: upper 95% confidence level of the risk index greater than 0.1; and
- Negligible: upper 95% confidence level of the risk index less than 0.1.

The review workshop considered the inputs and associated outputs of the level two seabird risk assessment for those 26 seabird taxa with the highest risk ratios (Figure 1 in Appendix 1 below, Richard & Abraham 2013b), specifically to determine whether the risk ratio estimate by species is a reasonable representation of risk and to make recommendations to improve species-specific risk assessment outputs. This review will inform prioritisation of resources to improve fisheries risk assessment for these species.

The workshop decided not to re-estimate risk for species where it was thought that the risk ratio estimated by Richard & Abraham (2013b) was likely to be biased. Instead, the workshop discussed and documented advice on the proper interpretation of the result and approaches to improving the estimation of risk at the next iteration under the existing framework. The workshop noted that a standardised algorithmic approach cannot be expected to incorporate all available information to inform our understanding of risk for each species/fishery group, nor is a fully quantitative risk assessment always available where additional information exists. As a result, workshops of this nature are likely to be important as an ongoing part of the hierarchical risk assessment framework to ensure that the outputs of the level two risk assessment are interpreted in the context of other information, and modified as appropriate. The next iteration of the level two risk assessment is expected to commence early in 2014.

In this context, it is important to note that a workshop conclusion of likely bias in the current risk ratio estimate does not necessarily imply that the species-level risk categorisation is incorrect (because each category includes a wide range of risk ratio) or that there is no risk. In general, it will be necessary to re-run the risk assessment before such conclusions can be drawn.

2. WORKSHOP RECOMMENDATIONS BY SPECIES

2.1 Black petrel (*Procellaria parkinsoni*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the black petrel at very high risk with a median estimated risk ratio of 19.90 (95% c.i.: 11.40 – 32.80). The review workshop agreed that this risk was likely to be overestimated in terms of the overall risk ratio and particularly in some fisheries, but because the current risk estimate is so extreme, actual fisheries risk to black petrels may remain in the 'very high; category even when appropriate modifications to the risk assessment method have been implemented.

Supporting information regarding the key parameters included in the level two risk assessment

Distribution:

The risk assessment predicts captures into the gulfs and harbours, such as into the Hauraki Gulf, however these are not supported by the observed captures. There have been some new seasonally disaggregated distribution plots developed by Dragonfly in a recent project supported by MPI. These distribution plots (shown to the workshop in draft form) utilise counts of black petrels by observers on board fishing vessels, transects undertaken by Chris Gaskin and a small amount of tracking of birds by Elizabeth Bell, and are correlated with environmental variables to produce predictive distributions in each of four distinct breeding cycle seasons (the pre-egg laying period, the incubation period, the guarding and chick rearing period, and the non-breeding season). The draft distribution plots estimate concentrations of black petrels further offshore and lower concentrations within the Hauraki Gulf. Re-implementation of the level two assessment using these distributions would be likely to reduce the risk

to black petrels from the inshore bottom longline fisheries, due to reduced overlap with these fisheries, but the risk from surface longline fisheries would remain high. The finalised spatially resolved distribution maps for black petrel will be presented to the AEWG for review and made available for future implementations of the level two risk assessment. Other work is currently underway for MPI to model spatial overlap with fisheries at a finer spatial and temporal scale, and to model the effect of other factors potentially affecting black petrel capture rates (i.e. mitigation, time of day, moon phase, etc.) to inform a species specific risk reduction strategy for black petrels.

The incorporation of the revised black petrel distribution layers will be likely to reduce the estimated fatalities. Further disaggregation of fishery groups (particularly bottom longline) within the risk assessment would also be desirable but due to the lack of available data about the interactions of some fisheries with seabirds this is not currently possible.

It was noted by the workshop participants that Bell's electronic tracking focussed on experienced breeding birds in order to ensure that the logger will be retrievable. Tracking a broader range of individuals may show differences in behaviour between groups.

Survival:
While there is a recent estimate of adult survival of 0.95 (Bell et al. 2013) the level two risk assessment method is designed to utilise estimates of base survival rate. The 0.95 estimated by Bell et al. (2013) is higher than that used by Richard & Abraham (2013b) and therefore closer to base survival. However adopting a higher estimate of adult survival rate might not result in a significantly altered Rmax value, as it is combined with age-at-first-breeding. Rmax estimates for all *Procellaria* species are similar.

Population size and trend:
The risk ratio was considered by the workshop participants to be implausibly high given the estimated small size of the black petrel population, the apparent growth rate of the population at the monitored colony, and estimated fatalities far in excess of the PBR. If the current risk ratio estimate was accurate, the population of black petrels would be declining rapidly, however the most recent analysis, a linear regression, of the most recent survey data by Bell et al. (2013) indicates an apparent decline of 2.5%.

The black petrel population model undertaken by Francis & Bell (2010) and updated by Bell et al. (2011) found that there was insufficient information, particularly in regards juvenile survival, to determine whether the population was increasing or decreasing, indicating that the population trend may lie anywhere between -2.4% and +1.6% per annum. The count in 2013 was much higher (approximately double) that of the previous year and in line with counts undertaken from 1999 to 2003, introducing further uncertainty. This population modelling work will be updated including the most recent count data from the 2013/14 season as part of the annual study funded by DOC.

It was noted by a workshop participant that a large proportion of tag events (initial tagging and re-sightings) were not recorded in some versions of the database, and therefore there is a need to check whether the complete datasets were used in the "Seabird" modelling.

The most recent survey by Bell et al. (2013) revealed higher numbers of black petrels and more successful breeding within the surveyed area than in previous years. These results may not indicate an increase in the population size but may indicate that the recent decline in the breeding population is not entirely driven by mortalities.

The workshop participants noted that that Bell's estimates of population size do not represent the total population of black petrels. It was noted that up to 1000 birds have been banded in the course of this work, meaning that if the population estimates currently utilised in the level two risk assessment were correct, more than one in every four black petrels should be banded, whereas in reality only a small proportion of black petrels observed away from the monitored colony location are banded. It is likely that these population estimates are accurate only for the main colony near the top of Mount Hobson/Hirakimata. Bell et al. (2013) notes that other areas on Great Barrier Island should be surveyed

in order to get closer to a total population estimate as lower densities of black petrel burrows are seen in lower areas, including on or near the Hog's Back, Mount Heale and Mount Matawhero and even some areas below 300 m above sea level (as black petrel burrows have been found well below 300 m above sea level).

A suggestion discussed by the workshop participants was to electronically tag and track black petrels captured at sea (using transmitters like those employed on taiko on Chatham Islands) to track where they return to on the island, therefore indicating their colony location and aiding efforts to accurately estimate the total population size.

While it was suggested that fishers or observers could opportunistically band birds that are captured and released alive; over time such a programme could inform improved population estimates as well as estimates of release mortality, however there was considerable concern about the ability of inexperienced people to tag birds appropriately.

Sex bias in fishery incidental captures:
It is important to assess capture bias and its implications for the population as it appears that the majority of birds caught and returned via the autopsy programme are males. This will have a subsequent impact on their breeding partner and their breeding success.

Recommendations for the level two risk assessment

- Update the species/fisheries distribution to estimate spatial overlap on a finer spatial and temporal scale.
- Revise population estimate upward to account for birds outside the currently monitored central breeding area.
- Revise the estimated (base) adult survival rate (0.95 rather than 0.90).

Recommendations/options for other research

- Multivariate modelling of factors affecting black petrel capture rate.
- Population trend, mark recapture analysis.
- Assessment of the risk to black petrels from recreational fisheries.
- Improved assessment of total population size.
- Transmitter attachment and tracking of black petrel caught at sea.

2.2 Salvin's albatross (*Thalassarche salvini*)

The current level two risk assessment (Richard & Abraham 2013b) assessed Salvin's albatross as being at very high risk, with a median estimated risk ratio of 2.88 (95% c.i.: 1.47 – 5.41). The review workshop agreed that this risk was likely to be a reasonable representation of the risk to this species from New Zealand commercial fisheries.

Supporting information regarding the key parameters included in the level two risk assessment

Population size:
There is a dearth of information on this topic and the limited information that is available seems to indicate a decline in the population size. While some work towards addressing this is underway, the workshop noted that ascertaining the population trend of Salvin's albatross is recommended.

Distribution:

The workshop noted that inshore trawl (fishery group 1) makes a substantial contribution to species level risk for Salvin's albatross, but that the spatial distribution of observed captures does not perfectly match the predicted distribution based on the estimated spatial overlap in the risk assessment. The current level two risk assessment predicts captures to be distributed roughly evenly between the east and west coast of the South Island, and to extend also to the east coast of the North Island, whereas actual observed captures are concentrated off the east coast of the South Island. The workshop recommended that the rate at which the estimated density of breeding birds declines with increasing distance from the colony be adjusted, to define a larger 'core' area encompassing the Chatham Rise and east coast of the South Island but excluding the west coast of the South Island, more consistent with the observed pattern. Other data sources (e.g. observer back-of-boat sightings data) may also prove useful in refining this distribution.

The workshop participants considered that the non-breeding distribution of Salvin's albatross was not accurately mapped, as most Salvin's albatross leave for Chilean waters once they have left the breeding colonies. The current non-breeding distribution seems to incorrectly replicate the expected pattern for breeders.

Workshop participants noted that utilising amended spatial distributions as recommended here may not substantially change the overall species-level risk score for Salvin's albatross but was important to inform the design and spatial implementation of management responses, and may have implications for cost recovery.

Recommendations for the level two risk assessment

- Revise the breeding and non-breeding distribution of Salvin's albatross.

2.3 Flesh footed shearwater (*Puffinus carneipes*).

The current level two risk assessment (Richard & Abraham 2013b) assessed the flesh-footed shearwater as being at very high risk with a median estimated risk ratio of 1.41 (95% c.i.: 0.59 – 2.94). The review workshop agreed that this risk was likely to be a reasonable representation of the risk to this species from New Zealand commercial fisheries.

Supporting information regarding the key parameters included in the level two risk assessment

Survival:
The estimate of adult survival used in the risk assessment should be increased to 0.94 to reflect recent research (Barbaud et al. submitted).

Population estimate:
The estimate of total population size used by the risk assessment should be increased to 10 000 to reflect the recent research (Baker et al. in prep, Jamieson et al. 2013).

Distribution:
It was considered likely that the New Zealand breeding populations of flesh-footed shearwaters only use New Zealand waters. The at-sea foraging distribution of flesh-footed shearwaters breeding on Lord Howe Island is primarily confined within the jurisdictional Australian Fishing Zone during the breeding season (Thalmann et al. 2009). During the non-breeding season Lord Howe Island birds migrate to the northern hemisphere. Although they have not been tracked, it was considered by the workshop that the Western Australian flesh-footed shearwaters are unlikely to use New Zealand waters. Flesh-footed shearwaters from northern colonies do not go further south than Banks Peninsula, although perhaps those that breed at the Titi Island (Cook Strait) colony may range further south. Therefore, adjusting

the current distribution map to reflect relative colony populations would be likely to yield an improved distribution, with lower densities of birds around the South Island; however the workshop noted that this change is unlikely to generate substantially different results at a species level because most fisheries risk to flesh-footed shearwaters arises from fisheries that are themselves exclusively confined to the upper North Island.

Recommendations for the level two risk assessment

- Update estimates of adult survival and population.

Recommendations/options for other research

- Assess the risk posed by recreational fisheries to this species.

2.4 Southern Buller's albatross (*Thalassarche bulleri bulleri*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the southern Buller's albatross at very high risk with a median estimated risk ratio of 1.32 (95% c.i.: 0.75 – 2.58). The review workshop agreed that this risk was potentially overestimated but noted that the risk category is unlikely to change.

Supporting information regarding the key parameters included in the level two risk assessment

Distribution:
The breeding season is from mid-December to mid-October, this was transposed in the overview document provided to the workshop, and there is a need to check whether that has been transposed in the risk assessment as well.

The current level two risk assessment estimates substantial risk originating from spatial overlap of southern Buller's albatross with trawl fisheries outside of the breeding season, despite almost no observed captures in this season. In reality these birds leave for South America post fledging; seasonal distributions and/or abundances will need to be adjusted to ensure that the spatial distribution and breeding season of both Southern and Northern Buller's albatrosses are correctly defined.

Population size:
The population on the Snares increased until 2002 and then declined recently.

Observed captures:
There have been few captures identified as northern Buller's albatross. Misidentification between southern and northern Buller's is possible particularly by observers at sea. Genetic analysis is unlikely to be an immediate solution for future species identification, as genetic markers will need to be identified to separate the taxa.

The surface longline captures of southern Buller's albatross in north-eastern New Zealand (see overview document for map of captures) are likely to be northern Buller's albatross given that they occur well beyond the northern extent of the range defined for southern Buller's albatross. These capture events should be reassigned in the database, and greater care taken to groom future captures data prior to use in risk assessment.

Recommendations for the level two risk assessment

- Non-breeding season distribution/abundance needs to be revised (as southern Buller's albatross leave for South America post breeding).
- Ensure that the distinction between breeding and non-breeding season is correctly applied; once this is done, evaluate whether or not it is still necessary to estimate a separate V (vulnerability) parameter for breeding versus non-breeding birds.
- Run a sensitivity analysis to the risk assessment assuming that all captures are from one or other species (i.e. all captures are southern Buller's or all captures are northern Buller's).
- Include new population estimates as they become available.
- Re-attribute captures from the north-eastern surface longline fishery as northern Buller's albatross.

Recommendations/options for other research

- How can bycatch specimens of the two Buller's taxa be better separated?
- More research on taxonomy, genetic markers?
- Level three population model rerun following the population census to be carried out in 2014.

2.5 Chatham albatross (*Thalassarche eremita*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the Chatham albatross as being at very high risk with a median estimated risk ratio of 1.30 (95% c.i.: 0.68 – 2.59). The review workshop agreed that this was likely to be an overestimate of risk.

Supporting information regarding the key parameters included in the level two risk assessment

Survival:
The level two risk assessment used the adult survival rate of Salvin's albatross as a proxy. A survival rate was estimated from recent research (less than 96%) (Scofield pers. comm.). However the workshop discussed that the lower survival rate is unlikely to be due to fisheries impacts, therefore it is better to use a 'base' survival rate.

Due to the limited recruitment related to the constraints on nesting habitat, age at first breeding may be the most useful statistic for identifying at risk species.

Population size and trend:
Population trend has not changed substantially since 1999 based on ground counts on the Pyramid. Available nesting space is completely occupied; the breeding population appears to be constrained by nesting habitat availability. While the breeding population trend is flat, the non-breeding component of the population is unknown; therefore incidental fisheries mortality may reduce the pool of non-breeders. There is a current project underway to trans-locate some Chatham Island albatross to the mainland Chatham Island to create another colony.

The New Zealand threat status of Chatham Islands albatross has recently reduced from Critically Endangered to Naturally Uncommon.

Distribution:
Birds mostly leave New Zealand in winter for South America; the non-breeding distribution should be adjusted to reflect this more appropriately.

Fisheries overlap:
Ling bottom longline fishing around the Chatham Islands poses the most risk to this species. The high vulnerability estimate for this fishery may be strongly influenced by a single observed trip that caught twelve Chatham albatross. The effect of low-frequency high-impact events such as this on species-specific risk scores is difficult to manage; without high levels of observer coverage the actual frequency of such occurrences is hard to estimate, but the population-level effects may be substantial, and cannot be discounted.

It is possible that classifying the Chatham Island ling fishery in the same fishery group as 'inshore bottom longline' is inappropriate, due to substantial differences in the ways in which the vessels themselves are configured and operate. However without higher levels of observer coverage it is likely that there is insufficient data to meaningfully disaggregate this fishery group.

Recommendations for the level two risk assessment

- Review bottom longline vulnerability estimate (with regard to deepwater/coastal bottom longline).
- Adjust seasonal distributions to accurately reflect where the birds go outside the breeding season.

Recommendations/options for other research

- Goya et al. (2011) has reviewed artisanal fishing effort in South America (note that this will be published in English however is currently available as a Spanish paper produced for consideration by ACAP's Advisory Committee. This paper may be relevant to the development of a global risk assessment for seabirds).

2.6 New Zealand white-capped albatross (*Thalassarche steadi*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the New Zealand white-capped albatross as being at very high risk with a median estimated risk ratio of 0.78 (95% c.i.: 0.28–3.13). The review workshop agreed that this risk was likely to be an overestimate of risk due to the low population size used in the risk assessment.

Supporting information regarding the key parameters included in the level two risk assessment

Population size:
The breeding population size as used in the current level two risk assessment appears to be too low. The most recent population estimate would be more appropriate to use, which is approximately 100 000 breeding pairs (when adjusted for non-breeding birds, see Baker et al. 2013). Workshop participants noted that the New Zealand white-capped albatross are principally biennial breeders, with some birds breeding annually, however, we would need to track the breeding of tagged birds during repeated on-colony surveys to detect the degree to which this is happening.

Fisheries overlap:
New Zealand white-capped albatrosses have been observed captured in the squid trawl fishery and these interactions are reasonably well described due to the level of observer coverage in this fishery. In lesser observed fisheries, they have also been observed captured in the inshore trawl fisheries. The current assessment estimates that spatial overlap with inshore trawl fisheries occurs on both the west coast and east coasts of the South Island; however actual observed captures are confined exclusively to the west coast of the South Island (i.e. the opposite pattern to that observed for Salvin's albatross). This is

consistent with tracking studies that very broadly show New Zealand white-capped albatross heading west to South Africa, while Salvin's albatross head east to South America. The workshop recommended that the spatial distribution could be changed to better reflect this pattern, if possible by defining distinct seasonal distributions.

Species identification:
The New Zealand white-capped albatross and the shy albatross were originally included in the polytypic species *Diomedea cauta* (Gould, 1841), however taxonomic revision (Nunn et al. 1996; Robertson & Nunn 1998) and subsequent molecular and morphological analysis supported the elevation of both to individual species status (Abbott & Double 2003a; 2003b; Double et al. 2003, Alderman et al. 2011). While observers often record captures of New Zealand white-capped albatrosses as "shy" albatross it is unlikely that any are in fact shy albatross. Abbott et al. (2006) showed, using mitochondrial DNA from samples from birds caught in New Zealand, Australia and South Africa, that the only area where bycatch mortality of both New Zealand white-capped albatross and shy albatross co-occurred was in Tasmanian waters; in all other zones the bycatch was exclusively white-capped albatrosses.

The misidentification of juveniles within the "shy" group of albatrosses (comprising the Chatham albatross, shy albatross, Salvin's albatross and New Zealand white-capped albatross) is possible. However, there are not many juveniles in the bycatch from New Zealand fisheries as they depart New Zealand waters, although they are known to be caught in the Great Australian Bight (principally South Australian waters) and South Africa.

Recommendations for the level two risk assessment

- More recent population counts need to be included.
- Modified and seasonally disaggregated spatial distributions should be investigated consistent with observed captures (west coast versus east coast) and inclusion of any new tracking data and/or back-of-boat sightings data.

2.7 Northern Buller's albatross (*Thalassarche bulleri platei*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the northern Buller's albatross as being at high risk with a median estimated risk ratio of 0.69 (95% c.i.: 0.38 – 1.36). The review workshop agreed that this risk was potentially overestimated but noted that the risk category is unlikely to change.

Supporting information regarding the key parameters included in the level two risk assessment

Distribution:
Seasonality of the distribution will need to be adjusted as birds leave for South America post fledging.

Observed captures (for more detail see the southern Buller's albatross section above):
There have been few captures identified as northern Buller's albatross. Misidentification between southern and northern Buller's is possible, particularly by observers at sea. Genetic analysis is unlikely to be an immediate solution for future species identification, as genetic markers will need to be identified to separate the taxa.

The surface longline captures of southern Buller's albatross in north-eastern New Zealand (see overview document for map of captures) are likely to be northern Buller's albatross given that they occur well beyond the northern extent of the range defined for southern Buller's albatross. These capture events should be reassigned in the database, and greater care taken to groom future captures data prior to use in risk assessment.

Also note the observed capture of a northern Buller's albatross from near the Three Kings Island where there is a small colony of only 14 breeding pairs. This would represent a significant impact on this small colony if this bird was from this colony.

Recommendations for the level two risk assessment

- Non-breeding seasonality distribution/abundance needs to be revised as northern Buller's albatross leave for South America post breeding.
- Run a sensitivity to the risk assessment that all captures from one or other species (i.e. assuming captures are all southern or all northern Buller's).
- Include new population estimates as they become available.
- Re-attribute captures from the north-eastern surface longline fishery as northern Buller's albatross.

Recommendations/options for other research

- How can bycatch specimens of the two Buller's taxa be better separated?
- More research on taxonomy, genetic markers?

2.8 Gibson's albatross (*Diomedea antipodensis gibsoni*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the Gibson's albatross as being at high risk with a median estimated risk ratio of 0.48 (95% c.i.: 0.25 – 1.00). The review workshop agreed that this risk was likely to be underestimated.

Supporting information regarding the key parameters included in the level two risk assessment

Fishery group definition:
Patterns of observed versus predicted capture events for Fishery Group 11 (domestic surface longline) are seen to fit poorly: the risk assessment estimates substantial numbers of captures arising from high spatial overlap with tuna target fisheries in the Bay of Plenty and southeast of East Cape, but actual observed captures are observed almost exclusively further north, in swordfish target fisheries. The workshop recommended that Fishery Group 11 be disaggregated into separate swordfish target and tuna target fisheries so that vulnerability can be estimated independently for each. This is likely to increase estimates of APF in the swordfish fishery and decrease estimates in the tuna. A higher vulnerability in the swordfish target fishery is considered likely, as swordfish is targeted closer to the surface than tuna, and wandering albatross, such as Gibson's, only have limited ability to dive and take a baited hook.

Species group vulnerability:
In the current level two risk assessment, the wandering albatrosses and royal albatrosses are grouped together for purposes of estimating vulnerability, and estimated captures are roughly equal for all four species. However actual observed captures are almost exclusively of wandering albatrosses; few royal albatross captures have been observed. The workshop recommended that in the next iteration of the level two assessment the wandering albatross species should be separated from the royal albatross species for purposes of estimating vulnerability. A likely consequence is that estimated vulnerability of wandering albatrosses (and therefore estimated APF and risk of Gibson's albatross) will increase.

It was noted that a single observed multiple-capture event in 2006 by a vessel new to the fishery may potentially skew the estimation of vulnerability, but in the absence of improved observer coverage it is difficult to estimate the frequency of such statistical outlier events, and thus their actual level of impact

on the species. The workshop participants agreed that a sensitivity analysis to observed major multiple-capture events should be undertaken in the level two risk assessment.

Misidentification of species:
Gibson's and Antipodean albatross can be particularly hard to conclusively identify, and it is worth noting that observers may identify these as a generic code for either Gibson's and Antipodean albatross combined or combined as all wandering albatross species. The misidentification of these species does not affect the estimation of vulnerability in the level two risk assessment, as all wandering albatross captures (including those of unidentified wandering albatross) are pooled to estimate vulnerability. It is possible that misidentification of the Gibson's albatross as snowy albatross which would have greater implications to the snowy albatross population (outside of New Zealand waters) due to their small population size.

Historically, live captures of seabirds were identified only by the observer, although now protocols are in place for observers to take photos (where possible) for expert verification of the species identification. There is also the ability to examine the identification success by comparing observer identification to necropsy identification.

Population size:
There is a new population estimate available in Elliot &Walker (2013). This species experienced a large adult mortality event in 2004 and since then has had greatly reduced breeding success.

Distribution:
There is new information about recent changes in distribution as tracked by Elliot & Walker (2013) with breeding individuals tracked after 2005 having a larger foraging range than those tracked prior to 2005.

Recommendations for the level two risk assessment

- Disaggregate fishery group 11 (domestic surface longline) into separate tuna target and swordfish target fishery groups.
- Split wandering albatross species from royal albatross species for estimation of vulnerability.
- Population estimate needs to be reduced (Elliot & Walker 2013).
- Spatial distribution data needs to be updated (Elliot & Walker 2013).

2.9 Cape petrel (*Daption capense*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the Cape petrel as being at high risk with a median estimated risk ratio of 0.33 (95% c.i.: 0.12 – 0.93). The review workshop agreed that this risk was likely to be overestimated.

Supporting information regarding the key parameters included in the level two risk assessment.

Taxa separation:
There are two sub-species of cape petrel. The Snare's cape petrel, *Daption capense australe*, breeds in New Zealand waters on the Snares, Bounty, Antipodes, Auckland, Campbell and Chatham Islands and the Antarctic cape petrel, *Daption capense capense*, which breeds on mainland Antarctic and Antarctic Peninsula and Antarctic and sub-Antarctic islands outside of New Zealand. A large proportion of those represented in New Zealand fisheries bycatch are the Snare's cape petrel (in 2012–13 all 28 cape petrels incidentally captured and photographed by observers were later identified as Snare's cape petrel (I.

Debski pers. comm.). The level two risk assessment has applied the bycatch of all cape petrels against the population parameters for the Snares cape petrel.

As many cape petrels are released alive and considered less likely to sustain injuries than larger birds, it was suggested at the workshop that the level two risk assessment undertake a sensitivity analysis including or excluding those birds released alive.

Recommendations for the level two risk assessment

- Only examine the effects of New Zealand fisheries bycatch of Snares cape petrel, by applying a proportional allocation approach based on the necropsy results; this may require an examination of the ratio of each species from previous necropsy/identification studies.
- Cross reference with temporal distribution data.
- Run a sensitivity analysis based on the levels of cape petrel released alive.

2.10 Antipodean albatross (*Diomedea antipodensis antipodensis*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the Antipodean albatross as being at high risk with a median estimated risk ratio of 0.30 (95% c.i.: 0.18 – 0.49). The review workshop agreed that this risk was likely to be underestimated.

Supporting information regarding the key parameters included in the level two risk assessment.

Fishery group definition (see Gibson's albatross above for more details):
The workshop recommended that Fishery Group 11 be disaggregated into separate swordfish target and tuna target fisheries so that vulnerability can be estimated independently for each. This is likely to increase estimates of APF in the swordfish fishery and decrease estimates in the tuna.

Species group vulnerability (see Gibson's albatross above for more details):
The workshop recommended that in the next iteration of the level two assessment the wandering albatross species should be separated from the royal albatross species for purposes of estimating vulnerability. A likely consequence is that estimated APF of Antipodean albatross will increase.

Population size and trend:
There has been a decline in the size of the Antipodean albatross population; this should be reflected in the updated level two risk assessment. It was also suggested that a bias in the sex of bycatch birds would also have flow on effects for the population; this needs to be checked in the necropsy records.

Distribution:
Tracking data show breeding Antipodean albatross going across to Chile. However, it is unknown what proportion of the population disperses out of New Zealand waters.

Recommendations for the level two risk assessment

- Disaggregate fishery group 11 (domestic surface longline) into separate tuna target and swordfish target fishery groups.
- Split wanderers from royal albatross species for estimation of vulnerability.
- Population estimate needs to be reduced.
- Check on sex bias and impacts of populations.

Recommendations/options for other research

- Level three population modelling which is planned under contract to MPI.
- Investigate the impacts of sex bias in bycatch on population and productivity.

2.11 Northern royal albatross (*Diomedea sanfordi*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the northern royal albatross as being at medium risk with a median estimated risk ratio of 0.29 (95% c.i.: 0.12 – 0.70). The review workshop agreed that this risk was likely to be overestimated.

Supporting information regarding the key parameters included in the level two risk assessment.

Population size and trend:
A large storm in 1985 removed the vegetation from breeding locations in the Chatham Islands which greatly reduced breeding success, as subsequent eggs were laid on rocks. Subsequently, both breeding cohorts were present each year following each successive breeding failure. The population is now back to 1970s levels.

At the workshop there were claims of a change in threat classification, however, both Robertson et al. (2013) and Miskelly et al. (2008) list northern royal albatross as Naturally Uncommon.

Fishery group definition (see the Gibson's albatross section above for more details):
The workshop recommended that Fishery Group 11 be disaggregated into separate swordfish target and tuna target fisheries so that vulnerability can be estimated independently for each.

Species group vulnerability (see the Gibson's albatross section above for more details):

The workshop recommended that in the next iteration of the level two assessment the wandering albatross species should be separated from the royal albatross species for purposes of estimating vulnerability. A likely consequence is that estimated APF of royal albatrosses will decrease.

Recommendations/options for the level two risk assessment

- Disaggregate fishery group 11 (domestic surface longline) into separate tuna target and swordfish target fishery groups.
- Disaggregrate royal albatross species from wandering albatross species for estimation of vulnerabilty.

2.12 Southern royal albatross (*Diomedea epomophora*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the southern royal albatross as being at medium risk with a median estimated risk ratio of 0.27 (95% c.i.: 0.16 – 0.43). The review workshop agreed that this risk was likely to be overestimated.

Supporting information regarding the key parameters included in the level two risk assessment

Fishery group definition (see the Gibson's albatross section above for more details)
The workshop recommended that Fishery Group 11 be disaggregated into separate swordfish target and tuna target fisheries so that vulnerability can be estimated independently for each.

Species group vulnerability (see the Gibson's albatross section above for more details):
The workshop recommended that in the next iteration of the level two assessment the wandering albatross species should be separated from the royal albatross species for purposes of estimating vulnerability. A likely consequence is that estimated APF of royal albatrosses will decrease.

Population size and trend:
The population of southern royal albatross has increased since the 1950s/60s, plateaued in the early 2000s and possibly declined recently. There are approximately 8000 breeding pairs on Campbell Island. They also breed in low numbers on the Auckland islands (Enderby and Adams islands).

Fishing impacts outside New Zealand:
Juveniles and previously successful breeding cohorts head to South America (Taylor 2000). Reanalysis of Japanese bycatch photos (Scofield pers. comm.) and the outputs of a global CCSBT risk assessment (Waugh et al. 2013) show that this species is vulnerable to Japanese tuna longline in the western Indian Ocean. Band recoveries of both northern and southern royal albatross have been reported from Uruguay (I. Debski, pers. comm.). As this species spends a large proportion of time outside of New Zealand waters, a global risk assessment would be useful in assessing the level of risk to this species from other surface longline fisheries.

Recommendations for the level two risk assessment

- Disaggregate royal albatross species from wandering albatross species.
- Fishery Group 11 disaggregation.

Recommendations/options for other research

- Southern royal population estimate and trend.

2.13 Westland petrel (*Procellaria westlandica*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the Westland petrel as being at medium risk with a median estimated risk ratio of 0.25 (95% c.i.: 0.10 – 0.66). The review workshop agreed that this risk was likely to be a reasonable representation of the risk from New Zealand commercial fishing.

Supporting information regarding the key parameters included in the level two risk assessment

Distribution:
The current level two risk assessment appears to be missing the distribution of Westland petrels as shown by Landers et al (2011).

Survival:
Workshop participants commented that the adult survival rate used in the level two risk assessment seems low. There may be better or more current estimates of adult survival for this species.

Population size and trend:
The workshop was comfortable with the population estimate overall, although it was noted that the level of skipped breeders seemed low. Accounting for burrow occupancy, which is low, leads to relatively large error bounds on population estimates, which hampers our ability to determine trends.

Recommendations for the level two risk assessment

- Check for improved recent adult survival information.
- Reduce the range of population size at the top end.
- May need to refine spatial distribution to reflect findings of Landers et al. 2011.

Recommendations/options for other research

- Why is the burrow occupancy rate so low? Review of *Procellaria* burrow occupancy rates may help answer this question.

2.14 Northern giant petrel (*Macronectes halli*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the northern giant petrel as being at medium risk with a median estimated risk ratio of 0.23 (95% c.i.: 0.06 – 0.85). The review workshop agreed that this risk was likely to be a reasonable representation of the risk from New Zealand commercial fishing.

Supporting information regarding the key parameters included in the level two risk assessment

Distribution:
There is a mixed population of New Zealand breeding and Macquarie Island breeding using New Zealand waters and exposed to New Zealand fishing. Juveniles travel around the world spending time in South American waters. In New Zealand, there is a mixture of birds from colonies outside New Zealand, but there will be a higher proportion of New Zealand breeders likely to be at risk. For the purposes of estimating vulnerability and risk, the risk assessment treats all observed captures as having originated from the New Zealand population.

Identification:
It is not possible to distinguish northern giant petrels from colonies inside New Zealand from those from colonies outside New Zealand. It can also be hard to distinguish between southern giant petrels and northern giant petrels.

Behaviour:
Northern giant petrels are aggressive birds during haul, which results in about a quarter of the total northern giant petrel bycatch being caught alive and subsequently released.

Population size:
The level two risk assessment and workshop documentation appear to be missing references regarding the colonies of northern giant petrels on Campbell, Auckland, and Antipodes Islands.

Recommendations/options for the level two risk assessment

- Check the population size used for northern giant petrel.

2.15 White-chinned petrel (*Procellaria aequinoctialis*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the white-chinned petrels as being at medium risk with a median estimated risk ratio of 0.22 (95% c.i.: 0.10 – 0.53). The review workshop agreed that this risk was likely to be a reasonable representation of the risk based on current knowledge.

Supporting information regarding the key parameters included in the level two risk assessment

Population size and trend:
During surveying on Antipodes Island, it has been found that burrow numbers are high but occupancy of the burrows by white-chinned petrels was found to be low. There has been no rigorous scientific population survey done on Disappointment Island, Adams Island or Enderby Island to date. It may be possible to conduct a survey in the next few years.

Distribution:
Fraser (2005) showed differences in morphometrics between colony sites. Tracking studies of French (Iles Crozet, and the Kerguelen islands) and British (South Georgia) breeding adult white-chinned petrels do not show them using New Zealand waters. White-chinned petrels also breed on the Falklands Islands and Marion Island (South Africa). It is possible that immature white-chinned petrels from elsewhere may be caught in New Zealand waters. The tracking of white-chinned petrels from the Antipodes Island colony show them utilizing waters on the eastern side of New Zealand. For the purposes of estimating vulnerability and risk, the risk assessment treats all observed captures as having originated from the New Zealand population.

Identification:
There is some possibility of misidentification as other petrel species can have white chins. The taxonomic status of birds breeding in New Zealand is also uncertain.

Recommendations/options for other research

- Disappointment Island, Adams Island, Enderby population estimates and tracking for distribution.
- Review morphometrics studies and taxonomy (Peter Ryan) for in-zone catch and meta-population splitting.

2.16 Spotted shag (*Phalacrocorax punctatus*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the spotted shag as being at medium risk with a risk ratio of 0.21 (95% c.i.: 0.09 – 0.48). The review workshop agreed that this risk was likely to be a reasonable representation based on current knowledge.

Supporting information regarding the key parameters included in the level two risk assessment

Population size and trend:
The population estimate for spotted shags is very uncertain. Some counts of spotted shags on Banks Peninsula doubled between the 1960s/70s and the 1980s/90s.

Distribution and taxonomy:
Spotted shags from the Auckland area might be quite different genetically and may be a separate taxa. The taxonomic status of birds on the West Coast of South Island (blue shag) remains uncertain.

Species group vulnerability:
Leucocarbo shags were considered to forage most often in groups, which can lead to multiple capture events. The workshop recommended that all *Leucocarbo* shags should be grouped together as group foragers for purposes of estimating vulnerability (and distinct from other shag species that should be grouped as solitary foragers). One such multiple capture event has been observed from very low observer coverage in the inshore fisheries. In the absence of improved observer coverage it is difficult

to estimate the frequency of such multiple-capture events, and thus their actual level of impact on the species.

Other sources of mortality:
Recreational set net bycatch may also have a big impact. Lalas (1991) documented recreational set net bycatch in Otago Harbour.

Recommendations for the level two risk assessment

- Re-group the *Leucocarbo* shags together for purposes of estimating vulnerability (with the exception of the New Zealand king shag) as distinct from other shag species. The *Leucocarbo* shags includes the Campbell Island, Stewart Island, Bounty Island, spotted, Auckland Islands, Chatham Islands, and New Zealand king shag species (although see the section on New Zealand king shags for an exception).

2.17 Campbell black-browed albatross (*Thalassarche impavida*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the Campbell black-browed albatross as being at medium risk with a median estimated risk ratio of 0.19 (95% c.i.: 0.08 – 0.44). The review workshop agreed that this risk was likely to be a reasonable representation of the risk to this species from New Zealand commercial fisheries.

Supporting information regarding the key parameters included in the level two risk assessment

Population:
The population of Campbell black-browed albatross was last estimated in the 1990s, the last survey was significantly lower than earlier surveys. NIWA, under contract to DoC, have recently updated the photo-point census of Campbell black-browed albatross on Campbell Island, although results are not yet available.

Distribution:
Since the last level two risk assessment there are more data available on the distribution of Campbell black-browed albatross from recent NIWA research. These GPS and geolocation data and draft results indicate more of an overlap with capture areas on the West Coast of the South Island and East Coast of the North Island.

Identification:
As juveniles, Campbell black-browed albatross are very hard to distinguish from southern black-browed albatross; observer misidentification may hide some captures.

Recommendations for the level two risk assessment

- Examine the extent to which new distribution data from NIWA supports or improves upon the distribution map currently used.
- Incorporate new population estimates into the next iteration of the level two risk assessment, as they become available.
- Conduct a sensitivity analysis to the misidentification of juvenile Campbell black-browed and southern black-browed albatrosses.

Recommendations/options for other research

- Undertake a survey to estimate population size.

- Investigate protocols to minimise misidentification of bycaught juvenile Campbell black-browed albatross captures. Genetic analysis may be necessary.

2.18 Yellow-eyed penguin (*Megadyptes antipodes*) – mainland population only

The current level two risk assessment (Richard & Abraham 2013b) assessed the yellow-eyed penguin (mainland population only) as being at medium risk with a median estimated risk ratio of 0.19 (95% c.i.: 0.09 – 0.37). The review workshop agreed that this risk was likely to be a reasonable representation of risk based on current knowledge but recognised that there are considerable gaps in knowledge about this species.

Supporting information regarding the key parameters included in the level two risk assessment

Distribution:
The workshop participants recommended that the next iteration of the level two risk assessment should use Ellenberg data to update the spatial distribution (Ellenberg et al. in press, Ellenberg & Mattern 2012); this data includes higher-resolution colony locations and population estimates, and presumed foraging distributions based on depth contours. However for the chick rearing period, it may be better to also incorporate a maximum distance from shore within the breeding region, as yellow-eyed penguin return to nest each night (noting that yellow-eyed penguins are the least colonial of all penguin species and their breeding is dispersed over considerable stretches of coastline). There is little information available about foraging ranges outside of the chick rearing period.

After fledging, yellow-eyed penguin move north in February, which needs to be considered when defining seasonal distributions used to estimate overlap with fisheries.

The workshop also noted that the setnet fishing effort distribution used to calculate spatial overlap should be updated to include only effort distributions subsequent to the adoption of the 4 nmi coastal setnet ban in 2008.

Survival/Rmax:
The workshop noted that Ellenberg & Mattern (2012) has calculated juvenile survival, however, the level two risk assessment uses adult survival.

The workshop considered that in general Rmax for this species should be relatively high given that yellow-eyed penguin can raise two chicks per year, but concern was expressed that the value currently used is even higher than for black backed gull. A further examination could be carried out to compare the Rmax of yellow-eyed penguin against other penguins, or against other yellow-eyed penguin population information.

A previous Ministry of Fisheries research project attempted a population model for yellow-eyed penguin but this was abandoned due to inconsistencies in the data.

There was a yellow-eyed penguin population increase at Banks Peninsula after a crash in 1989–1990 and the beach and nest counts detailing the recovery could give an indication of Rmax. Workshop participants noted that this data indicates rapid recovery, suggesting that the current high Rmax values may be valid. Counts were conducted by Department of Conservation, Otago and the Yellow-eyed Penguin Trust.

Population size and trend:

Populations of yellow-eyed penguins have experienced periodic die offs of chicks and adults which are possibly related to El Nino/La Nina fluctuations. Another potential issue that has been raised is the ongoing reduction in the localised prey availability for the Stewart Island yellow-eyed penguin colonies.

Recommendations for the level two risk assessment

- Reflect the change in fishing effort distribution due to the Hector's dolphin setnet area closures.
- Include a new spatial distribution based on Ellenberg's data and presumed foraging distributions.
- Rmax should be re-examined including comparison against other penguin species and against other available yellow-eyed penguin population information.

Recommendations/options for other research

- Representative independent observer coverage on set netters that operate in important yellow-eyed penguin foraging areas i.e. Statistical areas 024 (Otago Peninsula), 026 (Catlins), 025 and 030 (Foveaux Strait).
- Comprehensive and reliable population monitoring at key breeding sites.
- At-sea distribution and foraging ranges of adults during the non-breeding season.
- GPS loggers/transmitters on juveniles, with regard to examining their distribution at sea and risk from fisheries.

2.19 Grey petrel (*Procellaria cinerea*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the grey petrel as being at medium risk with a median estimated risk ratio of 0.12 (95% c.i.: 0.06 – 0.27). The review workshop agreed that this risk was likely to be overestimated.

Supporting information regarding the key parameters included in the level two risk assessment

Grey petrel was the major species of concern for bycatch decades ago, however, changes to the levels of effort by Japanese tuna surface longline in New Zealand and use of mitigation in bottom longline (i.e. integrated weight line, tori lines, offal handling etc.) have reduced the levels of incidental captures.

Distribution:
There are new data from the Antipodes Islands breeding population that will update the distribution for the breeding season, which will increase the size of the core area, and may also add some additional core areas. A higher intensity distribution around East Cape during the breeding season during the key fishery time will increase the overlap and reduce the vulnerability, but possibly won't change the level of risk.

Non-breeders leave the New Zealand zone, migrating to the mid-Pacific ridge, north of the polar front. When the grey petrel return, they come back to Antipodes Islands for a few days then return to the mid-Pacific.

The workshop considered that the level two risk assessment should change the distribution to reflect the presence of the grey petrel population on the Campbell Islands. Observer counts behind boats on the Campbell Plateau could give an indication of relative abundance. There has been a band recovery of an Antipodes Island breeding grey petrel on Makara Beach near Wellington.

Grey petrels that breed in the Indian Ocean don't utilise New Zealand waters, and so do not co-occur with New Zealand grey petrels in New Zealand bycatch.

Survival/Rmax:
The workshop discussed the suitability of the Rmax value given that there are no data on age at first breeding and access to breeding burrows is very difficult. This could be considered as part of a *Procellaria*-wide review regarding burrow occupancy.

Population size and trend:
There have been two grey petrel population surveys on Antipodes Island which both gave very similar population estimates. Grey petrel are also known to breed on Campbell Island and on the nearby offshore stacks, but these populations are poorly known.

Table A1 from Richard & Abraham (2013b), lists 37 000 breeding pairs which is somewhat low given that two surveys on Antipodes Island estimate 53 040 (Bell 2002) and 48 960 (Sommer et. al. 2010) and there are other small populations on the Campbell Islands as well which may hold another 1000 pairs, but no one has been there in winter to conduct a survey. 50 000 breeding pairs would be a better estimate for use in the level two risk assessment.

It appeared that the proportion of grey petrel breeding may be too high.

Sex bias in fishery bycatch:
There is a sex bias of grey petrels in the observed bycatch, with predominantly females caught off East Cape. Undertaking the Fishery Group 11 split is unlikely to change the result for grey petrels to any degree. Grey petrels get caught foul hooked but also swallow entire surface longline hooks and bait.

Recommendations for the level two risk assessment

- Alter distribution based on tracking results from NIWA.
- Increase population size.
- Review proportion breeding across all species.

Recommendations/options for other research

- Survey the Campbell Island grey petrel population during winter.

2.20 Little black shag (*Phalacrocorax sulcirostris*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the little black shag as being at low risk with a median estimated risk ratio of 0.07 (95% c.i.: 0.03 – 0.15). The review workshop agreed that this risk was likely to be overestimated.

Supporting information regarding the key parameters included in the level two risk assessment

Fishery group definition (see spotted shag for more information):
This species is a flotilla bird (i.e. they forage in groups) and therefore should be regrouped for the purposes of estimating vulnerability with only the other *Leucocarbo* shags.

Distribution:
Little black shags utilise lakes during summer, feeding on smelt. They utilise estuaries and harbours mainly in winter, and don't feed far from land.

Tasman Bay is a predicted hot spot of risk to this little black shag from flatfish trawl, but this is still a very low predicted number of captures.

Population size and trend:
This species may have come from Australia within the last 150 years. It is known to have arrived in large numbers in Waikato lakes in the 1970s. Population size was estimated some time ago and is considered out of date. Graeme Taylor conducted a survey in the 1980s on the major colony at Lake Rotorua, and estimated 950 nests. This species has dispersive juveniles. The colony has moved repeatedly since the 1980s around sites in the central North Island. Some breeding in addition to the main colony occurs in other areas including Canterbury, but these are only very small colonies.

The workshop considered that it may be appropriate to increase the population estimate, given the estimate of 2000–4000 individuals from Taylor (G. Taylor pers. comm.).

Other sources of risk:
There have been tag returns by recreational fishers, so this species is susceptible to inshore recreational setnet fishing.

Recommendations for the level two risk assessment

- Regroup shags with *Leucocarbo* (group foraging) shags.
- Check that the distribution is appropriate.
- Revise the population estimate upward.

2.21 Yellow-eyed penguin (*Megadyptes antipodes*) – all populations

The current level two risk assessment (Richard & Abraham 2013b) assessed the yellow-eyed penguin (all New Zealand populations) as being at low risk with a median estimated risk ratio of 0.07 (95% c.i.: 0.03 – 0.12). The review workshop agreed that this estimate was likely to be a reasonable representation of the risk.

Supporting information regarding the key parameters included in the level two risk assessment

Fisheries overlap:
As there is no set net or trawl fishing within territorial waters around yellow-eyed penguin colonies on the sub-Antarctic islands, any changes to this information will be just to the denominator (i.e. population productivity).

Population size and trend:
Population levels on both Campbell and Auckland Islands were estimated by Moore (1992). Current studies on Auckland Islands have been undertaken by the Yellow-eyed Penguin Conservation Trust last summer and in December 2013.

2.22 Kermadec storm petrel (*Pelagodroma marina albiclunis*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the Kermadec storm petrel as being at low risk with a median estimated risk ratio of 0.06 (95% c.i.: 0.02 – 0.18). The review workshop agreed that this estimate was likely to be a reasonable representation of the risk.

Supporting information regarding the key parameters included in the level two risk assessment

Distribution:
The Kermadec storm petrel breeds on a rock stack off Macauley Island (Haszard Islet), in the Kermadec Islands. The breeding distribution should be changed so that it is constrained in the breeding season around the Kermadecs with a limit on the southerly extent of the distribution at 33o S. Note that when species distributions are changed they should be changed in NABIS.

Population size and trend:
The population size used in the level two risk assessment was considered to be appropriate.

Behaviour:
This species is very prone to attraction to vessel lights. However, deck "captures" are excluded from the level two risk assessment. While it was noted that there have been no large deck capture events recorded by observers, even though observers collect information about deck strikes, there has been no assessment to date of the utility of the data collected by observers about deck strikes of seabirds.

Observed captures:
The observed and reported capture in a deepwater trawl off the Chatham Islands was actually a New Zealand white-faced storm petrel.

Recommendations for the level two risk assessment

- Modify the distribution for breeding Kermadec storm petrels.
- Re-estimate vulnerability after correcting formerly mistaken species identity

2.23 Pied shag (*Phalacrocorax varius varius*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the pied shag as being at low risk with a median estimated risk ratio of 0.06 (95% c.i.: 0.01 – 0.20). The review workshop agreed that this risk was likely to be overestimated.

Supporting information regarding the key parameters included in the level two risk assessment

Fishery group definition:
The pied shag is not a *Leucocarbo* shag, theoretically it is a solitary foraging shag. However, in Australia, pied shags often forage in large numbers and could be considered a flotilla species at times. Vulnerability should be recalculated, as a sensitivity analysis, based on the re-grouping of shag species with solitary versus flotilla foraging (generally *Leucocarbo*) shags.

Distribution:
The NABIS distribution for pied shags, as used by the level two risk assessment was considered appropriate. It was noted that there has been a rapid expansion in the range of the pied shag following unsanctioned culling in the mid-twentieth century due to their perceived impacts on trout stocks, with a recent 5.4% annual increase in population size in the Wellington region.

Population size and trend:
Bell (2013) estimates a total population of 3100–6400 breeding pairs. The upper extent of this estimate includes an allowance for multiple use of nests in a year by other breeding pairs.

Vulnerability to fisheries:
The level two risk assessment calculates a higher risk from surface longline than from bottom longline despite an observed capture in bottom longline but not in surface longline. The zero observed captures constrains the level two risk assessment to a low figure. Higher levels of zero observations in the snapper bottom longline probably constrains the predictions of fatalities more than the less observed inshore surface longline.

While the pied shag travels further offshore than many other shag species, the range of these shags are not considered to overlap significantly with surface longline fishing. The apparent overlap and resulting risk to pied shags from surface longline fishing may be an artefact of the size of effort cells. The spatial resolution of fishing effort is likely to be leading to an overestimate of risk.

Pied shags are known to take baited hooks and, based on information from Chatham Island shags, may also get caught in rock lobster pots. Recreational fishing gear is likely to pose a risk to pied shags as well.

Recommendations for the level two risk assessment

- Recalculate vulnerability based on re-grouping with solitary shag species only, as a sensitivity analysis.
- Increase population size to reflect the most recent population estimate by Bell (2013).
- Review Rmax.
- Identify whether a finer spatial resolution could be used. Perhaps independently estimate a proportional reduction in spatial overlap based on analysis of actual overlap at a finer scale than is utilised in the current level two assessment.
- It may be necessary to constrain the vulnerability of solitary shags to be lower than that of the *Leucocarbo* shags due to lack of observed captures.

2.24 Stewart Island shag (*Phalacrocorax chalconotus*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the Stewart Island shag as being at low risk with a median estimated risk ratio of 0.04 (95% c.i.: 0.01 – 0.11). The review workshop agreed that this risk was likely to be overestimated.

Supporting information regarding the key parameters included in the level two risk assessment

Population size and trend:
A new census for Stewart Island shag was conducted in 2011, which estimated 2075 – 2482 breeding pairs (Lalas & Perriman 2012) due to extensions in area. Detailed analysis of colony counts by Lalas & Perriman (2009) found mixed trends in various areas. The rates of increase in new areas may be useful for verifying Rmax.

Fishery group definition (see spotted shag for more information):
This species is a flotilla bird (i.e. they forage in groups) and therefore should be regrouped for purposes of estimating vulnerability with only the other *Leucocarbo* shags.

Observed interactions:
Two Stewart Island shags have been observed caught in separate events; one was caught in a net set at 80 m, no birds were seen in the area prior to or after the set (this was the first record of maximum diving depth for this species).

Taxonomy:
Genetic analysis of Chatham and Stewart Island shag show that Otago coast Stewart Island shags are more closely related to Chatham Island shag with the Foveaux Strait Stewart Island shags being more distantly related. These may need to be treated as meta-populations in future.

Recommendations for the level two risk assessment

- Regroup shag species, *Leucocarbo* versus others.
- The population estimate is considered to be a bit low, revise based on Lalas & Perriman (2012).
- Review Rmax based on expansion into new areas.
- Reflect change in fishing effort distribution due to the Hector's dolphin setnet closures.

2.25 New Zealand king shag (*Phalacrocorax carunculatus*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the New Zealand king shag as being at low risk with a median estimated risk ratio of 0.04 (95% c.i.: 0.00 – 0.24). The review workshop agreed that this risk was likely to be underestimated.

Supporting information regarding the key parameters included in the level two risk assessment

Population size and trend:
There was a survey of the size of the New Zealand king shag population from 1992 to 2002, Schuckard (2006) estimated 645 birds, 102–146 breeding pairs per annum, which is consistent with earlier estimates. The population trend is fairly consistent.

This small population is very susceptible to any single event, particularly if a multiple capture event were to occur. The current level two risk assessment doesn't deal with small population sizes very well, and the PBR method does not work well either.

Distribution:
The distribution of New Zealand king shags overlaps with setnet effort by commercial and recreational fishing. As with the pied shag (see above) there may be some effect of spatial artefacts due to the size of the fishing effort cells. A finer resolution analysis would be useful for this species.

Behaviour:
The preferred prey of the New Zealand king shag is seawitch (a non-commercial species of flatfish), and they are considered solitary feeders (Schuckard 1994). While the New Zealand king shag is one of the *Leucocarbo* shags, it is considered to be a solitary feeder so should be grouped with the other solitary shags (see spotted shag section for more details).

Recommendations for the level two risk assessment

- Regroup as a solitary feeding shag species as a sensitivity analysis.
- Possible analysis of spatial overlap at a finer spatial resolution.

2.26 New Zealand storm petrel (*Fregetta maorianus*)

The current level two risk assessment (Richard & Abraham 2013b) assessed the New Zealand storm petrel as being at negligible risk with a median estimated risk ratio of 0.00 (95% c.i.: 0.00 – 0.12). The review workshop agreed that this risk was likely to be overestimated.

Supporting information regarding the key parameters included in the level two risk assessment

Distribution:
Information regarding the breeding and at-sea distribution of the New Zealand storm petrel is available (see Chris Gaskin). This species is absent from New Zealand waters in winter.

Population size and trend:
In order to estimate the population size, mark-recapture analysis is possible based on available data (see Paul Scofield).

Other impacts:
It was noted that there has been a recorded deck strike of a New Zealand storm petrel.

3. OTHER RECOMMENDATIONS

3.1 Other updates recommended for species parameters used in the level two risk assessment:

Cook's petrel: The population size needs to be increased substantially (see estimate by Rayner et al. 2008).

Taiko: The population size needs to be increased (Scofield & Taylor unpublished data).

Mottled petrel: The population size needs to be decreased to 202 000 breeding pairs from 300 000 (see Scott et al. 2009).

Pycroft's petrel: The population size needs to reflect the increases since rat removal on the Mercury Islands, there are 10 000 to 20 000 (see Birdlife factsheet).

Chatham petrel: The population size needs to increase to 1400 birds total, the breeding figure is correct as it stands (Birdlife International 2014).

Black-backed gull: The population size used is an order of magnitude too high, there are 100 000s instead of millions.

Clarify why noddies and grey ternlets are not included in the level two risk assessment.

Clarify why little penguins have been split into meta-populations and not common diving petrels or the little shearwaters.

Note that the eastern rockhopper penguin breeds in New Zealand, not the western rockhopper penguin as mentioned in the level two risk assessment report.

In general, the Birdlife factsheets are a good source for population estimates as these are updated regularly.

3.2 Potential future improvements to the level two risk assessment method:

- Population estimation - dealing with breeding and non-breeding seabirds (outside New Zealand).
- Improve how the level two risk assessment will deal with new population estimates in future.
- Incorporating population trend information in the level two risk assessment.
- Including population trend information in the risk assessment hierarchy beyond level two.
- Improve how the level two risk assessment deals with new vulnerability estimates in future.
- Documenting vulnerability changes through time (to ensure lessons on how to reduce vulnerability remain explicit over time).
- Dealing with unidentified (as opposed to cryptic) mortalities e.g. juveniles caught on the warp.
- Seasonal distributions – Ensure that in-zone populations are scaled appropriately in seasonal distributions (e.g. if most birds from a species leave New Zealand waters during the non-breeding season).
- Conduct a sensitivity analysis to including/excluding live captures that were subsequently released, and/or estimate release survival (with Bayesian uncertainty).
- Survival rate – the PBR method is meant to include an optimal survival rate, to give a best possible Rmax figure (in some situations it may be important to consider that Rmax is not a realistic construct for a particular population due to substantive shifts in the external environment subsequent to the time at which data describing the optimal rate of recovery were collected).
- Conduct a review of the generic survival value used for the Procellariform species.
- Where management changes have occurred estimate vulnerability based on a longer time series for which observer data is available but estimate spatial overlap (and current risk) only on the effort since the management change was introduced (e.g. yellow-eyed penguins and set-net closure).
- Need to better describe the level two risk assessment input parameters in Tables A1 and A2, as some do not match the figures in the supplement AEBR and they are not fully explained.
- Review the proportion of adults breeding across all species.
- If bird species distributions are changed then changes should be reflected in NABIS maps.
- Conduct a sensitivity analysis to the re-grouping of shags as flotilla/Leucocarbo shag species versus other shag species.
- Incorporate gender bias in incidental captures and impacts on the populations.
- Clarify the way in which the method deals with large "one-off" multiple capture events may be improved, and/or illustrate effect of 'one-off's in sensitivity analyses.
- Improve how the method deals with small populations.
- Clarify the names of the fishery groups used.
- Further document the observed versus expected capture plots (which proved useful to this workshop) as a standard diagnostic for future level two risk assessment iterations, and consider whether a "goodness of fit" metric is useful.

3.3 Potential future research to better understand the total risk to New Zealand seabirds:

- Improved understanding of what empty nests in albatross colonies actually mean in the context of estimating population size and various biological parameters.
- Improved understanding on what burrow numbers within burrowing petrel colonies mean in the context of estimating population size and various biological parameters.
- Impacts of plastic rubbish on New Zealand birds and whether the pollution is from New Zealand or elsewhere.
- Risk assessment of recreational fishing at a finer spatial resolution (particularly for coastal species).

- Global risk assessment to address out-of-zone mortalities (e.g. Chatham albatross juveniles, southern Buller's albatross in fisheries operating off South America, etc.).
- Reanalysis of southern royal albatross bycatch photos and band recoveries. Results from this could be useful in the global risk assessment.

4. ACKNOWLEDGMENTS

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APPENDIX 1 TERMS OF REFERENCE

Terms of reference for workshop on the review of outputs of the Richard and Abraham [2013] level two seabird risk assessment

November 2013

Working Group papers are 'works in progress' whose role is to facilitate the discussion of the Working Groups. They often contain preliminary results that are receiving peer review for the first time and, as such, may contain errors or preliminary analyses that will be superseded by more rigorous work. For these reasons, attendees must agree not to release information contained in Working Group papers to external media. In general, Working Group papers should never be cited. Exceptions may be made in rare instances by obtaining permission in writing from MPI and the authors of the paper.

TERMS OF REFERENCE FOR WORKSHOP ON THE REVIEW OF OUTPUTS OF THE RICHARD AND ABRAHAM [2013] LEVEL TWO SEABIRD RISK ASSESSMENT

PURPOSE

The core purpose of this review is to review the inputs and associated output of the level two seabird risk assessment for at-risk species contained in Richard and Abraham [2013], specifically to determine if the assessment by species is a reasonable representation of risk. Underlying this is the intent to ensure the prioritisation of further work on seabirds in fisheries is most appropriately targeted where needed.

For each species:

- where there are data to suggest the representation of risk may not be appropriate, the workshop should document that information and suggest required future work to address the identified issues; and
- if possible in the context of the existing level two risk assessment framework identify replacement input parameters of the imposition of Bayesian constraints on outputs consistent with the other data sources identified.

As with all MPI fisheries science reviews, this review is fundamentally about science quality assurance.

SCOPE

This review is a science peer review of the output of the level two seabird risk assessment for at-risk species contained in Richard and Abraham [2013], including the biological parameters and spatial distributions used to generate the outputs. The underlying method of risk assessment is out of scope for the workshop.

The workshop will address the output for the nineteen species assessed as at very high, high and medium risk. Subject to available time it will assess the output for the six species assessed at low risk.

CONTEXT

More seabirds breed in New Zealand than anywhere else in the world. New Zealand seabirds should be able to thrive in New Zealand waters and around the world without pressure from fishing-related mortality. The National Plan of Action (NPOA) - Seabirds 2013 recognises New Zealand's unique place in the world for seabirds and our desire to be at the leading edge of international seabird conservation.

The long term objective of the NPOA-Seabirds 2013 is: New Zealand seabirds thrive without pressure from fishing related mortalities, New Zealand fishers avoid or mitigate against seabird captures and New Zealand fisheries are globally recognised as seabird friendly.

The NPOA-Seabirds 2013 sets out objectives for five years to guide management of incidental seabird catch in New Zealand fisheries. The current management approach will see the objectives achieved through integration into MPI's annual and five year plans for fisheries.

Research and information underpin management of seabird interactions with fisheries. MPI and the Department of Conservation contract independent research providers to provide technical reports as required. This research covers seabird interactions with fisheries, population studies and mitigation research. International information resources include Agreement on the Conservation of Albatross and Petrel (ACAP) species profiles, best practice mitigation guidelines and the International Union for Conservation of Nature (IUCN) Red List on population status.

Information about seabird interactions with fisheries comes from a variety of sources. Some is collected incidentally - while other information collection is designed to describe the nature and extent of seabird captures in fisheries. Many New Zealand commercial fisheries have Ministry for Primary Industries (MPI) observer coverage. All commercial fishers are required to provide data about their fishing

activities in standardised forms. In combination these data sources can be used to describe the nature and extent of seabird captures in fisheries. A database of seabird capture information including associated fishing activity and observer data, is maintained online. It can be used to produce annual fishery-by-fishery or seabird-by-seabird summaries over one or many years (http://data.dragonfly.co.nz/psc/).

A key step in using this information, and critical to the NPOA-Seabirds 2013, is risk assessment. The risk assessment approach is used to determine management priorities. The five year biological risk objective in the NPOA Seabirds 2013: the level of mortality of New Zealand seabirds in New Zealand commercial fisheries are reduced so that species currently categorised as at very high or high risk from fishing move to a lower category of risk. The biological risk high level subsidiary objective provides, at a fundamental level, the basis for setting priorities for action in respect of New Zealand seabirds at risk through interactions with fisheries. The main focus is priority setting for action within New Zealand fisheries under both the practical and research and development subsidiary objectives. It is also relevant for setting priorities for action under the international subsidiary objective.

Richard and Abraham [2013] provides the assessment of risk which underpins the NPOA Seabirds 2013. The study presents a risk assessment of the impact of fishing-related mortalities on most of the seabird species that breed in the New Zealand region. The potential effect of New Zealand commercial fisheries on New Zealand seabird populations was assessed by comparing an estimate of the annual potential fatalities (APF), from fisheries bycatch, to an index of population productivity (Potential Biological Removals, or PBR). The annual potential fatalities include an estimate of the cryptic fatalities, seabirds that may be killed by the fishing but not brought on board the vessel and so would not be reported by observers.

	PBR_1		APF		Risk ratio		P_1	$P_{0.5}$	$P_{0.1}$
	Mean	95% c.i.	Mean	95% c.i.	Median	95% c.i.			
Black petrel	74	47-117	1 440	1 070-1 900	19.90	11.40-32.80	100.00	100.00	100.00
Salvin's albatross	975	521-1 740	2 690	2 100-3 420	2.88	1.47-5.41	99.80	100.00	100.00
Flesh-footed shearwater	590	288-1 200	780	523-1 090	1.41	0.59-2.94	80.60	99.00	100.00
Southern Buller's albatross	513	270-831	663	520-839	1.32	0.75-2.58	79.20	100.00	100.00
Chatham Island albatross	159	94-264	205	136-316	1.30	0.68-2.59	78.20	99.70	100.00
NZ white-capped albatross	4 040	908-9 840	2 830	2 080-3 790	0.78	0.28-3.13	36.20	76.70	100.00
Northern Buller's albatross	617	325-1000	418	312-560	0.69	0.38-1.36	17.20	82.30	100.00
Gibson's albatross	260	132-425	121	86-164	0.48	0.25-1.00	2.52	45.40	100.00
Cape petrel	840	283-1 890	254	175-361	0.33	0.12-0.93	1.74	23.30	99.10
Antipodean albatross	295	203-419	89	63-121	0.30	0.18-0.49	0.00	2.06	100.00
Northern royal albatross	396	164-782	108	72-160	0.29	0.12-0.70	0.30	11.70	99.50
Southern royal albatross	441	302-630	116	82-160	0.27	0.16-0.43	0.00	0.30	100.00
Westland petrel	241	142-384	63	28-129	0.25	0.10-0.66	0.10	7.68	97.90
Northern giant petrel	217	66-486	47	18-103	0.23	0.06-0.85	1.44	13.60	87.40
White-chinned petrel	7 920	3 280-15 800	1 670	1 210-2 330	0.22	0.10-0.53	0.04	3.54	97.10
Spotted shag	3 780	1 730-7 570	745	485-1 100	0.21	0.09-0.48	0.00	1.64	94.60
Campbell black-browed albatross	1 020	514-1 830	192	111-324	0.19	0.08-0.44	0.00	1.12	94.00
Grey petrel	2 170	1 010-3 900	247	169-364	0.12	0.06-0.27	0.00	0.00	65.10
Little black shag	120	67-216	8	5-14	0.07	0.03-0.15	0.00	0.00	18.00
Yellow-eyed penguin	537	352-805	35	19-56	0.07	0.03-0.12	0.00	0.00	10.20
Kermadec storm petrel	4	1-9	0	0-0	0.06	0.02-0.18	0.00	0.00	25.70
Pied shag	172	75-329	10	3-24	0.06	0.01-0.20	0.00	0.02	22.50
Stewart Island shag	269	218-334	13	3-29	0.04	0.01-0.11	0.00	0.00	4.44
NZ king shag	16	13-20	1	0-4	0.04	0.00-0.24	0.00	0.12	12.10
Light-mantled sooty albatross	237	167-319	7	2-20	0.02	0.01-0.09	0.00	0.00	1.94
Chatham petrel	11	5-26	0	0-1	0.02	0.00-0.10	0.00	0.00	2.30
Grey-headed albatross	333	157-613	6	1-20	0.01	0.00-0.07	0.00	0.00	0.76
Australasian gannet	4 190	1 500-9 770	62	7-222	0.01	0.00-0.07	0.00	0.00	1.12
Fiordland crested penguin	488	255-866	6	1-17	0.01	0.00-0.04	0.00	0.00	0.02
Soft-plumaged petrel	171	32-553	1	0-3	0.01	0.00-0.05	0.00	0.00	0.04
Grey-faced petrel	14 000	6 290-31 200	108	51-207	0.01	0.00-0.02	0.00	0.00	0.00
Cook's petrel	2 430	1 140-5 500	17	6-35	0.01	0.00-0.02	0.00	0.00	0.00
Pycroft's petrel	109	48-241	1	0-2	0.01	0.00-0.02	0.00	0.00	0.00
Northern little penguin	1 360	869-2 000	9	2-23	0.01	0.00-0.02	0.00	0.00	0.00
Sooty shearwater	348 000	115 000-751 000	1 760	1 260-2 480	0.01	0.00-0.02	0.00	0.00	0.00
Fluttering shearwater	5 220	1 240-13 700	19	5-54	0.00	0.00-0.02	0.00	0.00	0.00
White-flippered little penguin	421	263-657	2	0-4	0.00	0.00-0.01	0.00	0.00	0.00
Mottled petrel	15 300	7 040-33 500	45	17-98	0.00	0.00-0.01	0.00	0.00	0.00
Southern little penguin	1 360	864-2 030	3	1-9	0.00	0.00-0.01	0.00	0.00	0.00
Hutton's shearwater	6 370	3 490-10 600	15	4-36	0.00	0.00-0.01	0.00	0.00	0.00
Black-bellied storm petrel	4 550	2 410-8 220	8	2-17	0.00	0.00-0.00	0.00	0.00	0.00
Snares crested penguin	4 910	2 520-8 800	8	2-19	0.00	0.00-0.00	0.00	0.00	0.00
White-headed petrel	18 500	6 760-44 000	23	11-41	0.00	0.00-0.00	0.00	0.00	0.00
Chatham Island little penguin	1 350	856-2 030	3	0-14	0.00	0.00-0.01	0.00	0.00	0.00
Common diving petrel	64 600	19 400-152 000	36	15-77	0.00	0.00-0.00	0.00	0.00	0.00
Buller's shearwater	14 800	5 530-33 800	10	2-32	0.00	0.00-0.00	0.00	0.00	0.00
Kermadec petrel	336	153-752	0	0-1	0.00	0.00-0.00	0.00	0.00	0.00
Little shearwater	7 800	4 090-13 200	4	1-10	0.00	0.00-0.00	0.00	0.00	0.00
NZ white-faced storm petrel	105 000	38 800-226 000	45	12-111	0.00	0.00-0.00	0.00	0.00	0.00
Western rockhopper penguin	7 510	5 580-9 990	3	1-8	0.00	0.00-0.00	0.00	0.00	0.00
Southern black-backed gull	371 000	148 000-751 000	94	25-231	0.00	0.00-0.00	0.00	0.00	0.00
Antarctic prion	40 100	9 230-110 000	5	2-10	0.00	0.00-0.00	0.00	0.00	0.00
Fairy prion	159 000	62 800-330 000	22	7-56	0.00	0.00-0.00	0.00	0.00	0.00
Erect-crested penguin	12 600	10 200-15 600	2	0-5	0.00	0.00-0.00	0.00	0.00	0.00
Broad-billed prion	106 000	48 700-201 000	11	4-26	0.00	0.00-0.00	0.00	0.00	0.00
NZ storm petrel	16	1-64	0	0-0	0.00	0.00-0.12	0.00	0.00	3.56
Chatham Island taiko	1	0-2	0	0-0	0.00	0.00-0.00	0.00	0.00	1.90
Chatham Island shag	51	38-68	0	0-4	0.00	0.00-0.08	0.00	0.00	1.56
Pitt Island shag	100	51-178	1	0-6	0.00	0.00-0.06	0.00	0.00	0.98
South Georgian diving petrel	5	2-8	0	0-0	0.00	0.00-0.00	0.00	0.00	0.02
Bounty Island shag	17	11-26	0	0-0	0.00	0.00-0.02	0.00	0.00	0.02
Wedge-tailed shearwater	4 120	2 720-5 760	0	0-0	0.00	0.00-0.00	0.00	0.00	0.00
White-naped petrel	2 990	1 060-7 410	0	0-0	0.00	0.00-0.00	0.00	0.00	0.00
White-bellied storm petrel	66	29-131	0	0-0	0.00	0.00-0.00	0.00	0.00	0.00
Masked booby	46	26-76	0	0-0	0.00	0.00-0.01	0.00	0.00	0.00
Auckland Island shag	305	132-581	0	0-1	0.00	0.00-0.00	0.00	0.00	0.00
Campbell Island shag	298	153-534	0	0-0	0.00	0.00-0.00	0.00	0.00	0.00
Subantarctic skua	31	19-45	0	0-0	0.00	0.00-0.01	0.00	0.00	0.00
Caspian tern	176	92-299	0	0-1	0.00	0.00-0.00	0.00	0.00	0.00
White tern	18	13-26	0	0-0	0.00	0.00-0.00	0.00	0.00	0.00

Table 1: Outputs from the 2013 level two risk assessment showing the risk ratio and its key components[1] [reproduced from Richard *et al.* 2013].

[1] Potential Biological Removal (PBR_1, i.e. with a recovery factor $f = 1$), total annual potential fatalities (APF) in trawl, longline, and set-net fisheries, risk ratio with $f = 1$ (RR = APF/PBR_1), and the probability that APF > PBR with $f = 1$, $f = 0.5$, and $f = 0.1$ (P_1, $P_{0.5}$, and $P_{0.1}$ respectively). Species are ordered in decreasing order of the median risk ratio.

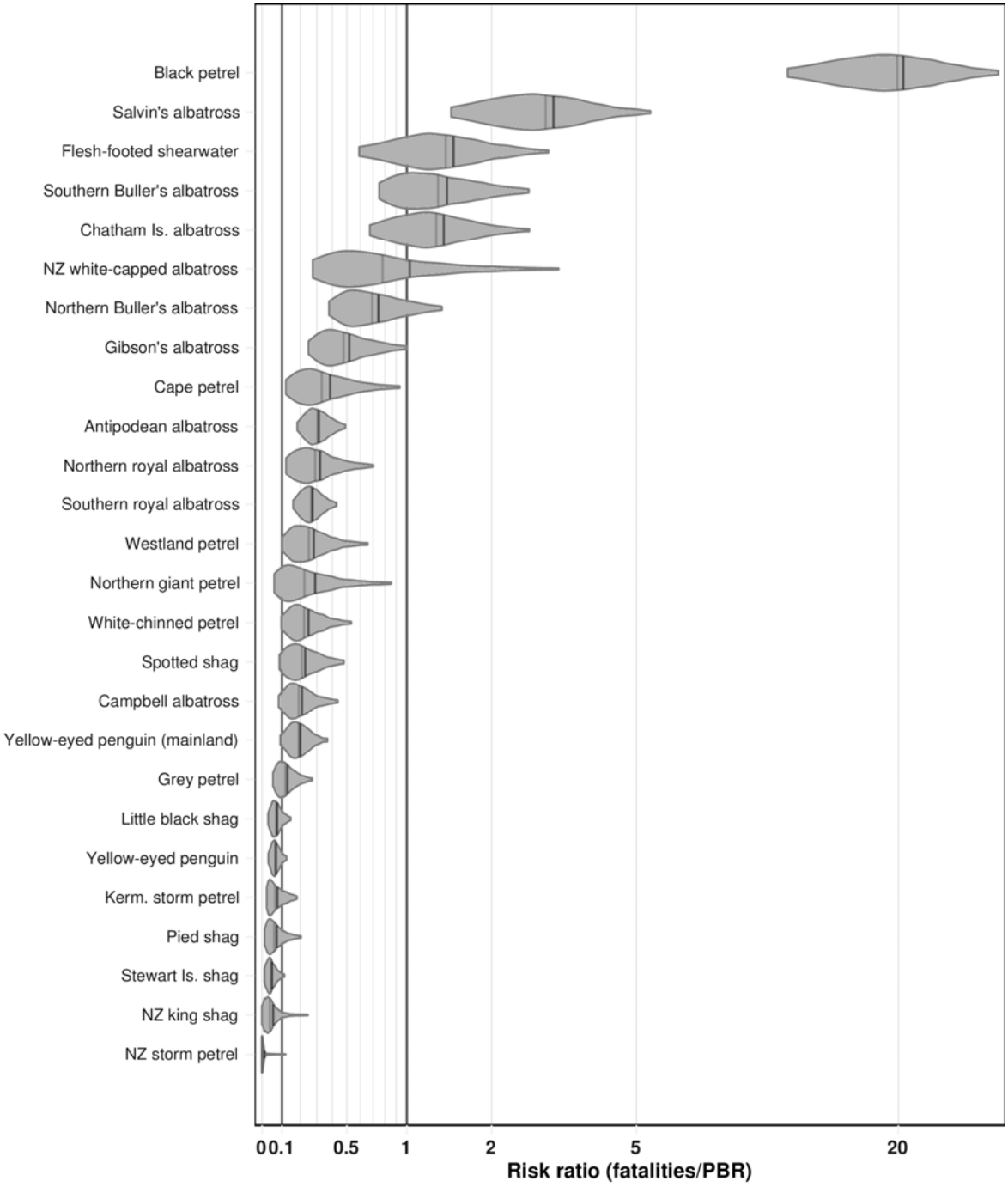

Figure 1: Outputs from the 2013 level two risk assessment showing the risk ratio for the most at risk species [reproduced from Richard et al. 2013].

An index of the risk to the population from fisheries bycatch was calculated as the ratio APF/PBR, with a risk index greater than one indicated that the fatalities may exceed the productive capacity of the population. The risk index was estimated for 70 seabird species (or subspecies) that breed in the New Zealand region (Table 1, Figure 1). From this index, the risk was assigned the following categories:

- Very high: median risk index greater than 1, or upper 95% confidence level greater than 2
- High: median risk index greater than 0.3, or upper 95% confidence level greater than 1
- Medium: median risk index greater than 0.1, or upper 95% confidence level greater than 0.3

- Low: upper 95% confidence level of the risk index greater than 0.1; and
- Negligible: upper 95% confidence level of the risk index less than 0.1.

The risk assessment was carried through Ministry for Primary Industries' project PRO2010/02.

The review will consider the inputs and associated outputs of the level two seabird risk assessment for the 25 at-risk species contained in Richard and Abraham, specifically to determine if the assessment by species is a reasonable representation of risk. This review will inform prioritisation of resources to specific issues in fisheries.

INFORMATION FOR THE REVIEW

A broad range of documents will be made available to the review workshop electronically. Workshop participants will be engaged in identifying the full range of documents in the lead up to the workshop.

The following key documents will be available for each species:

- a summary of available documents for the species
- an overview of the detailed risk assessment outputs for the species
- the ACAP and DOC factsheets for the species
- MPI and DOC project outputs relating to the species; and
- relevant reports from the primary literature for the species.

A series of short email briefings will be provided to the workshop participants in the period immediately prior to the meeting.

FORMAT FOR REVIEW

Workshop participants will have read the email briefings and associated attachments and prepared for a detailed discussion of any issues they may have identified in advance of the meeting.

Workshop participants will attend a meeting on 19th and 20th November 2013 in Wellington, where a systematic approach to reviewing each species will be undertaken. For each species a series of questions will be posed to assess whether the representation of risk is reasonable. Where there are data which suggest the risk may not be reasonable, that will be documented. The draft agenda provides additional detail on the structure of the review.

Throughout the workshop, participants will participate fully in discussions. MPI will appoint a chair for the workshop. The chair will be responsible for coordinating the production of the draft and final report of the workshop. A workshop participant will be engaged to prepare the draft and final report.

TIMETABLE

The workshop will occur on 19/20 November 2013. The final report of the workshop is to be submitted to MPI before the end of December 2013.

PARTICIPANTS

Participants must declare any actual or potential conflicts of interest that might affect their ability to provide an objective review. Participants will have scientific expertise in seabird biology and ecology, seabird incidental mortality in fisheries or ecological risk assessment relevant to New Zealand.

Confirmed participants are:

- Will Arlidge, MPI
- Barry Baker, Latitude 42
- Martin Cryer, MPI
- Igor Debski, DOC
- Ed Abraham, Dragonfly Science

- Ben Sharp, MPI
- Nathan Walker, Mr Fish Consulting Ltd
- Richard Wells, Deepwater Group
- Neville Smith, MPI
- Kris Ramm, DOC
- Paul Scofield, Canterbury Museum
- Rose Grindley, MPI
- Graeme Taylor, DOC
- Paul Sagar, NIWA
- Dave Middleton, SeaFood NZ
- David Thompson, NIWA
- Vicky Reeve, MPI
- Geordie Murman.

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Richard, Y; Abraham, E R (2013b). Risk of commercial fisheries to New Zealand seabird populations. *New Zealand Aquatic Environment and Biodiversity Report* No. 109. 58p.

Richard, Y; Abraham, E R (2013c). Risk of commercial fisheries to New Zealand seabird populations: Supplementary information. *New Zealand Aquatic Environment and Biodiversity Report* No. 109S. 77p.

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APPENDIX 2 MEETING AGENDA

Day One

Venue
Mercy Conference Centre, 15 Guildford Terrace, Thorndon, Wellington

Timing
0900-1700 Tuesday 19th November

Purpose
To review the output of the level two seabird risk assessment for at-risk species contained in Richard and Abraham [2013], specifically to determine if the assessment by species is a reasonable representation of risk. Where there are data to suggest the representation of risk may not be appropriate, to document that information and suggest required future work to address the identified issues.

0900-0930 Introduction

- Introductions
- Facilities and timing
- Purpose of meeting
- Adoption of agenda
- Available documents
- Method of work
- Post workshop reporting

0930-1030 Test Cases

- Run through an assumed no change species
- Run through an assumed change species
- Confirm method of work

1100-1230 Review session one

- Review ~ four species

1315-1445 Review session two

- Review ~ four species

1515-1645 Review session three

- Review ~ four species

1645-1700 Wrap up

- Summary
- Preparations for day two

Day Two

Venue
Mercy Conference Centre, 15 Guildford Terrace, Thorndon, Wellington

Timing
0900-1700 Wednesday 20th November 2013

Purpose
To review the output of the level two seabird risk assessment for at-risk species contained in Richard and Abraham [2013], specifically to determine if the assessment by species is a reasonable representation of risk. Where there are data to suggest the representation of risk may not be appropriate, to document that information and suggest required future work to address the identified issues.

0900-0915 Introduction

- Facilities and timing
- Recap on method of work

0915-1030 Review session four

- Review ~4 species

1100-1230 Review session five

- Review ~4 species

1315-1445 Review session six

- Review ~4 species

1515-1645 Workshop summary and next steps

- Summary
- Report guidance
- Follow up actions

References

Richard, Y; Abraham, E R (2013). Risk of commercial fisheries to New Zealand seabird populations. *New Zealand Aquatic Environment and Biodiversity Report* No. 109. 58p.

Richard, Y; Abraham, E R (2013). Risk of commercial fisheries to New Zealand seabird populations: Supplementary information. *New Zealand Aquatic Environment and Biodiversity Report* No. 109S. 77p.

APPENDIX 3 LIST OF PARTICIPANTS

Neville Smith, Martin Cryer, Ben Sharp, Will Arlidge, Vicky Reeve, Rose Grindley (MPI), Igor Debski, Graeme Taylor (DOC), Paul Sagar, David Thompson (NIWA), Paul Scofield (Canterbury Museum), Barry Baker (Latitude 42), Ed Abraham (Dragonfly Science), David Middleton (SeaFood NZ), Geordie Murman (Charter vessel operator, Ocean Ranger), Richard Wells (Deepwater Group), Nathan Walker (Mr Fish Consulting Ltd).

Apologies (Note that these experts provided documents prior to the meeting, and commented on the draft report):
Elizabeth Bell (Wildlife Management International Ltd), Ursula Ellenberg (University of Otago).

APPENDIX 4 LIST OF BACKGROUND DOCUMENTS PROVIDED TO PARTICIPANTS

Key Documents

Baird, S J; Gilbert, D J (2010) Initial assessment of risk posed by trawl and longline fisheries to selected seabird taxa breeding in New Zealand waters. *New Zealand Aquatic Environment and Biodiversity Report* No. 50. 98 p.

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Black petrel

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Flesh-footed shearwater

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