SCIENTIFIC COMMITTEE
THIRTEENTH REGULAR SESSION

Rarotonga, Cook Islands
9-17 August 2017

A short note on the development of WCPFC seabird bycatch estimates for Project 68

WCPFC-SC13-2017/EB-IP-18

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Project 68: Estimation of seabird mortality across the WCPO Convention area

1 Introduction

The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Convention) entered into force in June 2004 creating one of the first regional fisheries management organizations to be established since the 1995 adoption of the United Nations Fish Stocks Agreement.

The objective of the Convention is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific Ocean (WCPO) in accordance with the 1982 United Nations Convention on the Law of the Sea (UNCLOS) and the Agreement. The Convention applies to all species of highly migratory fish stocks (defined as all fish stocks of the species listed in Annex I of UNCLOS occurring in the Convention Area and such other species of fish as the Commission may determine) within the Convention Area, except sauries. Conservation and management measures under the Convention are to be applied throughout the range of the stocks, or to specific areas within the Convention Area, as determined by the Commission.

The Commission adopted CMM 2015-03 which requests the Scientific Committee to estimate seabird mortality in all fisheries where the Convention applies. The Twelfth Scientific Committee (SC12) developed terms of reference (scope of work) for the estimation of seabird mortality across the WCPO Convention area, Project 68.

1.1 Project Objective

The objective of Project 68 is to integrate improved bycatch mitigation technologies and practices in tuna fisheries into regular management planning process at regional and national levels.

1.2 Project History

The Twelfth Scientific Committee (SC12) developed terms of reference (scope of work) for the estimation of seabird mortality across the WCPO Convention area, which was endorsed and approved by the Commission in December 2016. However, progress on this research was dependent on co-funding from the GEF-FAO Common Oceans project. The GEF-FAO Common Oceans project has confirmed co-funding and is in discussion with the WCPFC Secretariat and the Scientific Services provider to get the project underway. The intent is that the WCPFC will contract the Scientific Services Provider to undertake the estimation of seabird mortality in the WCPO Convention Area as per the project scope in Section 1.3 below.

1.3 Project Scope

The scope of work for this project will include, but not be limited to, the following:

a) Develop a methodology to estimate total seabird mortality, including treatment of data gaps, in all fisheries to which the WCPF Convention applies;
b) Estimate the total number of seabirds being killed per year in all fisheries to which the WCPF Convention applies;

c) Assess mortality per year over the ten years since the first WCPFC seabird CMM (CMM 2006-02), add additional most recent years of data that are available, and assess whether there is any detectable trend;
d) Identify the limitations in the data available and provide advice on what improvements are needed to enable better analyses to be made; and
e) Produce one comprehensive report describing methodology, the results of the analyses and findings, including advice on what further level of seabird assessment at species or species-group level can be conducted, given the amount and quality of data currently available.

1.4 Project Schedule and Reporting

The project is expected to begin in the last quarter of 2017. A substantive report will be prepared for SC14 in 2018. Subject to funding, additional updates with methodological improvements and additional years of data will be provided in 2019 and 2020.

2 Summary of seabird bycatch data held by SPC

In the context of this work, we define 'seabird' as any species of bird that are covered by the following families (grouped by order): Procellariiformes – Diomedeidae, Procellariidae, Pelacanoididae and Hydrobatidae; Suliformes – Sulidae, Phalacrocoracidae and Fregatidae; Phaethontiformes – Phaethontidae; Charadriiformes - Stercorariidae, Laridae, Sternida, Rhynchopidae and Alcidae.

The majority of seabird bycatch data held by SPC relates to observed bycatch on longline fishing vessels (Table 1). At the time of making the data extract for this paper (TUBS data extracted in June), there were a total of 991 seabirds observed caught on longline fishing vessels from 2007 to 2016 and recorded on the LL-4 observer form. Preliminary investigation of data on the Gen-2 forms suggests that there are potentially an additional 87 seabirds recorded as 'landed', though at least some of these represent individuals that were recorded on both Gen-2 and LL-4 forms. In comparison, total seabird bycatch in purse seine observer data held by SPC was 15 individuals from 2007 to 2016 (Peatman et al., 2017). We note that the integration of data from the Gen-2 and LL-4 forms is ongoing, and should be completed within the timeframes of Project 68. We also note that additional historical non-ROP observer data have very recently been added to the database which will increase the number of records of observed captures (Williams et al., 2017).

3 Proposed methodology

The terms of reference call for estimation of total seabirds killed by year in all fisheries to which the WCPFC convention applies, and assessing whether there is a detectable trend in seabird mortality since implementation of CMM 2007-04. We use seabird mortality throughout this report to refer to number of seabirds killed.

Seabird mortality will be estimated for longline and purse seine fisheries using available observer data. Qualitative estimates of seabird mortality for other fisheries will be based on available information in literature, noting that this is likely to be limited.

In the context of the seabird bycatch data held by SPC, we propose to estimate seabird bycatch for all species combined, as there appears to be insufficient bycatch data held by SPC for estimation of

bycatch for individual species and/or species groups. This assumption will be reviewed during the course of the project, or if additional observer data are made available for the project.

Observer data held by SPC provides at-vessel condition and fate for seabirds. This information can be used to identify seabirds that were dead either at-vessel, or when subsequently released/discarded. We propose to define a seabird mortality as a seabird that was dead either at-vessel or when released/discarded. Seabirds will be assumed dead if provided condition and fate information do not allow determination of the condition of the seabird at release.

Total estimates of seabird bycatch are most commonly obtained using two techniques: stratified ratio estimators (e.g. Abraham and Thompson, 2009); and model based approaches based on bycatch-per-unit-effort (e.g. Li et al., 2016; Abraham and Thompson, 2009). Both approaches use observer data to extrapolate seabird bycatch on sets with observer coverage to total seabird bycatch for all sets.

With the stratified ratio estimator, observed and unobserved effort are stratified in to consistently defined strata. For each strata, mean observed seabird bycatch by set is then calculated using the observer data in the strata in question, and then applied to the unobserved effort (or total effort) to estimate unobserved bycatch (or total bycatch). Uncertainty in bycatch estimates can be obtained using non-parametric bootstrapping. With model based bycatch-per-unit-effort (BPUE) based approaches, statistical models are constructed to predict mean bycatch rates based on explanatory variables. The models are then used to predict mean bycatch rates (and their uncertainty) for unobserved effort. We note that for both approaches, estimates of total bycatch can be obtained by estimating bycatch for unobserved effort only and combining with recorded bycatch for observed effort, or, by estimating bycatch for all effort, regardless of whether there was observer coverage.

Stratified ratio estimators are susceptible to bias if observed effort is not representative of total effort within strata. Model-based BPUE approaches are less susceptible to this bias, but do require sufficient observer data to obtain robust estimates of bycatch rates for unobserved effort.

We propose to attempt to use model-based BPUE approaches to estimate total seabird bycatch for longline fisheries, as the longline observer data held by SPC is limited (Williams et al, 2016) and is unlikely to be representative (see Section 4). However, stratified ratio estimators may need to be used if it is not possible to fit robust statistical models to observed seabird bycatch. Estimates of seabird bycatch in purse seine fisheries will be based on stratified ratio estimators, noting that seabird bycatch in WCPO purse seine fisheries is limited. Qualitative estimates of seabird bycatch for other fisheries falling under the WCFPC convention will be based on available information.

Seabird mortalities will then be estimated using available information on seabird condition, and the estimates of total seabird bycatch. It is important to note that the vast majority of longline seabird bycatch data held by SPC represents seabirds observed caught on, or interacting with, fishing gear at the time of hauling. The estimates of seabird bycatch, and mortalities, will therefore not include individuals that are caught, and killed, during setting but not observed during hauling. This will likely result in (potentially substantial) under-estimation of total mortalities (Brothers et al, 2010).

There are fleets with limited, or no, observer data held by SPC. Furthermore, there are likely to be regions where available observer data is insufficient to obtain robust estimates of bycatch rates. We

propose to fill these data gaps on a case-by-case basis, using the most appropriate information available.

4 Limitations in data available

Longline observer coverage in the WCPFC convention area is generally limited, with the exception of specific fleets (Williams et al., 2016). The coverage levels suggest that the observed effort is unlikely to be representative of total fishing effort for all fleets. In particular, the high-latitude areas of the WCPFC convention area are considered to be those where longline fisheries pose the greatest risk to seabird populations, and so in turn are areas where seabird bycatch mitigation measures are mandated. However, observer coverage in high latitude areas is very low for a number of longline fleets operating in the WCPFC, based on experience from other work, and preliminary exploration of observer data held by SPC for this work (Figures 1 and 2).

References

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Tables

Table 1 Total annual observed seabird bycatch recorded on the LL-4 form by species/species group in longline observer data held by SPC, for 2007 to 2016.

Species/species group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Species totals
ALBATROSS	53	24	36	41	13	28	12	30	23	1	**261**
BLACK-FOOTED ALBATROSS	0	0	1	1	1	1	1	1	96	145	**247**
BLACK-BROWED MOLLYMAWK	5	5	6	51	0	5	3	1	3	0	**79**
LAYSAN ALBATROSS	0	0	0	0	0	1	0	0	18	58	**77**
NEW ZEALAND WHITE CAPPED MOLLYMAWK	27	4	5	10	2	8	11	0	6	0	**73**
PETRELS AND PUFFINS	0	0	1	4	2	0	5	9	30	9	**60**
BIRD (UNIDENTIFIED)	0	0	0	9	2	3	3	2	4	6	**29**
CAPE PIGEON	4	1	0	0	3	6	5	5	1	0	**25**
WANDERING ALBATROSS	6	4	5	1	2	2	2	1	2	0	**25**
GREY PETREL	11	1	6	1	0	1	0	1	0	0	**21**
WHITE-CHINNED PETREL	1	4	4	5	0	4	1	1	0	0	**20**
BLACK PETREL	0	2	5	4	1	0	0	2	5	0	**19**
SALVIN'S ALBATROSS	0	3	4	0	0	1	0	0	1	0	**9**
SHORT-TAILED SHEARWATER	0	0	0	0	0	0	0	0	5	4	**9**
FLESH-FOOTED SHEARWATER	3	2	0	2	0	0	0	0	1	0	**8**
WESTLAND PETREL	0	0	0	3	0	1	0	0	3	0	**7**
GULLS - TERNS AND SKUAS	0	0	1	0	0	0	2	2	0	0	**5**
BOOBIES AND GANNETS	0	0	0	1	0	1	3	0	0	0	**5**
GREAT SKUA	3	0	0	0	0	0	0	0	0	0	**3**
SOOTY SHEARWATER	1	0	0	0	1	0	0	0	0	0	**2**
BULLER' S ALBATROSS	0	1	1	0	0	0	0	0	0	0	**2**
CAMPBELL IS BLACK-BROWED MOLLYMAWK	0	0	0	0	0	1	0	0	1	0	**2**
GREY HEADED ALBATROSS	1	0	0	0	0	0	0	0	0	0	**1**
YELLOW-NOSED ALBATROSS	0	0	0	1	0	0	0	0	0	0	**1**
NORTHERN GIANT PETREL	0	0	0	0	0	0	1	0	0	0	**1**
Annual totals	**115**	**51**	**75**	**134**	**27**	**63**	**49**	**55**	**199**	**223**	**991**

Figures

Figure 1 Observer coverage of longline vessels in 2014, percentage of hooks with an observer onboard by 5°x5° square across the WCPC area for ROP data (top) and all SPC observer data (bottom). Size of circles is proportional (log scale) to total longline fishing effort, non-observed effort in blue and observed effort in red.

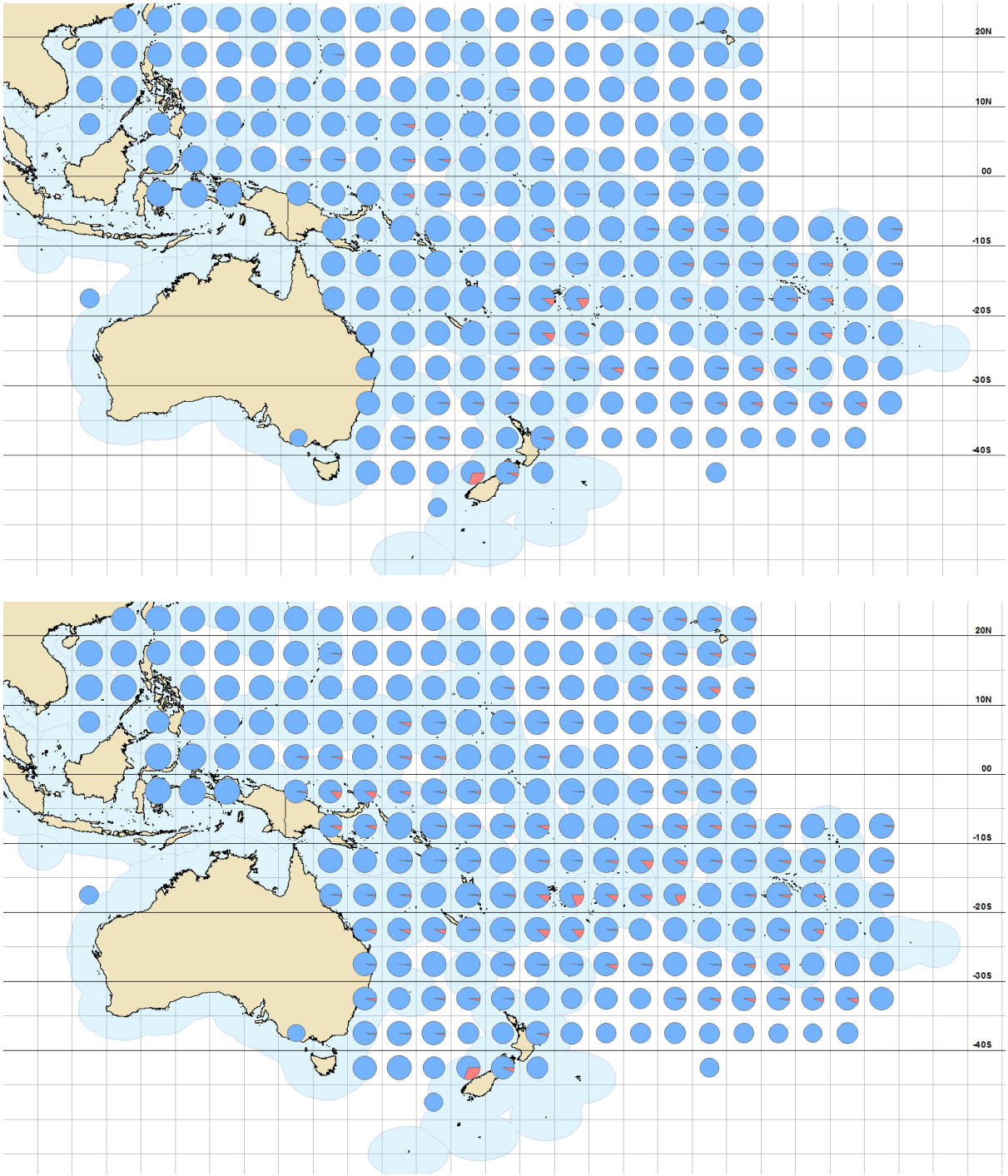

Figure 2 Observer coverage of longline vessels in 2007, percentage of hooks with an observer onboard by 5°x5° square across the WCPC area for ROP data (top) and all SPC observer data (bottom). Size of circles is proportional (log scale) to total longline fishing effort, non-observed effort in blue and observed effort in red.