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Commission's information needs on the bycatch of seabirds and the design of observer coverage

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Purpose

The purpose of this paper is to seek guidance from the Commission on the nature and quality of the information it needs on the bycatch of seabirds and other species of concern, and other incidental impacts of SPRFMO fisheries on marine systems, insofar as these can be informed by data collected by observers.

Scientific information collected by observers

The purpose of the SPRFMO observer programme (paragraph 2 of CMM-16-2019) is to facilitate the collection of verified scientific data and additional information related to fishing activities in the Convention Area and its impacts on the ecosystem, and also to support the functions of the Commission and its subsidiary bodies, including the CTC.

To meet the first part of this purpose, observers in the SPRFMO Area collect information on:

- Target species (e.g., length or age measurements for jack mackerel, squid, orange roughy, wreckfish) to support stock assessments and understanding life histories;
- Catch of lesser or non-target fish and invertebrates (e.g., length and sometimes age measurements for chub mackerel, boarfish, tarakihi, kingfish) to support risk assessments and understanding life histories;
- Bycatch of seabirds, marine mammals, reptiles, and other species of concern to understand the nature and extent of interactions and support risk assessments and inform potential mitigation approaches if necessary;
- Bycatch of vulnerable marine ecosystem (VME) indicator taxa and other benthic fauna to support risk assessments and the design of management measures to prevent

significant adverse impacts on VMEs, and to assist vessel masters to operate VME encounter protocols;

- Attributes of the vessel, fishing gear being used, and any mitigation measures being employed to reduce impacts on the ecosystem.

The type and quality of observer information required to underpin stock assessments for major target species is relatively clear and well-understood by the Scientific Committee for most fisheries. Observer information (as well as industry self-sampling information for jack mackerel) has been critical for the development of stock assessment models for jack mackerel and orange roughy that have underpinned management advice to the Commission on catch limits. To support this type of work, minimum levels of observer coverage have been specified for bottom fisheries (100% for trawl and exploratory line fisheries and 10% for other bottom line fisheries, Annex 8 of CMM-03-2019) and for jack mackerel fisheries (10% for trawlers and purse seiners, paragraph 22 of CMM-01-2019).

However, it is less clear what other information the Commission needs that can be generated by observers (such as capture rates of seabirds or other species of concern) and, more specifically, the quality, certainty, and timeliness of that information that would allow the Commission to manage those issues effectively.

Cost-quality trade-offs in data collection

Previous papers to the Scientific Committee (e.g., Debski & Pierre 2014, SC-02-Doc14; and Cryer et al. 2018, SC-06-Doc30) have shown that there are clear and relatively predictable trade-offs between sampling effort (i.e., the level of observer coverage or the number of observations in complementary electronic monitoring, EM, systems) and the quality of the estimates that can be made (i.e., the likelihood that the bias and uncertainty in those estimates will be acceptable for the defined management need). Put simply, frequent, representative sampling produces reliable estimates with low uncertainty whereas sparse, patchy sampling produce estimates that may be badly biased or too uncertain to be informative.

However, in addition to the frequency of sampling, levels of uncertainty associated with estimates can also be influenced by the frequency at which the events of interest occur. For example, if events are rare, like captures of seabirds or marine mammals, more sampling is required to get a good understanding of the average capture rate. Similarly, if events are patchy and often come in clusters, like potential interactions with pods of dolphins or flocks

of birds, more sampling is required to get a good understanding of the average capture rate. Also, fisheries that are variable in time or space will require more sampling to understand than fisheries that are more consistent.

Figure 1 shows an example of how uncertainty associated with estimates can be influenced by the level of observer coverage (frequency of sampling) and other factors (using data from New Zealand in-zone surface and demersal longline and trawl fisheries). Each point represents the uncertainty in an estimate of the total number of seabirds captured in a fishery in a year, and the different symbols represent different fisheries. Uncertainty is plotted on the y-axis (as the 95% confidence interval of each estimate compared with that estimate's mean) and the level of observer coverage is plotted on the x-axis.

Uncertainty generally decreases with increasing observer coverage but there are large differences between fisheries caused by differences in the frequency of captures and the different levels of spatial or temporal variability in particular fisheries.

Taking the general trend first, in the bluenose longline fishery where observer coverage is less than 10%, estimates of seabird bycatch are very uncertain and probably biased. Conversely, where observer coverage is greater than 80%, in the squid and southern blue whiting trawl fisheries, estimates are very reliable, with little bias.

Within the general trend, factors such as the average capture rate of seabirds in different fisheries and the spread of observer coverage across seasons, locations and vessels can also influence the level of uncertainty. For example, observations from 20–30% of events in hoki and squid trawl fisheries (which are both well-understood and have relatively high capture rates of seabirds) produce reliable estimates of seabird bycatch with little bias. However, similar levels of coverage in trawl fisheries for southern blue whiting, and bottom longline fisheries for ling, produce much less certain estimates because the capture rates are lower and more variable.

Thus, it is very important to understand the specifics of each fishery and the nature and quality of information needed when designing an observer programme. Bearing this in mind, Table 1, gives a broad guide to the trade-off between cost (in terms of indicative levels of observer coverage, perhaps) and information quality (in terms of the proportion of issues for which sufficiently reliable estimates can be made and in what timeframes). The table is based on our interpretation of published analyses and previous papers to the Scientific Committee.

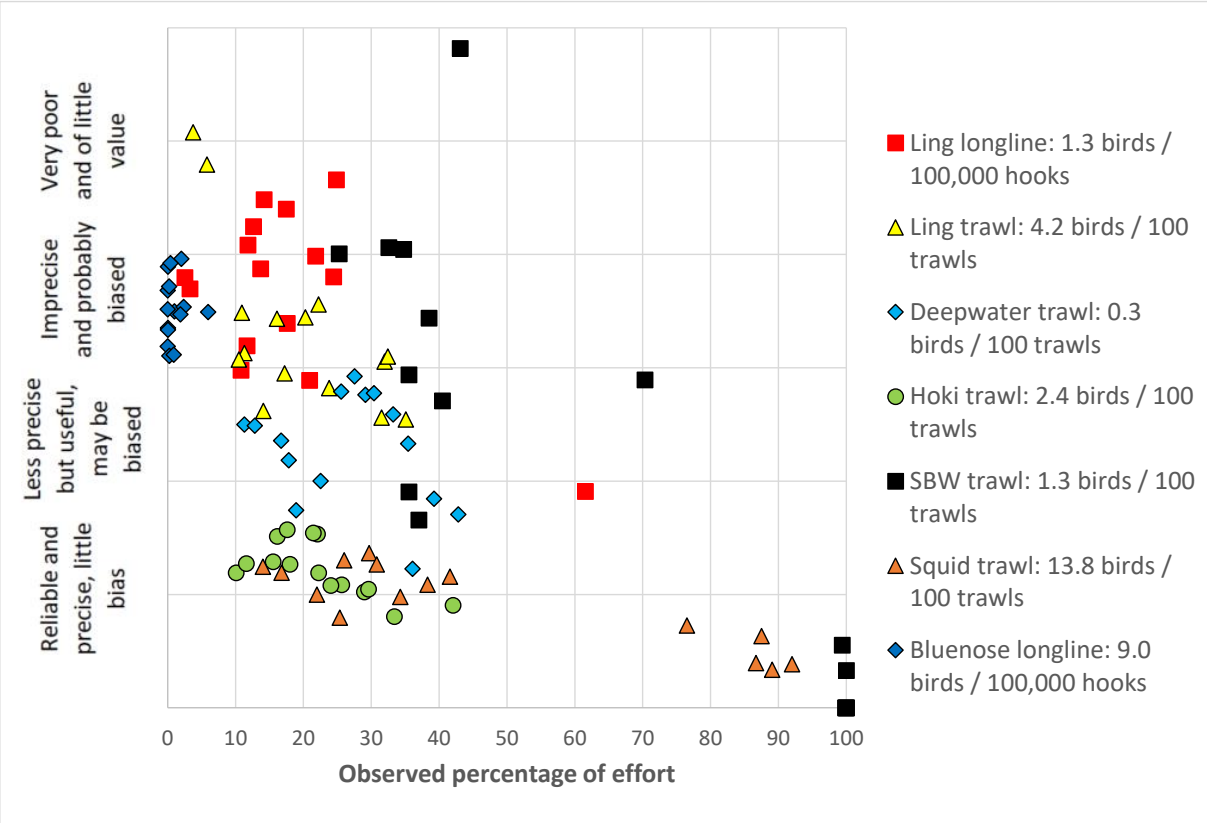

Figure 1: Uncertainty in seabird bycatches estimates (all seabird taxa combined) plotted against the percent of fishing evets observed for selected New Zealand in-zone fisheries 2003-2017.

The extent of observer coverage or other observations (such as complementary electronic monitoring systems) needed to generate robust estimates of the frequency and total number of bycatch events in a fishery varies with the characteristics of the fishery, the species of interest, and bycatch patterns, particularly patchiness and the prevalence of multiple captures. In relatively homogeneous and well-understood fisheries, carefully designed programmes with low levels of observer coverage (5%) or other verifiable observations can provide sufficient information to support stock assessments (e.g., sufficient data on fish size and age structure). However, such low levels of coverage will generate highly uncertain estimates of rare or episodic events like bycatch of rare species or seabirds in a given year. Making estimates of such rare events may still be necessary in large fisheries because the total number of captures may be large compared with the ability of the population to sustain them. For example, Antipodean albatross is a seabird for which there is significant conservation concern in the south Pacific and even very rare captures in the large fisheries for jack mackerel and squid may cause unsustainable rates of mortality. Issues like these may require higher levels of coverage levels (>25%) to provide even moderately reliable estimates in the short to medium term, especially in fisheries that are highly variable in space or time. If observer coverage continues for several years, an increasingly high proportion of bycatch issues will be

identified, and long-run averages of the number of fatalities can be calculated with increasing certainty for the commoner events. However, it is important to note that this applies only if the placement of observers is representative or random within a fishery, and this is very difficult to achieve in heterogeneous or unpredictable fisheries with low levels of coverage.

Table 1: Guide to the key risks associated with different approaches to information quality and sampling intensity for seabird bycatch issues. Levels of observer coverage are indicative only, and actual levels for each required level of information quality would need to be determined statistically using information specific to each fishery on the frequency and patchiness of interactions and other operational characteristics.

Nature and required quality of information	Indicative observer or EM coverage	Risks of this approach (noting that these risks may not be realised in all fisheries, especially those that are relatively homogenous and well-understood)
A: Indicative but patchy information on very common bycatch issues in a fishery	<5%	• Most bycatch issues not identified in the short to medium term, especially in large and variable fisheries; • Highly non-representative coverage in time, space, or by vessel type; • Estimates badly biased if coverage is not representative; underestimating captures is more common than overestimating; • Meaningful quantitative estimates not possible; • No ability to understand key drivers of captures (and design any necessary mitigation);
B: Basic understanding of the most common bycatch issues in a fishery	5–10%	• Several bycatch issues (e.g., for moderately rare species or species found only in a small area) not identified in the short term, especially in large, variable fisheries; • Non-representative coverage in time, space, or by vessel type; • Estimates biased, potentially badly, if coverage is not representative; underestimating captures is more common than overestimating; • Meaningful quantitative estimates not possible; • Poor ability to understand key drivers of captures (and design any necessary mitigation);
C: Identification of most bycatch issues, quantitative but imprecise estimates for all species combined and, perhaps, some common bycatch species	10–25%	• Increasing cost; • Some rare bycatch issues (e.g., for rare species or species found only in a small area) not identified in the short or medium term, especially in large and variable fisheries; less likely in focussed, predictable fisheries; • Bycatch estimates for many individual species very imprecise and quite likely to be biased, especially in fisheries with very low capture rates; • High variability of estimates between years;
D: Identification of all but the very rarest bycatch issues, precise quantitative estimates for all species combined and reasonable estimates for some common bycatch species	25–50%	• Moderately high cost; • Some very rare or episodic bycatch issues not identified in the short term, especially in large and variable fisheries; • Bycatch estimates for several individual species imprecise and potentially biased, especially in fisheries with very low capture rates (spatial overlap modelling is probably preferable, reducing the relevance of this risk);
E: Identification of all bycatch issues, precise quantitative estimates for common bycatch species	>50%	• High costs; • Bycatch estimates for rare species may be imprecise or biased (spatial overlap modelling is probably preferable, reducing the relevance of this risk)

The need for guidance from Commission

It is a scientific job to assess the level of sampling or observer coverage required to deliver information with acceptable levels of uncertainty within given timeframes. However, before it can undertake this task, the Scientific Committee needs to understand the nature, quality, and timeliness of the information that the Commission needs to manage incidental impacts like seabird bycatch in SPRFMO fisheries in accordance with the Convention. In its report to the Commission in 2018, therefore, the Scientific Committee sought guidance from the Commission on the information it required to understand and manage impacts on seabirds, marine mammals, reptiles, and other species of concern:

> *In this regard, the SC **advised** the Commission that observer coverage of 20% or more may be required to robustly estimate incidental mortality of seabirds, marine mammals and other species of concern in some fisheries. Furthermore, a periodic review of observer coverage and the utility of the data generated should be used to fine-tune levels of observer coverage. On this topic, the SC **seeks guidance** from the Commission on the nature of its information needs for the bycatch of Seabirds, Marine Mammals, and Other Species of Concern, so that the SC can more precisely advise on observer deployment requirements in SPRFMO fisheries.*

This was not discussed in detail at the Commission's 7th meeting in 2019, perhaps because no paper was provided to inform a discussion. However, the issue arose as part of the Commission's discussion of the recommendations from the 2018 review of SPRFMO under Article 30 of the Convention. In particular, paragraph 100(d) of the review stated:

> *Recommends that the Commission implement more effective and comprehensive bycatch data collection and reporting, particularly but not limited to dependent and associated species in each fishery and identified species of concern, the collection of sufficient biological data to support the development of reliable stock assessments for all fisheries, and the extension of data collection programmes to include environmental data and other data to assist in estimating potential impacts on non-target species*

The review panel also noted that the need for observer coverage [should] be directly linked to data and verification needs.

In response to this and other recommendations under paragraph 100 of the review, Commission instructed its Scientific Committee to provide advice sufficient to enable its consideration of this recommendation (see COMM7-Report Annex 8).

SC7's report (see Annex 10) contains responses to all such instructions to provide advice, including on the bycatch of seabirds and other species of concern. This paper provides more background on that particular issue and a mechanism for Commission to define its particular information needs.

Conclusion

If it is to design observer programmes to meet the Commission's information needs on the bycatch of seabirds, marine mammals, reptiles and other species of concern, SC7's report suggests that the Scientific Committee's work would be greatly eased if Commission were to describe the nature, quality, and timeliness of the information it needs. One way to describe quality would be to identify a row in Table 1 of this paper (labelled A through E) that is closest to the Commission's aspirations for information on such bycatch. Alternatively, the Commission could modify one of the descriptions in the table.

New Zealand's view is that the Commission should accept a target no lower than the collection of information (consistent with row C in the table) that would allow:

- the identification of most bycatch issues in the major fisheries in the short to medium term; and
- the identification of all but the very rarest bycatch issues in the medium to long term; and
- the calculation of quantitative (but probably uncertain) estimates of total fatalities for all species combined and for some of the more common bycatch species in the medium term (pending actual data collection).

Once the information need has been defined, the Scientific Committee can begin the task of designing sampling programmes to deliver that information and advising the Commission. Given the timing of meetings, the Scientific Committee will not be able to provide advice on coverage levels following Commission's clarification of its needs until the Commission's 10th meeting in 2022 at the earliest.

Recommendation

It is **recommended** that the Commission

- **agrees** that it requires information sufficient to:
    - identify most bycatch issues related to seabirds and other species of concern in each of the major SPRFMO fisheries in the short to medium term; and
    - provide quantitative estimates in the medium term for all species of seabird combined and some of the more common bycatch species;
- **communicates** this information need to its Scientific Committee; and
- **instructs** its Scientific Committee to determine and advise, by no later than the Commission's 10th meeting in 2022, the observer coverage or other observations needed in each major fishery to deliver this information.

References

Cryer M, Debski I, Bock T. (2018). Observer coverage to monitor seabird captures in fisheries. Paper SC-06-30 for the 6th Meeting of the Scientific Committee, Puerto Varas, Chile, 9–14 September 2018. 11 p. Available at http://www.sprfmo.int/assets/2018-SC6/Meeting-Documents/SC6-Doc30-Observer-coverage-seabird-bycatch.pdf.

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