Agreement on the Conservation of Albatrosses and Petrels

Seventh Meeting of the Seabird Bycatch Working Group

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The further development of ACAP seabird bycatch indicators, data needs, methodological approaches and reporting requirements

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SUMMARY

The ACAP Action Plan calls on the Advisory Committee to routinely review and update data on the mortality of albatrosses and petrels in commercial and other relevant fisheries. In order to achieve this objective, a web-based reporting system was developed to capture and use fisheries and bycatch data submitted by Parties and collaborating Range States. Previous reviews of the aggregated data submitted by Parties highlighted that the temporal and spatial resolution are generally too coarse to enable useful assessments of seabird bycatch levels and trends. At SBWG6, an alternative proposal was discussed: that each Party analyses their own data and submits the relevant results to the Secretariat. It has been agreed previously that the Status-Pressure-Response framework will be used by ACAP to measure performance, and that the main Pressure Indicator for bycatch (P1) should be: total number of birds killed per year of ACAP species (by species where possible), and their bycatch rate, across each of the fisheries of member Parties. We have assessed this indicator and identified a number of matters that must be considered when estimating and reporting bycatch numbers and rates. We provide recommendations to standardise the approach to estimating and reporting these metrics for each fishery, so that metrics are comparable. We also consider how the indicator can be reported by ACAP at a global level, recognising that differences in data resolution exist between fisheries, and make recommendations on a reporting framework.

RECOMMENDATIONS

1. That the SBWG review and endorse the guidelines provided on estimating seabird bycatch and reporting the results and associated information to the ACAP Secretariat
2. That the SBWG request the Advisory Committee to adopt the proposed seabird bycatch reporting framework to form part of the national reporting mechanism.
3. That the SBWG consider and provide advice on any additional work that should be undertaken as part of this process.

Perfeccionamiento de los indicadores de captura secundaria de aves marinas, de las necesidades de la recopilación de datos, de los abordajes metodológicos y de los requisitos DE presentación de datos del ACAP

RESUMEN

El Plan de Acción del ACAP solicita al Comité Asesor revisar y actualizar periódicamente los datos sobre mortalidad de albatros y petreles en pesquerías comerciales y en otras pesquerías pertinentes. A tal fin, se creó un sistema de notificación a través de Internet a fin de recabar y utilizar datos de pesquerías y de captura secundaria suministrados por las Partes y los Estados colaboradores del Área de Distribución. Las revisiones anteriores de los datos en forma totalizada presentados por las Partes destacaron que la resolución temporal y espacial suele ser muy baja para efectuar evaluaciones útiles sobre los niveles y tendencias de la captura secundaria de aves marinas. En GdTCS6, se discutió una propuesta alternativa según la cual cada Parte debería analizar sus propios datos y presentar los resultados pertinentes a la Secretaría. Se ha convenido anteriormente que el ACAP utilizará el marco de Estado-Presión-Respuesta para medir el rendimiento y que el principal indicador de Presión para la captura secundaria (P1) debería ser: el número total de aves muertas por año que forman parte de las especies amparadas por el ACAP (en la medida de lo posible, según la especie) y la tasa de captura secundaria de estas últimas en cada una de las pesquerías de las Partes. Hemos evaluado este indicador y hemos, asimismo, identificado una serie de asuntos que es necesario tener en cuenta a la hora de estimar y notificar el número y la tasa de captura secundaria. Formulamos recomendaciones a fin de estandarizar la manera de estimar y notificar estas métricas para cada pesquería, a los efectos de que estos valores sean comparables. También consideramos la manera en que el ACAP puede notificar el indicador a nivel mundial, sin perder de vista que existen diferencias en la resolución de datos entre las diferentes pesquerías, y formulamos recomendaciones sobre un marco de notificación.

RECOMENDACIONES

1. Que el GdTCS revise y avale las pautas proporcionadas en materia de estimación de la captura secundaria de aves marinas y de notificación de resultados e información asociada a la Secretaría del ACAP.
2. Que el GdTCS solicite al Comité Asesor adoptar el marco propuesto de notificación de captura secundaria de aves marinas para que forme parte del mecanismo de notificación a nivel nacional.
3. Que el GdTCS analice todo tipo de labor adicional que debería llevarse a cabo como parte de este proceso y que brinde recomendaciones al respecto.

Élaboration des indicateurs, des besoins de données, des approches méthodologiques et des obligations de compte-rendu des captures accessoires d'oiseaux marins de l'ACAP

RÉSUMÉ

Le Plan d'action joint à l'Accord invite le Comité consultatif à régulièrement revoir et mettre à jour les données concernant la mortalité des albatros et des pétrels dans les pêcheries commerciales et autres pêcheries pertinentes. Afin d'atteindre cet objectif, un système de compte-rendu en ligne a été créé afin de saisir et utiliser les données relatives à la pêche et aux captures accessoires soumises par les Parties et les États de l'aire de répartition. Il était ressorti d'une révision des données agrégées soumises par les Parties que la résolution spatiale et temporelle était généralement trop faible pour que celles-ci soient utilisées dans l'évaluation des niveaux et des tendances de captures accessoires d'oiseaux de mer. Une proposition alternative a été abordée lors du GTCA6 : que toutes les Parties analysent leurs propres données et soumettent les résultats pertinents au Secrétariat. Il a été convenu précédemment que le modèle « pression-état-réponse » serait utilisé par l'ACAP pour mesurer ses performances et que l'indicateur de pression principal en matière de captures accessoires (P1) devrait être le nombre total d'oiseaux des espèces de l'ACAP tués par an (par espèces si possible), et leur taux de capture accessoire dans chacune des pêcheries des États membres. Nous avons évalué cet indicateur et identifié un certain nombre de questions à examiner lors de l'évaluation et du compte-rendu des nombres et taux de captures accessoires. Nous émettons des recommandations visant à normaliser les méthodes d'évaluation et de compte-rendu de ces mesures pour chaque pêcherie, afin que ces mesures soient comparables. Nous examinons également comment l'ACAP peut rendre compte de cet indicateur au niveau mondial, reconnaissant qu'il existe des différences dans la résolution des données entre pêcheries ; et proposons des recommandations concernant la méthode de ces comptes-rendus.

RECOMMANDATIONS

1. Que le GTCA examine et adopte les lignes directrices fournies en matière d'estimation des captures accessoires d'oiseaux marins et de compte-rendu des résultats et des informations associées au Secrétariat de l'ACAP.
2. Que le GTCA demande au Comité consultatif d'adopter la méthode de compte-rendu proposée pour les captures accessoires d'oiseaux marins afin qu'elle s'intègre au mécanisme national de compte-rendu.
3. Que le GTCA examine et offre ses conseils pour tout travail supplémentaire qui devrait être entrepris dans le cadre de ce processus.

1. INTRODUCTION

The ACAP Action Plan calls on Parties 'to collect reliable, and where possible, verifiable data to enable accurate estimation of the nature and extent of albatross and petrels interactions with fisheries' (Action 4.2). The Action Plan also expects the Advisory Committee regularly to review and update data on the mortality of albatrosses and petrels in fisheries (5.1f) as well as data on the distribution and seasonality of fishing effort for those fisheries that affect species listed in Annex 1 of the Agreement (5.1g). In order to achieve this objective, a web-based reporting system was developed to capture and use fisheries and bycatch data submitted by Parties and collaborating Range States (see AC6 Doc 16 and SBWG4 Doc 25). Previous reviews of the aggregated data submitted by Parties highlighted that the temporal and spatial resolution are generally too coarse to enable useful assessments of seabird bycatch levels and trends (see SBWG5 Doc 16 and SBWG6 Doc 09).

At SBWG6, there was discussion about whether Parties should analyse their own bycatch data and routinely submit the results to ACAP, or whether the raw or aggregated data should be sent to ACAP for analyses. The SBWG recommended that it is necessary to first clarify the objective (indicators). It has been agreed previously that the objective of the bycatch data reporting process is to routinely review and update information on the current levels and trends of incidental mortality of ACAP-listed species in relevant fisheries and to assess the implementation and effectiveness of bycatch mitigation measures in those fisheries. In addition, it has been agreed that the Status-Pressure-Response framework will be used by ACAP to measure performance, and that the primary Pressure Indicator for Bycatch (P1) should comprise two linked components:

i) the total number of birds killed (bycaught) per year of ACAP species (by species where possible), and ii) their bycatch rate, across each of the fisheries of member Parties.

A range of methodological approaches could be used by Parties to estimate these figures, and appropriate methodologies would vary according to the availability of data and capacity to undertake assessments. An intersessional group was established to further define the bycatch indicator, and review the range of methodologies currently used by Parties and Range States to analyse and assess bycatch, in order to establish guidelines and advice on suitable methodologies and reporting requirements.

In this paper, we first identify issues that need to be considered in reporting against the indicators and propose guidance and recommendations to achieve consistent reporting. We then provide a broad assessment of seabird bycatch estimation methods currently in use, and outline the basis of a proposed reporting framework for the consideration and further development by the SBWG.

2. REFINING INDICATORS

2.1. Bycatch Pressure indicator 1 (P1)

There is a range of methods that may be used to estimate and monitor levels of seabird bycatch in fisheries. Inevitably, the assessment methods are dependent on the quantity and quality of data available, as well as the specific objectives of the exercise. In most situations, only a portion of the total fishing effort is formally observed for bycatch events. Consequently, extrapolation of bycatch figures from observed fishing effort to total fishing effort is required to estimate the bycatch associated with an entire fleet (i.e. including the unobserved fishing

effort). ACAP has previously agreed that assessment and monitoring of seabird bycatch levels over time should include estimates of **a) bycatch rates per unit fishing effort** (e.g. birds per 1000 hooks) and **b) the total number of birds killed per fleet**. The reason it is important to include both of these measures as indicators is that although bycatch rates are suitable for direct comparisons over time or across strata or fisheries, it does not account for differences in fishing effort. Even if bycatch rates decline, impacts on seabirds could increase if fishing effort increases. In some cases, changes in bycatch rates could also reflect declining/increasing seabird populations. Consequently, bycatch rates should be used in combination with estimates of the total number of birds killed per fleet as an overall indicator to monitor bycatch trends over time.

There are a number of issues to consider when estimating and interpreting these two measures. These are discussed below, together with recommendations on how these issues could be considered for the purpose of indicator reporting, either recommending a preferred methodology, or providing guidance on potential approaches and comparable reporting. The indicator should ultimately be able to report cumulative bycatch levels and rates across fisheries for all ACAP species explicitly accounting for these factors.

2.1.1. Undetected mortality

Seabird mortality estimates are generally based on the number of dead birds brought aboard vessels on hooks (in longline fisheries), and on trawl gear (in trawl fisheries) or on direct observations of mortality events. However, in many cases an unknown proportion of birds that are caught on longlines during line setting may drop off hooks prior to hauling, and so will not be retrieved and recorded. This undetected mortality is sometimes referred to as “cryptic mortality”, and the proportion in some longline fisheries has been estimated at 50% (Brothers et al. 2010). Similarly, an unknown proportion of birds that collide with trawl warps or other fishing gear and either drown or are fatally injured, may not be retrieved and included in mortality estimates. This undetected mortality has the potential to significantly underestimate actual mortality. Ideally, the undetected mortality should be accounted for in bycatch estimates, but this is not necessarily a simple task. Some studies have been undertaken to derive correction factors, by for example quantifying the relationship between heavy contacts of seabirds with trawl gear and observed mortality. However, such a relationship is influenced by a number of variables, making it difficult to apply broadly. We recognise that methods to estimate undetected mortality are likely to vary, and rather than stipulating a single preferred method, providing metadata on the methods may be a more appropriate solution. The use of standardised metadata will allow quick assessment of the comparability of different estimates.

Guidelines and Recommendations:

- Recognise that mortality estimates based on retrieved seabird carcasses are likely to underestimate actual mortality.
- The P1 indicator should account for undetected mortality where possible by including this component in bycatch estimates, or where knowledge is insufficient by explicitly noting the exclusion of undetected mortality. If observers record the source of mortality, this may allow a subsequent consideration of cryptic mortality to be factored in later.
- Bycatch estimates reported to ACAP should state whether undetected mortality is included, and if so provide some metadata on the methods used (e.g. based on proxy figures from an experimental study of the fishery).

- Encourage investigations that attempt to quantify the incidence and extent of undetected mortality. In longline fisheries, this would generally require focussed observations of seabird hookings during line setting, and comparing these with the number of birds subsequently hauled aboard. For trawl fisheries, the fatal outcomes of seabird collisions with trawl gear (observed through dedicated observation of seabird interactions with trawl gear) can be compared to the number of carcasses subsequently retrieved. Other experimental approaches may also be applied to estimate the levels of undetected mortality associated with each fishery/method.

2.1.2. Uncertainty in estimation

Where there is 100% observer coverage, bycatch should be completely observed, and there is no need for estimation. However, in most situations, observer coverage is substantially lower, and extrapolation of bycatch from observed to total fishing effort is required. Seabird bycatch rates and numbers are influenced by a range of environmental, ecological and operational factors, all of which vary in space and time. Variation in the gear and fishing techniques used within a fishery may also influence seabird bycatch rates. Observations and data estimation should also consider the different modes of bycatch. For example, in trawl fisheries birds may be captured on the warps or in the net (or even entangled in the Bird Scaring Lines), which may require different observation protocols and may have different levels of undetected mortality to be considered in the estimation process. In longline fisheries, birds may be killed during the line setting process, but also during the haul, and it is useful to differentiate between these sources of mortality.

It is inappropriate to assume that bycatch and associated data collected for a small sample of the overall fishing effort is necessarily representative of the whole fleet. Applying a bycatch rate from a particular area/time across a whole fleet, part of which may not be interacting with the seabirds will result in biases. With this in mind, every effort should be made to ensure that observer programmes sample a representative portion of the fishing effort of each fleet, spatially, temporally and across the full range of vessels and gear types. Ideally estimates should be reported with a some measure of representativeness, but given the complexity of issues affecting representativeness a simpler approach is to simply collect and report metadata including the level of observer coverage and the factors used in the estimation (e.g. factors used to stratify data or co-variables in model derived estimates). The representativeness of the observer coverage can be determined in simple terms by comparing the nature of the observed effort with the total effort. However, in some cases information on the overall fishing effort may be lacking, thus hampering efforts to determine how representative the observer coverage is. Some diagnostics of representativeness that may be considered include plots of observer coverage versus total fishing effort by area/vessel size/fishing method/month. It's worth noting that representativeness is less important when using a modelling approach to extrapolate bycatch estimates, provided the appropriate factors have been included.

Given generally low levels of observer coverage for many fisheries, there will inevitably be some level of uncertainty associated with bycatch estimates. In order to reflect this uncertainty and to understand the bounds of the estimates, confidence intervals should be calculated and reported together with the estimates of bycatch. Inconsistent methodology and therefore comparable uncertainty across countries, methods and underlying data structures will be difficult to achieve. Consequently, it may be useful to consider assigning

uncertainty based on a range of factors, such as level and representativeness of observer coverage and level/acuracy of species identification.

Guidelines and Recommendations:

- Encourage observer programmes to implement coverage of fishing effort that is representative across fishing operations, spatially and temporally, and sufficient to derive robust estimates of bycatch.
- Confidence intervals should be calculated and presented together with estimates of bycatch. As a minimum, these can be based on simple mathematical formulae, but consideration should be given to more complex methods where possible and appropriate.
- When submitting bycatch estimates, metadata should also be provided to describe the methods used, levels of underlying observer coverage and factors related to representativeness considered by the methodology.

2.1.3. Uncertainty in species identification

An important consideration for bycatch estimation is whether it is possible to estimate bycatch by species or some species groupings. The ability to provide estimates for each species is dependent on the accurate identification of bycaught seabirds by observers, or the use of programmes to analyse samples collected, or photographs, taken at sea. In order to understand the conservation implications of bycatch, it is preferable that estimates are derived for each species, which can also then be aggregated to groupings of species, and for all birds combined. Consequently, efforts should be directed towards encouraging the identification of all bycaught birds to species level, by for example retaining carcasses, biological samples, and taking photographs for later identification. However, it may not always be possible to identify a bycaught bird to species level. In these cases, the identification of a bycaught bird at a coarser level (e.g. large/great albatross), or even unidentified birds, still contribute to the estimate of the total number of birds caught. A proposed standard set of nested groupings for birds unidentified species level is provided in Annex 3, the use of which would allow estimates to be summed at different taxonomic levels.

Guidelines and Recommendations:

- It is preferable that estimates are derived for each species. Consequently, efforts should be directed towards encouraging the identification of all bycaught birds to species level, by for example retaining carcasses, biological samples, and taking photographs for later identification
- For mortalities that cannot be identified to species level, estimates should be reported at the lowest taxonomic level possible (see Annex 3).

2.2. Bycatch State indicator 2 (S2)

State indicator 2 (S2) relates to the availability of bycatch data relevant to ACAP species. SBWG6 Doc 10 proposed an indicator table based on raw data availability. However, following discussion at SBWG6, this indicator may be best targeted at recording the extent of estimates reported (by Party and/or fleet). As a number of methodological approaches are available and used by Parties to estimate bycatch rates and levels, the indicator should

report on the availability of estimates by method over time. Progress would be then measured as an increasing number of Parties and/or fleets reporting bycatch estimates over time, and a change in methods used to those producing most robust estimates. A table will be developed to summarise this information, once agreement is reached on the details of Bycatch Pressure indicator P1.

3. METHODOLOGICAL APPROACHES THAT COULD BE USED TO REPORT AGAINST THE MEASURES DEVELOPED IN INDICATOR P1

Any approaches ACAP recommend should be suited to the likely range of raw data available across different jurisdictions and fisheries. Key properties of the raw data that influence estimation were identified, including:

- varying resolution;
- varying precision;
- varying data collection methods;
- varying levels of observer coverage; and
- use of Electronic Monitoring (EM) and industry reported data.

3.1. Reivew of bycatch estimation methods

3.1.1 Bycatch rates per unit fishing effort

One of the commonest ways to measure and report levels of seabird bycatch is to express the number of birds caught per unit fishing effort (e.g. per 1000 hooks set for longline fisheries, and trawl, trawl day or hour of observation for trawl fisheries). Other approaches that more precisely target risk periods may also be appropriate, such as trawl hours while discarding. Even for these simple and well-understood measures, there are challenges and limitations regarding representativeness and bias when dealing with low levels of observer coverage. All aspects of representativeness discussed in Section 2.1.2 are relevant to estimates of bycatch rate, and observer programmes should strive to ensure the data collected are truly representative of the fishery. In addition to the limitations associated with data gaps, bycatch rates do not account for changes in fishing effort, and therefore should be used as part of a broader indicator, in combination with estimates of the total numbers of seabirds killed. Ideally, estimates of bycatch rates should be provided for each species caught. However, data limitations will often preclude such an approach, and Parties should aim to provide estimates and the finest level possible (see Annex 3).

3.1.2 Estimating the total number of birds killed

Given the situation in most fisheries, in which bycatch data are available for only a portion of the overall fishing effort, some sort of extrapolation is required to derive estimates for the total number of birds killed annually in a fishery. The usefulness of this metric is that it integrates the bycatch rate estimate with fishing effort, hence the ACAP approach of including both in the overall Bycatch Indicator. Generally, estimating total captures relies on the observed effort being representative of the total effort. In many fisheries, this may not be the case. For example, the observations may be biased towards a particular time of year

when captures of seabirds are more or less frequent, or observers may be placed on vessels that are not representative of the fleet as a whole. Model-based approaches (such as generalised linear models) can be used to deal with these issues (unobserved fishing effort, quantifying uncertainty or error), but also have their limitations. Ideally, estimates of the total numbers of seabirds killed should be provided for each species caught. However, data limitations will often preclude such an approach, and Parties should aim to provide estimates and the finest level possible (see Annex 3).

3.1.2.1 Simple ratio estimate

The simplest method of extrapolating bycatch from observed to total fishing effort is to multiply the rate estimator (observed bycatch rates) by the total fishing effort (in the case of longline fishing, this would be number of hooks set). This can be applied to data across a fleet. The number of birds observed caught is divided by the number of hooks observed to derive the ratio estimator (Birds Per Unit Effort, or BPUE), which is normally expressed as the number of birds caught per 1000 hooks set. BPUE is then multiplied by the total fishing effort within the fleet or fishery to estimate the total number of birds killed. Ratio estimation relies on the assumption that the observed fishing effort is similar to the unobserved effort. Because seabird bycatch rates and numbers are influenced by a range of environmental, ecological and operational factors, that vary in space and time, it is inappropriate to assume that bycatch and associated data collected for a small sample of the overall fishing effort is necessarily representative of the whole fleet. Applying a bycatch rate from a particular area and time across a whole fleet, which will likely vary in its interaction with the seabirds will result in biases.

3.1.2.2 Stratified ratio estimate

In order to improve the accuracy of bycatch estimation in cases where bycatch rates vary spatially and temporally within the fleet it is useful to stratify the data. However it is important to ensure that sufficient data are contained within each stratum to allow estimation of total bycatch for each stratum. The amount of data required to enable total bycatch to be estimated within each stratum is influenced by the level of observer coverage and the frequency of bycatch events observed. Stratifying the ratio estimation helps address the issue of representativeness because the observed and unobserved fishing effort are likely to be more similar within the strata than for the entire fleet. The bycatch estimates for each strata are then summed to derive the total estimate for the fleet. Given that seabird bycatch varies spatially and seasonally, stratification should include both area and time components. At a coarse level, this stratification could for example divide a year into four quarters, and the area into 5x5 degree grids. However, many Parties use much finer-scale resolutions than these. The key objective is to capture time and area strata that are similar in their attributes, and to ensure that there are sufficient data collected within each.

3.1.2.3 Model based extrapolation

If additional data are recorded by observers for variables that might influence the capture rate of seabirds (such as specific fishing activities and environmental conditions), it may be possible to construct statistical models that analyse the effect of these variables on seabird bycatch. One can then estimate the expected level of bycatch based on these variables and resulting coefficients. This method is better able to account for a lack of representativeness of observer coverage. Models can be of varying complexity depending on the data available (i.e. observer coverage level). For example, the inclusion of random year effects and random

vessel effects are possible when sufficient data are available and will improve the model fit. Models should be developed to report error bounds for estimates using a methodology appropriate to the model and data.

3.1.2.4 Quantitative risk assessment approaches

More complicated modelling approaches have been used to estimate total seabird bycatch. One example of this is the quantitative risk assessment for seabirds undertaken by New Zealand. This method uses seabird distribution maps and migration timing to estimate overlap with fishing effort. The overlap is compared to observed captures to estimate the vulnerability of species to capture. The vulnerability is applied to the fishing effort to predict annual potential fatalities (note the different terminology, annual potential fatalities are an assessment of risk rather than a true estimate of what would be observed with 100% observer coverage). This approach includes estimates for multipliers for undetected mortalities but does not account for lack of observer representativeness. The approach used in New Zealand also incorporates error around each model input parameter, providing for consolidated error bounds around risk estimates.

3.2 Questionnaire regarding approaches used by Parties to collect, analyse and report seabird bycatch data

Recognising that a range of methodological approaches could be used to estimate seabird bycatch, and appropriate methodologies would vary according to data availability and capacity, a questionnaire was sent intersessionally to Parties and Range States to solicit information for this assessment. The questionnaire, which is included in Annex 1, posed questions regarding the resolution at which bycatch and fisheries data are collected, and how these data are extrapolated to derive estimates for each fishery.

We received responses from five Parties (Brazil, France, New Zealand, Spain and the United Kingdom) and one Range State (the USA). The results of the survey highlight that the resolution at which fisheries and bycatch data are collected, and estimation methods, varies both between and within Parties, the latter due to differences between multiple fisheries for which a Party has responsibility. Most fisheries included in the responses, and for which observer data are collected, capture bycatch and fisheries effort data at a raw, fine-scale resolution (shot-by-shot). There was much greater variation in the methods used by Parties to extrapolate observed levels of bycatch to the whole fleet/fishery. In a few cases (some CCAMLR fisheries), the entire fishing effort is observed, and so extrapolation is not required. However, these represent the minority of fisheries for which responses were received. For several fisheries, modelled extrapolation (using explanatory variables to estimate bycatch) and stratified extrapolation, or a combination of both approaches, are used. The choice of methods is generally influenced by the availability of data. In some fisheries, bycatch is simply reported as the number of birds observed caught, and in others it is not reported at all. This is generally the case when there are insufficient data to conduct extrapolations, either because the fishery is perceived not to be problematic for seabirds, or there is simply not enough observer coverage and data. A summary of the responses received is provided in Annex 1. All those Parties who did not provide feedback are encouraged to submit their responses to the Secretariat prior to SBWG7 so that they can be considered at the meeting.

3.3. Guidelines and recommendations on methodological approaches

Inevitably, it will be necessary to strike a pragmatic balance between a simple assessment approach with course resolution data and a highly sophisticated and quantitative approach. With low quality input data, an overly simple approach will lack accuracy and precision whereas an overly complex one will be hampered by data gaps and invalid assumptions (but certainly no more invalid than a data-poor assessment), and therefore provide a false representation of the level of accuracy. More complex models, with higher quality and quantity of data, allow more refined biological assumptions, so are more realistic than data poor models. An overly complex approach will also be much more costly and onerous to implement. However, the cost implications relate more to the collection of data than to the assessment procedure.

Guidelines and Recommendations:

- The guidelines provided in section 2.1.2 (Uncertainty in Estimation) are all relevant to this section on methodological approaches. Observer programmes should strive to ensure the data collected are truly representative of the fishery, and Confidence Intervals, or other estimates of uncertainty, should be presented together with bycatch estimates.
- Including spatial, temporal and other strata in the estimation procedure helps address the issue of representativeness because the observed and unobserved fishing effort within strata are expected to be similar, and the extrapolation from observed to unobserved fishing effort more appropriate than simply extrapolating from the observed to the total fishing effort. This relies on the suitable selection of strata (that are similar in their seabird bycatch related attributes), and sufficient data within each stratum to enable estimates to be derived for each.
- More quantitative model-based approaches are useful in dealing with unobserved fishing effort, unrepresentative observer coverage, and quantifying uncertainty or error, but can be resource intensive, and require the scientific capacity to conduct the analyses. These approaches are most suited to fisheries where there is substantial bycatch and where sufficient data has been collected to inform the development of robust models. In these cases the models will allow more precise tracking of changes in bycatch over time and facilitate the investigation of factors that contribute to seabird captures, and the assessment of bycatch management measures.

4. DEVELOPING A REPORTING FRAMEWORK

The reporting framework should allow input of bycatch estimates and associated metadata across the range of recommended estimation methods such that each jurisdiction/fishery estimate can be provided in the most appropriate form. The outputs would form the measures identified as indicators P1 and S2. A draft outline of the information that should be solicited through the reporting framework is provided in Annex 2.

5. IMPLEMENTATION

We recommend that following SBWG7, once broad agreement has been reached on the indicator and reporting framework, and sufficient guidance is available, a staged approach to implementation is progressed. We envisage that a trial period of reporting by Parties will be useful to test the framework and identify any aspects requiring modification, further development, or further guidance. Trial reporting in the lead up to AC10 would allow us to review and modify the framework in the lead up to, and at, SBWG8, with a view that a robust and workable framework could be agreed prior to MoP6.

Recommendations:

- Encourage trial reporting by Parties prior to AC10 using the framework developed at SBWG7.
- Review and finalise the framework at SBWG8 based on an assessment of the trial reporting.

ANNEX 1: ACAP BYCATCH METADATA QUESTIONNAIRE

Dear AC members

As we outlined previously, this year we have suspended the reporting of fisheries and bycatch data pending the outcome of the intersessional work currently underway on the objectives/indicators and methodological approaches in respect of bycatch, and what information should be submitted to ACAP.

At SBWG6, there was discussion about whether Parties should analyse their own bycatch data and routinely submit the results to ACAP, or whether the raw or aggregated data should be sent to ACAP for analyses. The SBWG recommended that it is necessary to first clarify the objective (indicators). The SBWG identified that a range of methodological approaches could be used by Parties to estimate these figures, and appropriate methodologies would vary according to data availability. An intersessional group was established to further define the bycatch indicator, and review the range of methodologies currently used by Parties to analyse and assess bycatch, in order to establish guidelines and advice on suitable methodologies and reporting requirements.

In order to assist the intersessional group with this process, we request that you complete this brief metadata survey. For each major fishery in your jurisdiction please tick which data category best suits your fishery for each of the three questions (bycatch data, fishing effort data and bycatch reporting). Please add as many columns as necessary.

To enable consideration of this information in the intersessional process and by SBWG7/AC9, we would be grateful if you could complete the attached questionnaire and return it to the Secretariat (Wieslawa.misiak@acap.aq) and the SBWG Convenor (acwolfaardt@gmail.com) by 01 February 2016.

A summary of the responses is provided below.

	Data Category	USA	New Zealand	United Kingdom	Brazil	France	Spain	TOTAL
Question	**TOTAL NUMBER OF FISHERIES REPORTED**	**2**	**8**	**8**	**7**	**2**	**9**	**36**
1. What level best describes how seabird bycatch data for your fisheries is captured	Raw fine-scale observer data (e.g. shot-by-shot)	2	7	6	1	2	8	26
	Aggregated observer data (e.g. 5x5 degrees, monthly)			1				1
	Totals of observer data (annual bycatch)							
	Other, please provide details		1	1				2
	No observer data captured				6		1	7
2. What level best describes how your fisheries effort data is captured	Raw fine scale data (e.g. shot-by-shot)	2	7	8		2	9	28
	Aggregated, coarse scale effort data (e.g. 5x5 degrees, monthly)				3			3
	Fishery-wide totals of effort (annual totals)							
	Other, please provide details		1		4			5
	No effort data captured							
3. What level best describes how your observed seabird bycatch data are extrapolated to the fishery to estimate and report total bycatch[a]	100% observer coverage, so no extrapolation	1		2			1	4
	Modelled extrapolation, using explanatory variables		7		1	2	1	11
	Stratified extrapolation of observed bycatch to total fleet (e.g. area and time strata)	1	6	3			1	11
	Simple (un-stratified) extrapolation from observed bycatch to total fleet							
	Not extrapolated, but simply reported as bycatch rates (e.g. birds per 1000 hooks)		1				7	8
	Not extrapolated, but simply reported as number of birds observed caught		1	3				4
	Seabird bycatch not reported in relation to fishery		1		6		1	8

[a] For some fisheries, more than one category applies (e.g. most New Zealand fisheries are included in both modelled and stratified extrapolation categories

ANNEX 2: ACAP SEABIRD BYCATCH REPORTING FRAMEWORK

Please not that this section is an initial outline of matters for consideration and input, and will be developed further following discussion at SBWG7.

Guiding principles

- The recommendations in this document reflect a movement away from ACAP requesting raw or aggregated data, and instead recommending that Parties submit estimates that they themselves have derived.
- This document serves to contribute towards the development and provision of guidelines in support of the derivation of these estimates.
- The two main components of the indicator, and the basis for the submission of estimates from Parties and Range States are: 1) bycatch rates, and 2) estimates of the total number of birds killed per year per fishery.
- For bycatch rates, it is recommended that Parties submit estimates of the rate per unit fishing effort. it is also recommend that bycatch rates be provided for each species, but if this is not possible at the lowest (most specific) taxonomic grouping possible (see Annex 3).
- For the estimates of total numbers of birds killed, Parties and Range State we will be request to provide one estimate per fishery, but will be expected to submit metadata that includes a range of explanatory information that can be used to interpret how robust/uncertain the estimates are. This will include the levels of observer coverage, what method was used to estimate the total numbers from the observed effort (perhaps using a drop-down menu or tick box approach), and broadly how the data were stratified for the purpose of extrapolation (see below).
- It is recommended that estimates are provided with 95% Confidence Intervals (or some measure of uncertainty).
- As with bycatch rates, it is recommended that estimates are provided per species, but if not possible then at the most specific level of taxonomic classification (see Annex 3).

Proposed information to be included in routine reporting by Parties and Range States

Jurisdiction (e.g. country):	
Fishery (name and type):	
Reporting period	
Mitigation measures used	Information will be provided by means of a drop-down menu listing specific options. Assumes that these are standard for the fishery. If these vary, it would be tricky to capture in this sort of reporting format, and perhaps not necessary. We are interested in tracking changes in bycatch levels and numbers quite broadly, and will not be able to use the information to assess robustly the relative efficacy of different mitigation measures. This is best done through proper experimental studies, which should be reported separately.
Agency responsible for management:	
Name of person filling out this form:	
Institution/Organization:	
Phone:	
Email:	

A brief description and map of the fishing area

Once discussed and agreed, the following sections can be converted into a template with tick boxes and/or drop-down menus and explanatory text.

BYCATCH RATES

Estimates of bycatch rates should be reported in the following manner:

- Parties and Range States should report **observed seabird bycatch rates per unit fishing effort (per fishery per year)**. The months that make up the annual periods will probably vary across management agencies.
- **Rates should be reported per species, or species groupings to the lowest taxonomic level possible** (see Annex 3).
- **Preferred Unit of Fishing Effort**:
    - For **longline fisheries**: *the number of birds killed per 1000 hooks set*.
    - For **trawl fisheries**: *number of birds killed per hour trawling, or per tow*.

The following metadata associated with the estimates of bycatch rates should also be reported:

- If Parties consider **any other unit of fishing effort better** suited for their fishery, this must be explicitly stated. Some trawl fisheries may for example calculate a bycatch rate per period of time that the vessel was discarding.
- **Degree of observer coverage** (% of unit fishing effort observed). For longline fisheries this should be % of set hooks that were observed. For trawl fisheries % of trawl tows or trawl hours that were observed). This measurement should reflect the proportion of actual fishing effort that was directly observed, and not some proxy, which includes for example travel time, or other periods when the vessel is not engaged in fishing.
- **How representative was the observer coverage of the total fishing effort?** This aspect still needs further development, but could include some diagnostics of representativeness, such as measures or plots of observer coverage against total fishing effort by area/season/vessel type.
- Was **undetected mortality** included? If so, how was this quantified?

ESTIMATES OF THE TOTAL NUMBER OF BIRDS KILLED

Estimates of the total number of birds killed should be reported in the following manner:

- **Estimates of the total number of birds killed**, per species if possible, or lowest (most specific) taxonomic group possible (see Annex 3).
- **95% Confidence Intervals for these estimates** (or another measure of uncertainty, which should be stated).

The following metadata associated with the estimates of total seabird bycatch should also be reported:

- **Degree of observer coverage** (% of unit fishing effort observed). For longline fisheries this should be % of set hooks that were observed. For trawl fisheries % of trawl tows or trawl hours that were observed. This measurement should reflect the proportion of actual fishing effort that was directly observed, and not some proxy, which includes for example travel time, or other periods when the vessel is not engaged in fishing. It is important to clarify if this is the same observer coverage used to calculate bycatch rates (above), and if not, to provide the necessary details.
- **How representative was the observer coverage of the total fishing effort?** This aspect still needs further development, but could include some diagnostics of representativeness, such as measures or plots of observer coverage against total fishing effort by area/season/vessel type (and others).
- **Methods used to extrapolate bycatch**. The intention would be to provide the list outlined in the main document (and additional if necessary). For modelled extrapolation, a broad indication of what methods and factors/explanatory variables were used would be required.
- **Was stratification used to extrapolate/model estimates?** A list will be provided of broad categories, which can be ticked. The list should include: Temporal, Spatial, Vessel Type, Specific Gear Type (any others?). The exact definition or details of the strata would vary by fishery, and Parties would not be requested to provide details of how these strata were used, but rather what categories of strata were used (e.g. temporal variation was used, rather than needing to specify that it was monthly/quarterly/yearly).
- **How the 95% Confidence Intervals, or alternative measure of uncertainty, was derived**.
- **Are there separate estimates for the different modes of capture?** For example, in longline fisheries are birds killed during line setting differentiated from birds that are caught during the haul. Similarly, are mortalities due to warp collisions, net entanglements and entanglements with other gear, such as bird scaring lines, differentiated?
- **Was undetected mortality included?** If so, how was this quantified?

ANNEX 3: PROPOSED CATEGORISATION FOR BIRDS UNIDENTIFIED TO SPECIES LEVEL

Every effort should be made to identify birds to species level, or failing that to the lowest level of taxonomic classification

Seabird sp	Large albatross sp	*Diomedea sp*	*Diomedea sanfordi*	Northern Royal Albatross
			Diomedea epomophora	Southern Royal Albatross
			Diomedea exulans	Wandering Albatross
			Diomedea antipodensis	Antipodean Albatross
			Diomedea amsterdamensis	Amsterdam Albatross
			Diomedea dabbenena	Tristan Albatross
	Smaller albatross sp	*Phoebetria sp*	*Phoebetria fusca*	Sooty Albatross
			Phoebetria palpebrata	Light-mantled Albatross
		Phoebastria sp	*Phoebastria irrorata*	Waved Albatross
			Phoebastria nigripes	Black-footed Albatross
			Phoebastria immutabilis	Laysan Albatross
			Phoebastria albatrus	Short-tailed Albatross
		Thalassarche sp	*Thalassarche chlororhynchos*	Atlantic Yellow-nosed Albatross
			Thalassarche carteri	Indian Yellow-nosed Albatross
			Thalassarche chrysostoma	Grey-headed Albatross
			Thalassarche melanophris	Black-browed Albatross
			Thalassarche impavida	Campbell Albatross
			Thalassarche bulleri	Buller's Albatross
			Thalassarche cauta	Shy Albatross
			Thalassarche steadi	White-capped Albatross
			Thalassarche eremita	Chatham Albatross
			Thalassarche salvini	Salvin's Albatross
	Petrel sp	*Macronectes sp*	*Macronectes giganteus*	Southern Giant Petrel
			Macronectes halli	Northern Giant Petrel
		Procellaria sp	*Procellaria aequinoctialis*	White-chinned Petrel
			Procellaria conspicillata	Spectacled Petrel
			Procellaria parkinsoni	Black Petrel
			Procellaria westlandica	Westland Petrel
			Procellaria cinerea	Grey Petrel
		Shearwater *sp*	*Ardenna creatopus*	Pink-footed Shearwater
			Puffinus mauretanicus	Balearic Shearwater

Highest (general) level of taxonomic classification → Lowest (specific) level of taxonomic classification