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# Defining "high risk areas" in southern bluefin tuna fisheries

**New Zealand**

Paper presented to the 12th Meeting of the Ecologically Related Species Working Group (ERSWG12)

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# Background

During the last meeting of the Ecologically Related Species Working Group (ERSWG), members agreed to "address the definition of 'high risk areas' through discussion of papers presented at ERSWG12". This task was put forward to reflect both the recognised risk to seabirds posed by this fishery and the need to direct limited resources to areas of greatest need.

The most recent Commission meeting also gave the ERSWG specific instructions that there be work undertaken to develop a multi-year strategy that identifies research, monitoring needs, and actions to reduce uncertainty and associated risks. Such an exercise will be significantly enhanced if it can be done under an agreed definition of 'high risk areas'.

The Terms of Reference for this group also state that the ERSWG is to provide advice on measures to minimise fishery effect on ecologically related species. Having an agreed definition of 'high risk areas' will allow this group to provide effective and focused advice to decrease risk to seabirds, and also to avoid imposing a potentially unnecessary burden on operators.

# Introduction

New Zealand proposes that the best way to structure this discussion is to identify the range of options available to members in identifying high risk areas and then to evaluate the positive and negative aspects of the respective options. Those aspects can include: the ability of the option to deliver meaningful results, constraints in the availability of data, financial barriers, or uncertainty in the methodology.

Reaching agreement on an appropriate method to use in identifying risk is a necessary first step towards a definition. Having agreed on the most appropriate methodology to apply, members will then need to also agree on what level of risk identified under the agreed method can be considered 'high'.

This paper provides a list of potential methods to apply in defining high risk areas using the waters around New Zealand as an example. While these options are shown at a finer spatial scale (0.2 degrees cells), the authors consider that, for CCSBT, 5 degree cells would be more appropriate given data availability and complexity in managing at a finer resolution.

As surface longlining does not pose high levels of risk to all of the 71 species included in the New Zealand Seabird Risk Assessment (**NZSRA**)[1], the number of species used to the define high risk areas can be limited using qualitative and/or quantitative assessment. Three methodological approaches ("methods") each applied to three sets of seabird species ("species sets") (**Table 1**) are presented and discussed, recognising the strengths and weaknesses of each approach. The number of seabird species are limited in order to make the resulting high risk areas relevant to species most at risk, either overall (species set b) or in terms of risk from surface longlining (species set c) (see Table 1).

[1] Richard & Abraham in prep.

**Table 1: Species Sets**

| Species Set | Criteria for Inclusion | Species |
|---|---|---|
| A | All 71 seabirds included in New Zealand Seabird Risk Assessment | See Appendix 1 |
| B | Cases where the species has a risk ratio with a median above 0.3 or with the upper 95% confidence limit above 1 | Black petrel, Salvin's albatross, flesh-footed shearwater, Westland petrel, Southern Buller's albatross, Chatham Island albatross, New Zealand white-capped albatross, and Gibson's albatross |
| C | The five species most at risk from surface longline fishing, as assessed by the New Zealand Seabird Risk Assessment | Black petrel, Antipodean and Gibson's albatross, southern and northern Buller's albatross |

# Spatial Risk Identification Methods

## Method 1: Seabird Distributions

*Density of seabirds as a proxy for risk of capture.*

This method utilises the seabird population density distribution data generated for the NZSRA in order to create seabird population distribution maps for each of the three species sets. This provides an approximation of the number of seabirds that might be present in any area. (**Figure 1**).

When the densities of all 71 species included in the NZSRA are mapped (Option 1a), the entire ocean around New Zealand shows high densities of seabirds, with some incredibly high densities shown in coastal areas and around offshore islands where the breeding colonies are located.

One benefit of Option 1a is that this is the only option proposed that does not require a risk assessment of some form.

When the most at-risk species only are included (Option 1 b), the risk area is slightly more limited but still includes most of the New Zealand EEZ. These species are more broadly distributed. As risk from other fishing methods was included, this will define potential risk areas that may be irrelevant for surface longline fishing.

When only the five species most at risk from surface longline are included (Option 1c), some key areas of risk become apparent to the north-east of New Zealand, the southern end of the South Island and around the Chatham Islands to the east.

The considerable drawback to Method 1 is that all seabirds are considered to be equally likely to be captured when present in an area, and all captures are considered equally impactful on the species. This means that some species included may be at risk from other fishing methods and may misrepresent risk from SLL, and large areas not relevant to seabirds that face a sustainability risk specifically from SLL could be defined as high risk areas.

Method 1 also results in a large amount of variation between Options 1a, 1b, and 1c, as reducing the number of species considered drastically changes the distribution of "high risk areas" in

line with drastic changes in population distribution when the number of species is reduced. This means that the decision as to which seabirds to include in the assessment will have a larger impact on which areas are considered high risk areas than is the case for Methods 2 and 3.

## Method 2: Risk of Captures

*Spatially located predictions of seabird fatalities*

The NZSRA is a spatially explicit risk assessment that uses effort and seabird distribution data to produce overlap. This overlap is then combined with vulnerability to capture, which is derived from observed capture rates. This produces spatially specific estimates of annual potential fatalities (**APF**), which can be combined across seabird species.

Method 2 narrows the areas of risk to areas of overlap between seabird populations, SLL effort, and observed captures. Following this method, high risk areas would be defined where seabirds are caught in high numbers by SLL fishing.

**Figure 2** shows this method as applied to each of the three sets of seabird species. The reduction in the number of species does not change the scale of APF to any large degree, except in a few locations. The maps that incorporate APF are considerably more focussed than the population distribution maps (Options 1a, 1b, 1c).

This method is included as it is often assumed that a high level of seabird captures equates to high risk. However, if the seabird species is abundant or has relatively high growth rate, the level of captures may have varying levels of impact on a population. This makes Method 2 less sophisticated than Method 3, as Method 2 does not consider the impact on the seabird populations, so therefore could only be considered a measure of risk of captures but not risk to seabird populations.

All options using Method 2 (Options 2a, 2b, 2c) require a spatial estimation of captures; this could be achieved with a quantitative risk assessment (as in this case with the NZSRA). However it is possible to undertake Option 2a using a spatial estimate of captures, which could be undertaken using other methods provided there was sufficient observer coverage within the cells. Option 2b and 2c provide a more limited definition of high risk areas than Option 2a, utilising a risk assessment.

## Method 3: Realised Risk

*Sum of risk ratio*

Risk ratios are calculated by the NZSRA by comparing the APF relative to the Population Sustainability Threshold (**PST**). PST is an analogue of the Potential Biological Removals (**PBR**) approach.

The PST defines a threshold level, below which the population can sustain mortalities while still meeting a pre-defined management objective. Mortalities above this level are unsustainable over the long term. In the NZSRA, the management objective has been set to maintaining the population at or above half the carrying capacity, with 95% probability over

the long term. Carrying capacity is the size of a population the environment can sustain considering the limiting factors.

The risk ratios can be summed across species sets to produce maps of cumulative risk from surface longline fishing. The resulting maps (**Figure 3**) show higher levels of risk in the north east of New Zealand relative to other areas, than the broader spread of APF alone under Method 2.

Method 3 limits the areas of risk to areas of high overlap of APF and seabird populations already defined as species at risk by a quantitative risk assessment. Option 3a is the most specific and sophisticated option proposed, as this option limits high risk areas to places where the most at-risk seabirds are at most risk from SLL fishing.

The choice of species set does not substantially change the areas of highest risk ratio. This is because most of the cumulative risk (total risk across all species) comes from these same at-risk species. The cumulative risk ratio map for the five most at risk species from surface longline (Option 3c) highlights a slightly more restricted set of key areas of risk than the map for all species (Option 3a).

All options using Method 3 (Options 3a, 3b, 3c) require a quantitative risk assessment.

**a) All 70 species** **b) At-risk species** **c) Five most at risk species from SLL**

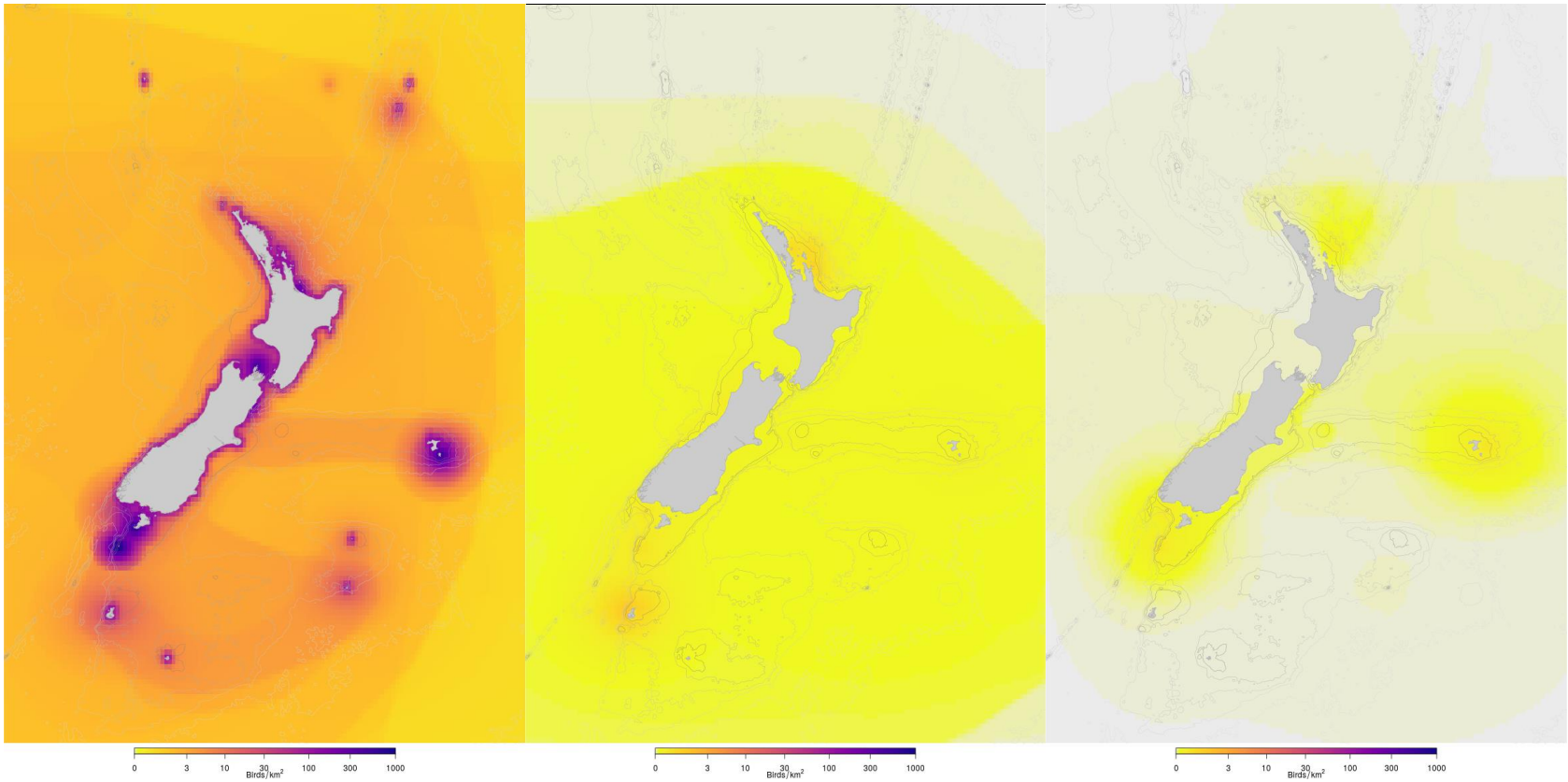


**Figure 1. Density of seabirds as included in the New Zealand seabird risk assessment (Richard & Abraham in prep) for a) all 70 seabird species included, b) at-risk species, risk ratio with a median above 0.3 or with the upper 95% confidence limit above 1 (black petrel, Salvin's albatross, flesh-footed shearwater, Westland petrel, Southern Buller's albatross, Chatham Island albatross, New Zealand white-capped albatross, and Gibson's albatross), c) the five species most at risk from SLL fishing (black petrel, Antipodean and Gibson's albatross, southern and northern Buller's albatross).**

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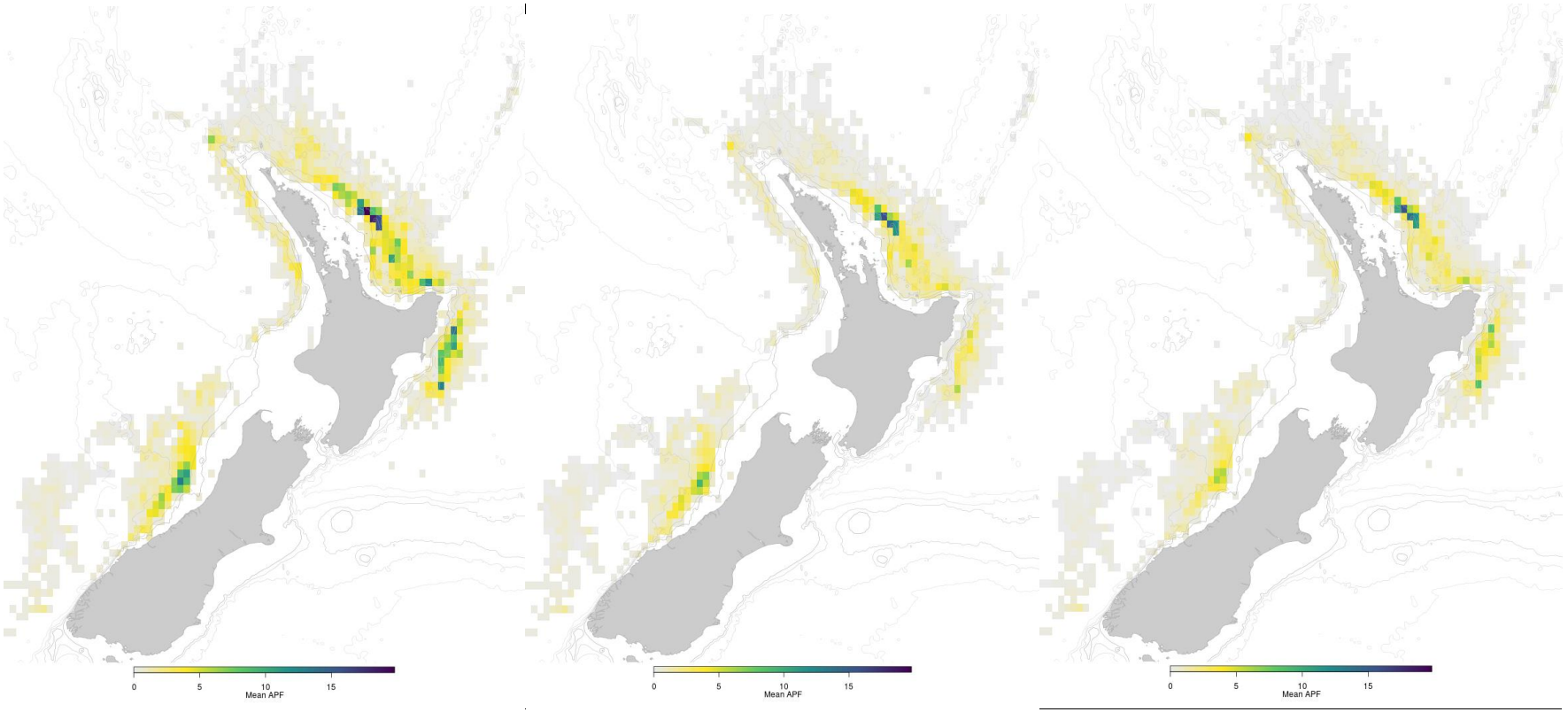


**Figure 2. Annual potential fatalities as included in the New Zealand seabird risk assessment (Richard & Abraham in prep) mapped into 0.2 degree cells for a) all 70 seabird species included, b) at-risk species, risk ratio with a median above 0.3 or with the upper 95% confidence limit above 1 (black petrel, Salvin's albatross, flesh-footed shearwater, Westland petrel, Southern Buller's albatross, Chatham Island albatross, New Zealand white-capped albatross, and Gibson's albatross), c) the five species most at risk from SLL fishing (black petrel, Antipodean and Gibson's albatross, southern and northern Buller's albatross).**

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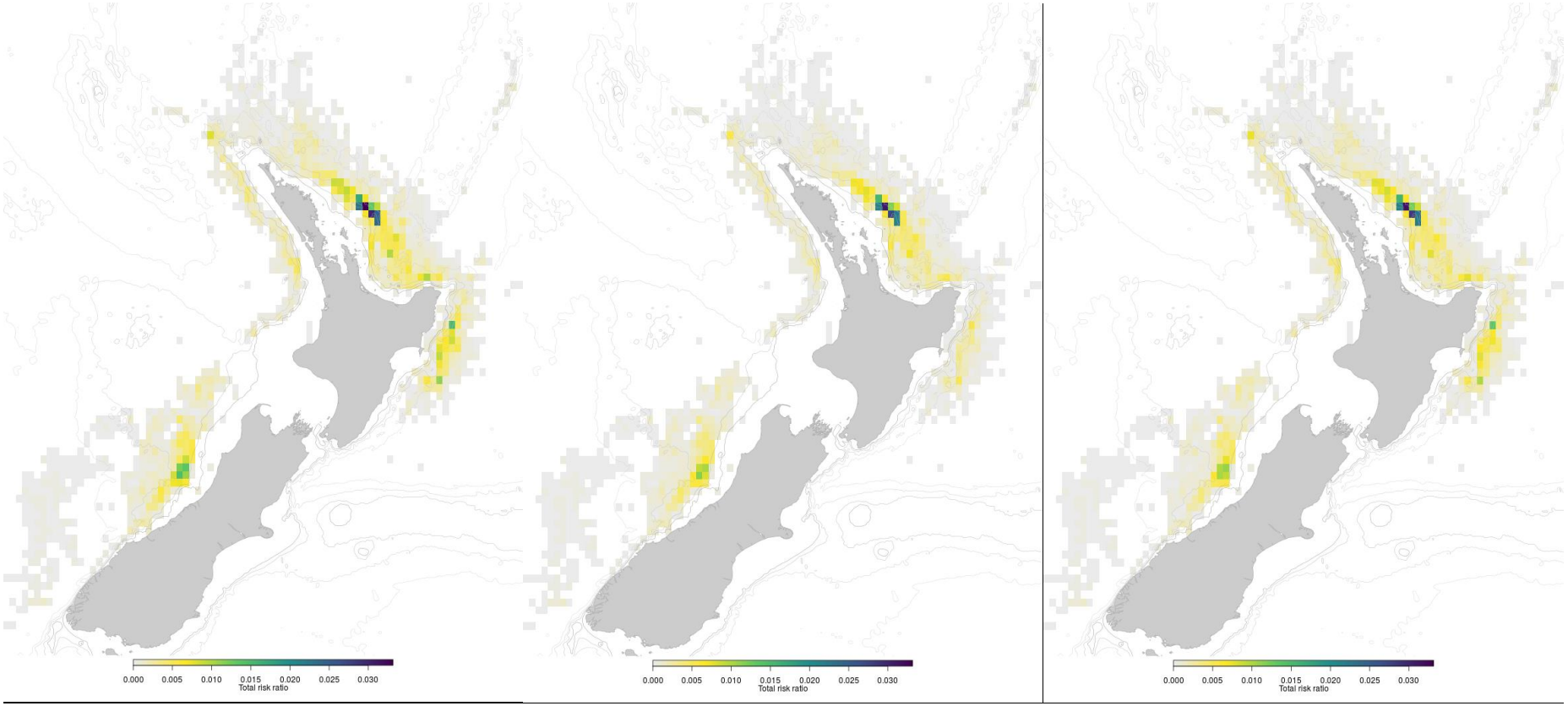


**Figure 3. Sum of risk ratios as estimated by the New Zealand seabird risk assessment (Richard & Abraham in prep) mapped into 0.2 degree cells for a) all 70 seabird species included, b) at-risk species, risk ratio with a median above 0.3 or with the upper 95% confidence limit above 1 (black petrel, Salvin's albatross, flesh-footed shearwater, Westland petrel, Southern Buller's albatross, Chatham Island albatross, New Zealand white-capped albatross, and Gibson's albatross), c) the five species most at risk from SLL fishing (black petrel, Antipodean and Gibson's albatross, southern and northern Buller's albatross).**

**Table 2: Comparison of all nine options**

| | Requires Risk Assessment | Incorporates seabird density distribution | Incorporates Annual Potential Fatalities (calculated based on effort distribution, observed captures and seabird distribution) | Incorporates Population Sustainability Threshold (calculated based on biological factors) | Considers all species | Considers only species at risk, from all fishing methods (based on NZSRA) | Considers only species most as risk, where risk is only derived from SLL fisheries (based on NZRSA) |
|---|---|---|---|---|---|---|---|
| **1a** | | ✓ | | | ✓ | | |
| **1b** | ✓ | ✓ | | | | ✓ | |
| **1c** | ✓ | ✓ | | | | | ✓ |
| **2a** | ✓ | ✓ | ✓ | | ✓ | | |
| **2b** | ✓ | ✓ | ✓ | | | ✓ | |
| **2c** | ✓ | ✓ | ✓ | | | | ✓ |
| **3a** | ✓ | ✓ | ✓ | ✓ | ✓ | | |
| **3b** | ✓ | ✓ | ✓ | ✓ | | ✓ | |
| **3c** | ✓ | ✓ | ✓ | ✓ | | | ✓ |

| | Requires Risk Assessment (either qualitative or quantitative) | Requires spatial estimation of captures | Requires quantitative risk assessment | Incorporates seabird density distribution | Based on scale of captures alone | Method includes risk to species | Broad areas defined | Areas limited to fishery/seabird overlap |
|---|---|---|---|---|---|---|---|---|
| **1a** | | | | ✓ | | | ✓ | |
| **1b** | ✓ | | | ✓ | | | | ✓ |
| **1c** | ✓ | | | ✓ | | | | ✓ |
| **2a** | | ✓ | | ✓* | ✓ | | | ✓ |
| **2b** | | ✓ | | ✓* | ✓ | | | ✓ |
| **2c** | | ✓ | | ✓* | ✓ | | | ✓ |
| **3a** | | | ✓ | ✓ | | ✓ | | ✓ |
| **3b** | | | ✓ | ✓ | | ✓ | | ✓ |
| **3c** | | | ✓ | ✓ | | ✓ | | ✓ |

- Option 2 may not require seabird distribution information if sufficient observer coverage existed to undertake a spatial estimation of captures.

## Conclusion

As shown in this paper, there are a number of potential methods that this Commission could utilise to define high risk areas for seabirds. Many of the options presented also allow for alternate sources of data to be used thereby providing further flexibility to Members. New Zealand recognises that defining high risk areas for seabirds is likely to be a difficult but also necessary objective for this Commission. New Zealand believes that agreeing on an appropriate methodology to apply is an essential first step towards that objective and that establishing a robust methodological framework around the discussion will remove much of the subjectivity in the process.

As a starting point for discussion at the ERSWG, New Zealand suggests that of the options listed in this paper those which best meet the objectives of this Commission are those found under Method 3: Realised Risk.

# Appendix 1

List of species included in the New Zealand Seabird Risk Assessment.

| Common name | Scientific name |
|---|---|
| Gibson's albatross | *Diomedea antipodensis gibsoni* |
| Antipodean albatross | *Diomedea antipodensis antipodensis* |
| Southern royal albatross | *Diomedea epomophora* |
| Northern royal albatross | *Diomedea sanfordi* |
| Campbell black-browed albatross | *Thalassarche impavida* |
| New Zealand white-capped albatross | *Thalassarche cauta steadi* |
| Salvin's albatross | *Thalassarche salvini* |
| Chatham Island albatross | *Thalassarche eremita* |
| Grey-headed albatross | *Thalassarche chrysostoma* |
| Southern Buller's albatross | *Thalassarche bulleri bulleri* |
| Northern Buller's albatross | *Thalassarche bulleri platei* |
| Light-mantled sooty albatross | *Phoebetria palpebrata* |
| Northern giant petrel | *Macronectes halli* |
| Grey petrel | *Procellaria cinerea* |
| Black petrel | *Procellaria parkinsoni* |
| Westland petrel | *Procellaria westlandica* |
| White-chinned petrel | *Procellaria aequinoctialis* |
| Flesh-footed shearwater | *Puffinus carneipes* |
| Wedge-tailed shearwater | *Puffinus pacificus* |
| Buller's shearwater | *Puffinus bulleri* |
| Sooty shearwater | *Puffinus griseus* |
| Fluttering shearwater | *Puffinus gavia* |
| Hutton's shearwater | *Puffinus huttoni* |
| Little shearwater | *Puffinus assimilis* |
| Snares Cape petrel | *Daption capense australe* |
| Fairy prion | *Pachyptila turtur* |
| Antarctic prion | *Pachyptila desolata* |
| Broad-billed prion | *Pachyptila vittata* |
| Pycroft's petrel | *Pterodroma pycrofti* |
| Cook's petrel | *Pterodroma cookii* |
| Chatham petrel | *Pterodroma axillaris* |
| Mottled petrel | *Pterodroma inexpectata* |
| White-naped petrel | *Pterodroma cervicalis* |
| Kermadec petrel | *Pterodroma neglecta* |
| Grey-faced petrel | *Pterodroma macroptera gouldi* |
| Chatham Island taiko | *Pterodroma magentae* |
| White-headed petrel | *Pterodroma lessonii* |
| Soft-plumaged petrel | *Pterodroma mollis* |
| Common diving petrel | *Pelecanoides urinatrix* |
| South Georgian diving petrel | *Pelecanoides georgicus* |
| New Zealand white-faced storm petrel | *Pelagodroma marina maoriana* |
| White-bellied storm petrel | *Fregetta grallaria grallaria* |
| Black-bellied storm petrel | *Fregetta tropica* |
| Kermadec storm petrel | *Pelagodroma albiclunis* |
| New Zealand storm petrel | *Pealeornis maoriana* |
| Yellow-eyed penguin | *Megadyptes antipodes* |
| Northern little penguin | *Eudyptula minor f. iredalei* |
| White-flippered little penguin | *Eudyptula minor f. albosignata* |
| Southern little penguin | *Eudyptula minor f. minor* |
| Chatham Island little penguin | *Eudyptula minor f. chathamensis* |
| Eastern rockhopper penguin | *Eudyptes chrysocome filholi* |
| Fiordland crested penguin | *Eudyptes pachyrhynchus* |
| Snares crested penguin | *Eudyptes robustus* |
| Erect-crested penguin | *Eudyptes sclateri* |
| Australasian gannet | *Morus serrator* |
| Masked booby | *Sula dactylatra* |
| Pied shag | *Phalacrocorax varius varius* |
| Little black shag | *Phalacrocorax sulcirostris* |
| New Zealand king shag | *Leucocarbo carunculatus* |
| Stewart Island shag | *Leucocarbo chalconotus* |
| Chatham Island shag | *Leucocarbo onslowi* |
| Bounty Island shag | *Leucocarbo ranfurlyi* |
| Auckland Island shag | *Leucocarbo colensoi* |
| Campbell Island shag | *Leucocarbo campbelli* |
| Spotted shag | *Stictocarbo punctatus* |
| Pitt Island shag | *Stictocarbo featherstoni* |
| Subantarctic skua | *Catharacta antarctica lonnbergi* |
| Southern black-backed gull | *Larus dominicanus dominicanus* |
| Caspian tern | *Hydroprogne caspia* |
| White tern | *Gygis alba candida* |