# Discussion paper for SEFRA output: evaluating relationships between bycatch risk and SBT fishery

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## SUMMARY

Based on the Seabird Ecological Risk Assessment (SEFRA) results conducted by CCSBT ERS, we conducted the analyses on spatial overlap between SBT catch CPUE and seabird distribution density and those between fishing effort and seabird density distribution, for the period 2012-23 using catch and effort (CE) data extracted from CCSBT Data Exchange. This document discussed future seabird management strategies in the CCSBT, based on the results of above mentioned analyses, together with the process of SEFRA development to date.

## BACKGROUND

The ERSWG seabird risk assessment project for longline fisheries agreed at the 2025 ERS Technical Meeting on finalization of risk assessment model to be used in discussion and development of the seabird management strategy within the CCSBT Convention Area. The finalized model adopts the SEFRA approach, is based on seabird ecological, distributional and population information submitted by seabird researchers (CCSBT-EC/2510/14), and is applied to the observer data submitted by CCSBT member countries. The output from the finalized model is shared among the CCSBT relevant scientists. The multi-year seabird management strategy places an emphasis on defining "reference species" and "risk zones" where bycatch has a major impact on reference species, based on the risk assessment results. This paper introduces the initial thought on the definition of those two terms, together with additional analyses conducted to assist further discussion.

## IDENTIFICATION OF REFERENCE SPECIES GROUP FOR MANAGEMENT

Although the CCSBT ERS risk assessment showed the bycatch risk by species by species (CCSBT-EC/2510/14; Table 10), it should also be noted that the model treated all bycatch information at genus level. In the other words, the assessment placed low confidence in capacity of species level identification on bycaught seabirds. In fact, during the SEFRA development process, it became clear that species level identification of bycaught seabird is challenging due to difficulty in developing adequate species identification capabilities

by on-board observers and through resolution of on-board cameras imageries. Some utilized genetic analysis on specimens collected from bycaught seabirds to assist and assure the accuracy of species identification, the concerns on the impacts of rapid and broad expansion of highly pathogenetic avian influenza made it pragmatically impossible to collect and bring back biological specimens obtained from bycaught seabirds (CCSBT-ERS/2406/16), not only at this moment and also probably in the future at least for quite long time.

This means that the identification of seabird bycatch would be feasible only up to the genus level, even though the assessment can provide risk score at species level. Considering the importance of capacity to monitor seabird bycatch at sea properly and promptly as well as the capacity to respond swiftly when undesired events detected in order to ensure proper management on seabird bycatch, we believe that "the reference species" should be defined at genus or species group level.

Defining the "reference species group" for management purpose would not prevent to continue assessing risks at individual species level. On the contrary, the continuation of species level risk assessment would be essential to evaluate actual impacts of bycatch mortality on individual species even with substantial time lag. However, it should be noted that the lack of timeliness in obtaining seabird population, migration and distribution and other biological and ecological parameters, as well as difficulty of connecting them with fisheries related information, including distinguishing mortality due to fisheries and non-fisheries causes would raise a challenge in evaluating the management effects and lead to gradually diminishing the credibility on assessment results in the long run.

In addition to continued updates of seabird related information, those members who hosts important colonies of "reference species" are strongly encouraged to enhance its effort in improving the timeliness in providing seabird related information.

When examining risk by species groups, the great albatross group clearly showed higher risk than other species groups, and we consider it appropriate to regard this as the reference species group tentatively. Although the dark albatross group also showed somewhat elevated risk, given insufficiency in distribution information, and taking into account that this is an initial trial to introduce new management scheme, we consider it better to focus one species group as "reference", examining the effectiveness as well as operational challenges, and then to consider for future expansion. Simultaneously, the improvement in analytical methods and supporting information may alter the existing recognition.

In addition, the multi-year seabird strategy requests to define the target rate for total seabird bycatch. The risk assessment indicated that the large majority of bycatch is from petrel group which has no concerns in population/ conservation status and therefore, we consider that there is no rational to determine additional management target for total seabird catch rate and that it is more appropriate to focus management efforts into improved monitoring and conservation of more concerned species groups, regarded as "reference".

**DATA ANALYSIS FOR ASSESSING THE IMPACT ON SBT-LONGLINE FISHERY**

The CCSBT ERS seabird risk assessment model (SEFRA approach) calculates seabird bycatch mortality and risk indices, based on seabird density, longline effort, observed seabird bycatch events and their observed effort, plus seabird biological parameters. In the other words, the output from the model reflects a distribution of estimated mortality.

However, when considering concrete bycatch management measures, it is, simultaneously, necessary to minimize the impacts on fishing activities as much as possible, i.e. balancing between seabird bycatch reduction and the impacts on SBT fishing activities. Therefore, we examined spatial overlap between longline effort density and SBT CPUE distributions, as an indicator of fishery gain, using the data shared in CCSBT Data Exchange.

For data, we first calculated species group density aggregated for the great albatross species group by aggregating the 5×5 degree grid densities of all great albatross species in each grid cell, using the seabird species-specific distribution density data from the SEFRA analysis. We used two indicators for SBT abundance subject to SBT fisheries, i.e. nominal SBT CPUE and SBT longline efforts in individual cell. Nominal CPUE was calculated data aggregated to 5×5 degrees based on longline effort and SBT catch data shared in CCSBT Data Exchange. Based on these data, the degree of overlap between seabird density and longline efforts distribution, and the overlap between seabird density and SBT nominal average CPUE, were calculated, and, then as the product of both was calculated as degree of overlap = (seabird density) * (effort or CPUE).

To assess the spatial balance between seabird density and fishing activity, we defined a "balance index" by standardizing species group density, SBT CPUE, and effort in each grid to a 0-1 scale, and calculating the difference between density and effort/CPUE values. Specifically, for each grid cell, we first normalized the values using min-max scaling: normalized value = (observed value - minimum) / (maximum - minimum), where minimum and maximum were calculated across all grid cells. The balance index was then calculated as the difference between normalized density and normalized effort (or CPUE). The closer a grid's index value is to 1, the lower the effort relative to seabird density in that grid, or the lower the SBT CPUE, meaning it would be useful as an additional management area for reducing seabird bycatch while reducing impacts on SBT fisheries. Finally, we calculated and visualized overlap degree and balance tables for seabird density versus longline effort and CPUE respectively.

The overlap between CCSBT longline effort and SBT CPUE with great albatrosses (Fig. 1 and 3) showed trends similar to the mortality distribution from SEFRA (CCSBT-EC/2510/14; Fig. 13, 16). Both indicated strong correlation in the Tasman Sea area, i.e. SBT fisheries in the Tasman Sea represent the time/area cooccurring high SBT density and high density of great albatrosses.

On the other hand, when examining the balance index distribution, areas with high seabird density relative to effort and CPUE were not exactly the same as those identified above and concentrated particularly in the southwestern Pacific (Fig. 2 and 4). This analysis would be helpful to further identify the area of more effective in seabird conservation whereas lowering the impacts on target catch.

## DISCUSSION

### Reference species group and area classification

This paper proposes great albatrosses, which have the most at-risk species, as the reference species group based on SEFRA output results. However, it is difficult to determine criteria for quantitatively classifying reference species groups with current information alone. This needs to continue to be discussed at future ERSWG meetings or technical meetings.

This paper also provided different aspects for spatial analysis to identify more effective areas for conservation of seabirds by SBT fisheries. When considering management that takes into account the balance with fisheries, areas where such mismatches are observed should also be examined as risk areas for considering additional seabird management.

Although the above analyses were made based on 5x5 degrees data, it should be noted that in developing the actual management measure, it is important to keep the time/areas subject for control as relatively broad to ensure its effectiveness as well as for monitoring efficiency, considering the operational scale of longline being an level of one degree.

### Future risk assessment

The SEFRA assessment has dramatically advanced the state of seabird bycatch impact assessment. This risk framework should be maintained and periodic assessments conducted going forward. However, risk assessment consumes significant ERSWG resources, and seabird population information is only updated over the long term, with the effects of regional tRFMO measure revisions also expected to take time to be in effect. Therefore, it is desirable to conduct assessments with some interval between them. They should be implemented at least on a four-year span. Through the risk assessment efforts to date, we have confirmed that seabird population information and seabird distribution information have a very large impact on risk assessment results. Therefore, for continuation of the framework, the need for periodic collection and provision of seabird population information from seabird researchers should be noted. Additionally, while this assessment focused only on the impacts of tuna longline fisheries, future efforts should continue toward integration with population dynamics models and, accordingly, inclusion of mortality factors other than tuna fisheries in risk assessments.

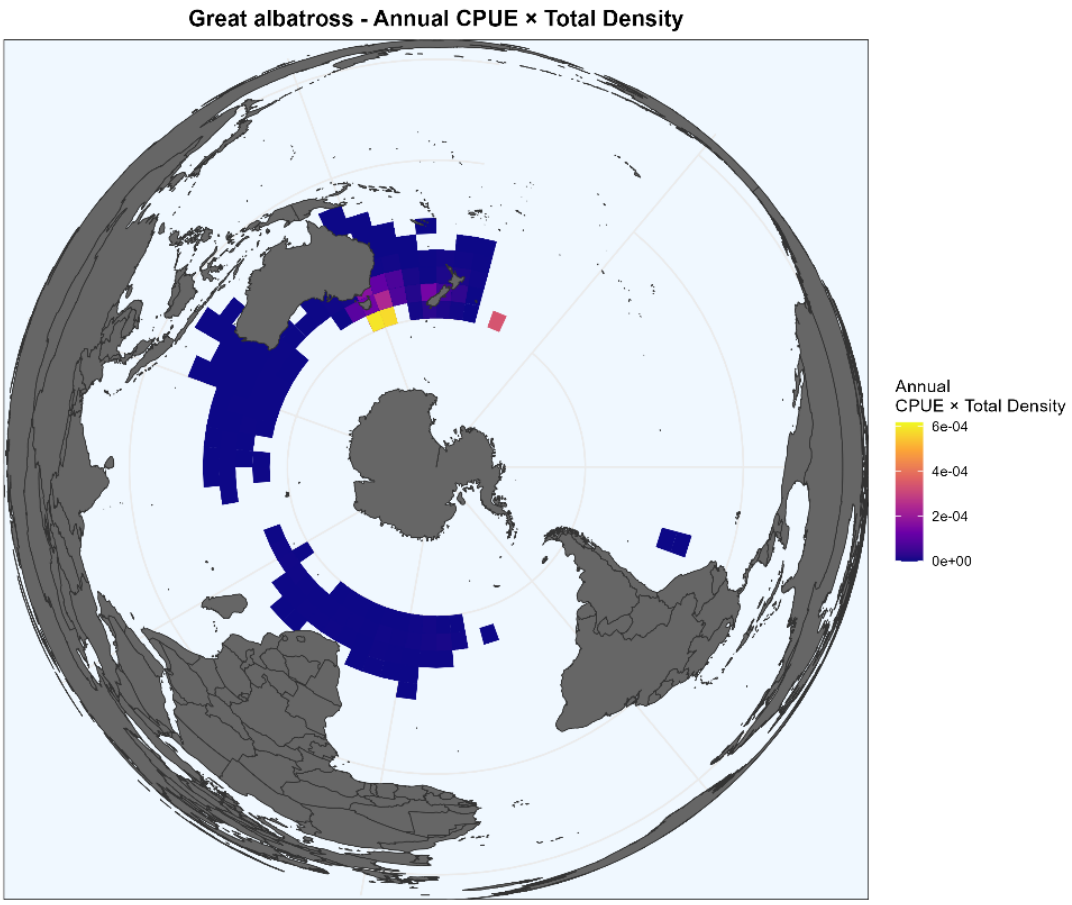



**Figure 1. Spatial overlap between seabird distribution and SBT CPUE (2012-2023) — Great albatrosses**

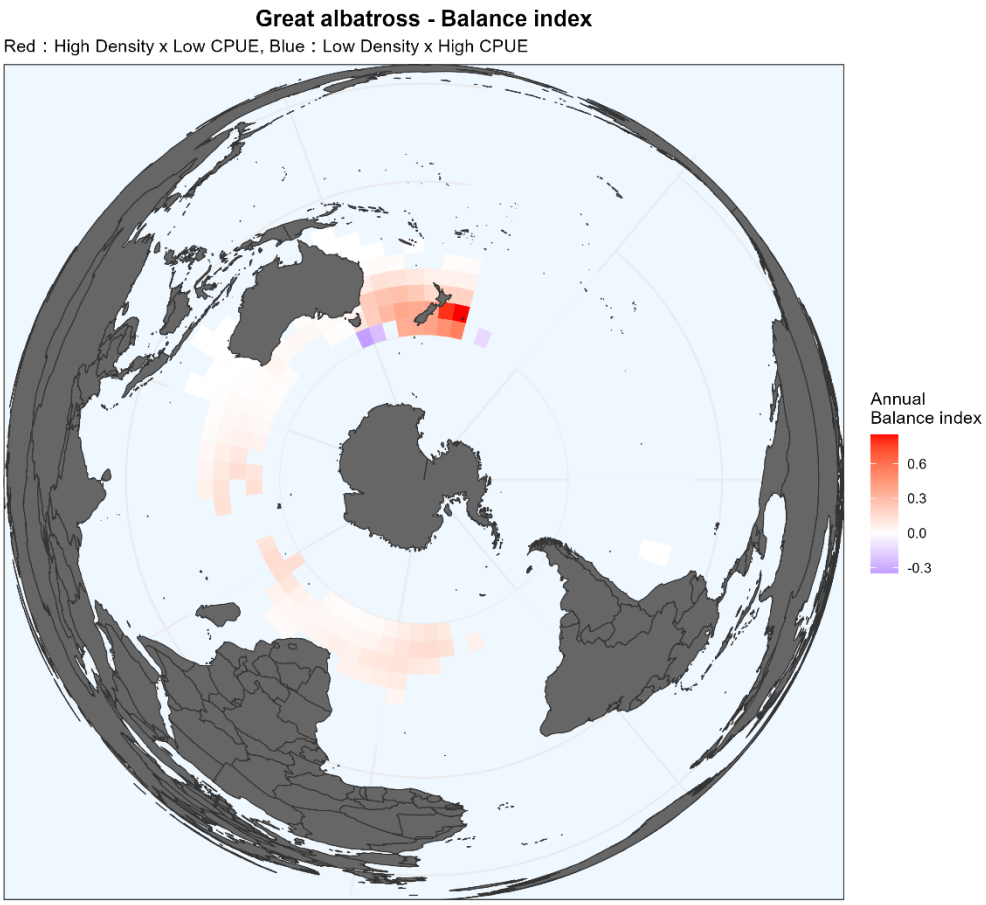



**Figure 2. Balance index between seabird distribution and SBT CPUE (2012-2023) — Great albatrosses**

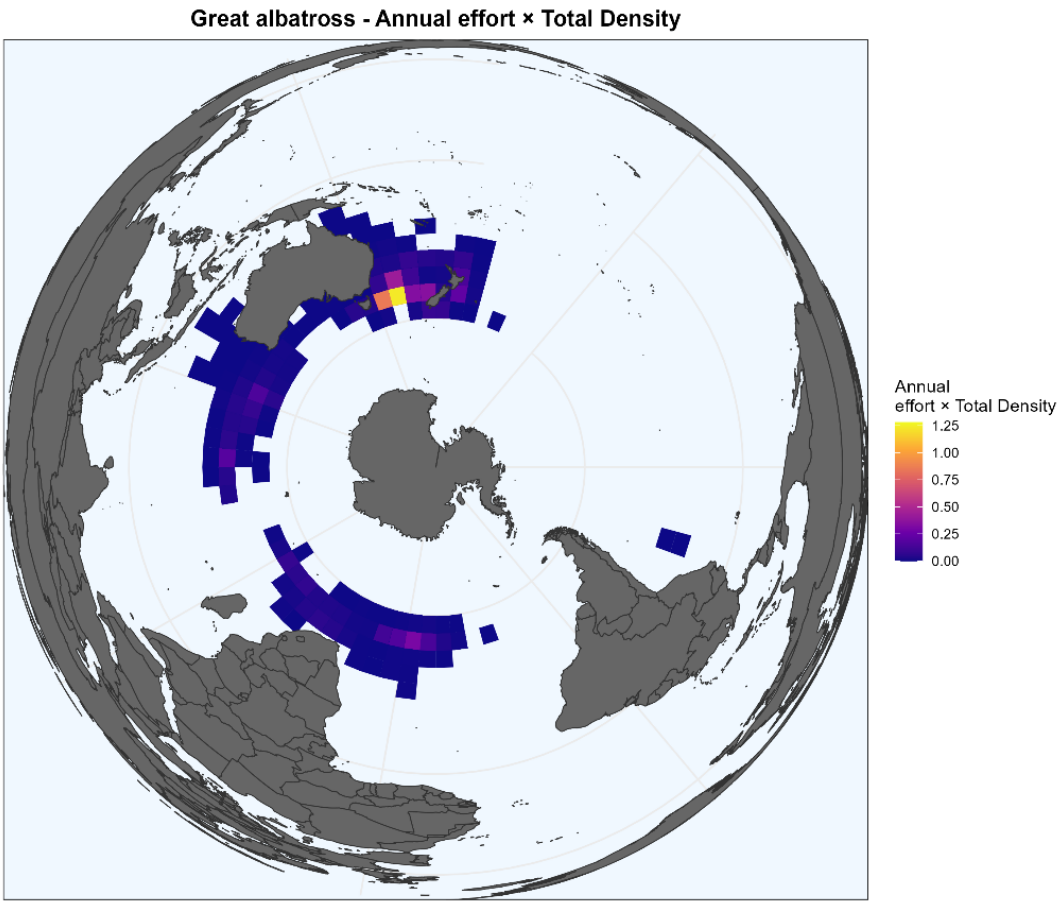



**Figure 3. Spatial overlap between seabird distribution and longline effort (2012-2023) — Great albatrosses**

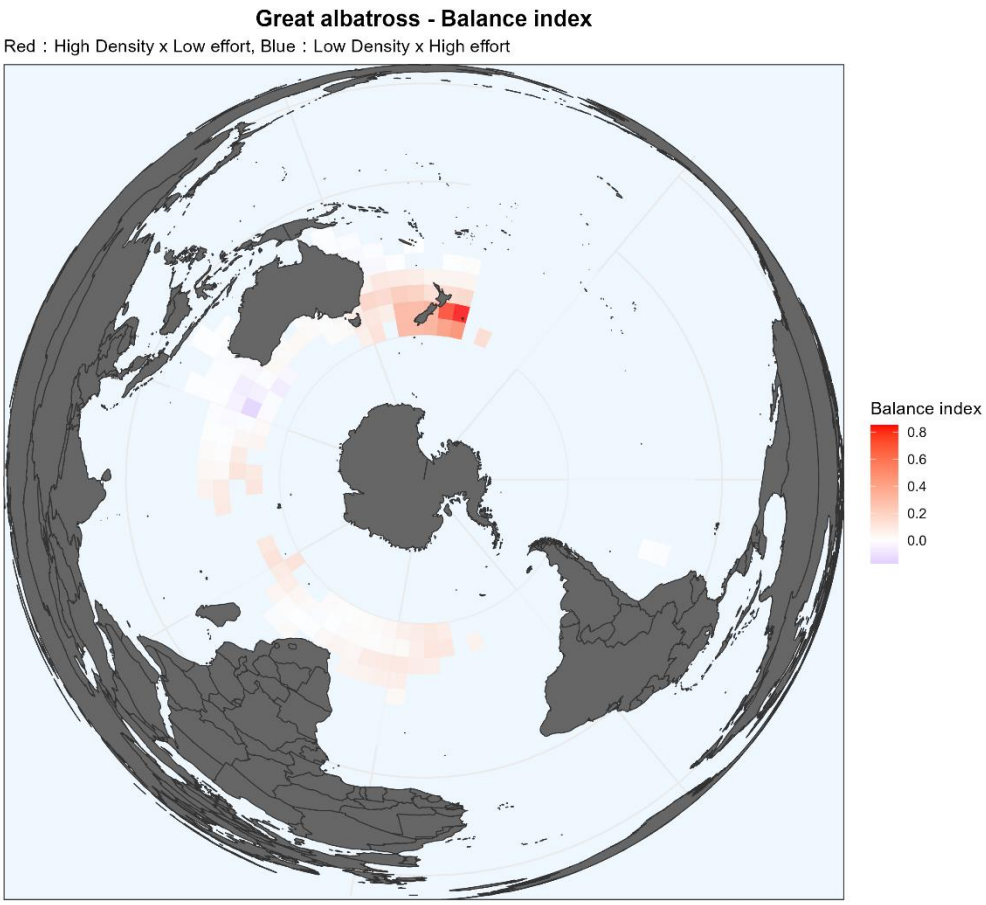



**Figure 4. Balance index between seabird distribution and longline effort (2012-2023) — Great albatrosses**