DATA COLLECTION REQUIREMENTS FOR OBSERVER PROGRAMMES TO IMPROVE KNOWLEDGE OF FISHERY IMPACTS ON SEABIRDS

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SUMMARY

The incidental catch of seabirds associated with pelagic longline fishing operations is considered one of the greatest threats to seabirds, especially albatrosses and large petrels. The five tuna Regional Fisheries Management Organisations (RFMOs) have established requirements for their pelagic longline vessels to use seabird by-catch mitigation measures in most areas overlapping with albatrosses, petrels and other seabirds impacted by by-catch, and have plans to monitor and review the effectiveness of these measures. Such a review relies on the effective collection, analyses and reporting of seabird by-catch and associated data and results. At the 2014 inter-sessional meeting of ICCAT's Sub-committee on Ecosystems, it was noted that the process to review ICCAT's seabird by-catch mitigation Rec. 11-09 should be initiated in 2015. One of the major constraints to an effective review is the availability and quality of by-catch data. This paper is a shortened version of a paper prepared previously for the Agreement on the Conservation of Albatrosses and Petrels (ACAP) that considers the data collection requirements for observer programmes to improve the knowledge of fishery impacts on albatrosses and petrels.

RÉSUMÉ

La prise accidentelle d'oiseaux de mer en association avec les opérations de pêche palangrière pélagique est considérée comme l'une des plus grandes menaces pesant sur les oiseaux de mer, notamment les albatros et les grands pétrels. Les cinq organisations régionales de gestion des pêches (ORGP) thonières ont imposé l'utilisation de mesures d'atténuation des prises accessoires d'oiseaux de mer à leurs palangriers pélagiques dans la plupart de zones de chevauchement avec les albatros, les pétrels et les autres oiseaux de mer affectés par la prise accessoire. De plus, elles ont l'intention de développer des programmes de suivi et de vérification de l'efficacité de ces mesures. Cette vérification repose sur la collecte, l'analyse et la déclaration efficaces des prises accessoires d'oiseaux de mer et des données et des résultats s'y rapportant. Lors de la réunion intersessions de 2014 du Sous-comité des écosystèmes de l'ICCAT, il a été observé que le processus d'examen des mesures d'atténuation des prises accessoires de la Rec. 11-09 devrait commencer en 2015. L'une des principales limitations d'un examen efficace est la disponibilité et la qualité des données sur les prises accessoires. Le présent document est une version abrégée d'un document préparé préalablement pour l'Accord sur la conservation des albatros et des pétrels (ACAP) consacré aux exigences en matière de collecte de données pour les programmes d'observateurs en vue d'améliorer les connaissances des impacts des pêcheries sur les albatros et les pétrels.

RESUMEN

La captura incidental de aves marinas asociada a las operaciones pesqueras de palangre pelágico está considerada como una de las mayores amenazas para las aves marinas, especialmente para los albatros y los grandes petreles. Las cinco Organizaciones regionales de ordenación pesquera (OROP) de túnidos han establecido requisitos para que sus palangreros pelágicos utilicen medidas de mitigación de la captura fortuita de aves marinas en la mayoría de las zonas de solapamiento con albatros, petreles y otras aves marinas impactadas por la captura fortuita, y tienen previsto realizar un seguimiento y un examen de la efectividad de dichas medidas. Ese examen depende de la efectividad de la recopilación, el análisis y la comunicación de datos sobre captura fortuita de aves marinas y de los resultados asociados. En la reunión intersesiones de 2014 del Subcomité de Ecosistemas de ICCAT, se observó que el proceso de examen de la Recomendación de ICCAT sobre mitigación de la captura fortuita de

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aves marinas [Rec. 11-09] debería iniciarse en 2015. Uno de los principales condicionantes a la hora de realizar un examen eficaz radica en la disponibilidad y la calidad de los datos sobre capturas fortuitas. Este documento es una versión abreviada de un documento preparado anteriormente para el Acuerdo sobre la conservación de albatros y petreles (ACAP) que considera los requisitos de recopilación de datos de los programas de observadores con miras a mejorar los conocimientos sobre el impacto de las pesquerías en los albatros y petreles.

1. Introduction

The incidental catch of seabirds associated with pelagic longline fishing operations is considered one of the greatest threats to seabirds, especially albatrosses and large petrels. The five tuna Regional Fisheries Management Organisations (RFMOs) have established requirements for their pelagic longline vessels to use seabird by-catch mitigation measures in most areas overlapping with albatrosses, petrels and other seabirds impacted by by-catch, and have plans to monitor and review the effectiveness of these measures. Such a review relies on the effective collection, analyses and reporting of seabird by-catch and associated data and results.

It is well recognised that the implementation of observer programmes that include the collection and management of seabird by-catch and associated data, are a critical means of monitoring fisheries performance with respect to seabird by-catch and use of mitigation measures (FAO 2009). Attempts to assess the impacts of fisheries activities on seabirds in some RFMOs, such as the International Commission for the Conservation of Atlantic Tunas, ICCAT, have been constrained by the lack of by-catch data in some areas and the inconsistent manner in which these data have been collected, analysed and reported. Consequently, several assumptions are required to fill observations in space and time, which inevitably leads to high but un-quantified uncertainty in by-catch estimates (International Commission for the Conservation of Atlantic Tunas 2009).

The development and implementation of effective observer programmes, including for RFMOs, is an important but challenging task. A number of initiatives have been implemented, some of which are ongoing, to address data collection and other requirements of observer programmes. Following a Fisheries Observer workshop held in November 2004, a document providing detailed best practice guidelines for observer programmes in longline fisheries on data collection requirements to assess and reduce by-catch of protected species (including seabirds, marine mammals, and sea turtles) was published (Dietrich *et al*. 2007). BirdLife International has developed and presented to a number of RFMOs recommendations relating to the establishment of regional observer programmes, and minimum data standards for collecting and reporting seabird by-catch (e.g. Black *et al.* 2007; Anderson et al. 2009; BirdLife International 2010; Anderson *et al.* 2010). Most recently the Joint tuna RFMO By-catch Technical Working Group held a workshop in January 2015 to consider and develop guidelines for the harmonisation of longline by-catch data collected by the tuna RFMOs, a process that is presently underway.

This paper is a shortened version of a document previously prepared for the Agreement on the Conservation of Albatrosses and Petrels (ACAP) (Wolfaardt 20111). It draws on and serves to complement the documents and initiatives referred to above. The purpose of the paper is to consider the data collection requirements for observer programmes to improve knowledge of fishery impacts on seabirds.

2. Objectives of collecting seabird by-catch and associated data

The main objectives of collecting seabird by-catch data are:

a) To characterise and quantify seabird by-catch within a fishery.
b) To understand the nature of seabird by-catch, and the importance of the various factors that contribute to the observed level of by-catch. This is important for identifying specific mitigation solutions for the particular fishery.
c) To assess and monitor the effectiveness of seabird by-catch mitigation measures in reducing mortality.

To fulfil these objectives a number of issues need to be addressed. These include:

- The establishment and implementation of effective observer programmes.
- Sufficient observer coverage of the fishing effort to quantify accurately seabird by-catch, and to scale up reliably observed by-catch to the whole fishery.
- Standardised collection of reliable seabird by-catch and associated data by well-trained observers.
- Clear and standardised requirements for reporting by-catch.

3. Observer programmes

The management and coordination of observer programmes differs between tuna RFMOs. It is critical that the specific requirements and protocols relating to the observer programme are clearly stated and communicated to all Parties, and properly co-ordinated by the RFMOs.

Although this paper deals specifically with seabird by-catch, it is important to recognise that observer programmes will have a number of other objectives, including the collection of by-catch data for other taxa, such as sea turtles and marine mammals, as well as collection of data on target species, and data collection protocols should cover all relevant species and objectives. An observer will often therefore have a range of responsibilities to implement, and it is critical that the observer programme is managed to ensure the necessary observation and data collection requirements are reliably and consistently fulfilled. For seabirds, this would best be achieved by using dedicated seabird observers, or at least to ensure dedicated time periods (at the optimal times) within the observer schedule for dedicated by-catch observations.

The harmonisation of data collection protocols between tuna RFMOs, advice for which is being developed by the Joint Tuna RFMO By-catch Technical Working Group, is necessary to facilitate collaborative and larger scale analyses of by-catch across ocean basins.

4. Observer coverage

To conduct a reliable assessment of seabird by-catch in a fishery, the level of observer coverage (percentage of fishing effort observed) needs to be tailored to the specific objectives of the monitoring programme. A higher level of coverage will be needed to quantify seabird by-catch and assess the efficacy of different mitigation measures than if the objective is simply to detect whether by-catch is occurring.

The exact level of observer coverage required depends on several factors such as the frequency of by-catch events, the variability of by-catch rates, and the desired coefficient of variation of by-catch estimates. This makes it difficult to recommend a single optimum level of observer coverage that will cover all fisheries and taxa. Seabird by-catch tends to be highly variable, often clumped in distribution, and may be relatively rare, making it difficult to obtain accurate estimates of mortality with low levels of observer coverage. It should be noted that although by-catch events may be relatively infrequent, for rare species, these events cumulatively constitute critical threats in population terms.

CCAMLR requires 100% observer coverage of their longline fishery (i.e. an observer on each trip). Although it would be ideal to have complete observer coverage of all fishing trips in other RFMOs, given the cost and other practical considerations, this is an unrealistic expectation. Lawson (2006) has shown that in general the co-efficient of variation of by-catch estimates decreases rapidly as the coverage rate increases to 20% and then decreases slowly to 0 when reaching 100% coverage. Therefore, in order to extrapolate observed by-catch rates to the whole fishery, the level of observer coverage should ideally be 20% of the fishing effort. Recent measures adopted in WCPFC, ICCAT, IATTC and IOTC have established minimum observer coverage rates of 5%. At this level of observer coverage, by-catch estimates will likely remain highly imprecise for low occurrence species, but it is better than no coverage at all. Further, it has been argued that 5% observer coverage is sufficient to identify simply where and when by-catch is occurring. Analysis of the by-catch data collected with this level of coverage will almost certainly reveal a lack of precision in by-catch estimates, and it is important that efforts continue to encourage the level of observer coverage, and the accuracy and precision of estimates, to be increased. Another option is adopt a targeted approach and identify high-risk areas that require greater levels of observer coverage. It is important to ensure that within these high-risk areas, observer coverage is spatially and temporally representative of fishing effort.

It is important that observer coverage targets are clearly defined, and differentiate between within fleet and within-trip coverage. The true coverage is a function of the proportion of fishing effort (number of hooks set/hauled) observed on each vessel within each trip. Coverage of 20% of the fleet, will equate to less than 20% of the overall fishing effort, because not all of the hooks will be observed on each trip observed.

4.1 Key Recommendations

- The level of observer coverage should be sufficient to allow accurate and precise estimates of by-catch to be derived for the whole fishery. It is important that ACAP Parties lead by example in terms of committing to minimum levels of observer coverage.
- The level of observer coverage should be based on the overall fishing effort (total number of hooks set/hauled), and not on the number of trips.
- Observer programmes should establish a process by which the effectiveness of the programme, and especially the level of coverage, is regularly reviewed. This should be a robust process with pre-agreed management decision rules on which to decide how the observer coverage should be amended.

5. Data collection protocols

In order to rigorously assess and monitor seabird by-catch, it is necessary for observers to collect a range of data in a systematic and standardised manner. It is crucial that the data collection requirements are made explicit in the relevant protocols and manuals, and that these protocols are standardised. Ideally, data collection protocols should be broadly consistent across all RFMOs, and ACAP member countries, to allow a wider-scale, and indeed global, assessment of fishery impacts on seabirds. The first step would be to identify a minimum set of fields that need to be cross-comparable. Although, countries and RFMOs that have already established data collection and management (including database) protocols will often be reluctant to change these, the development of any new programmes should be informed by initiatives in adjacent fisheries. Standardisation of seabird by-catch data collection protocols across RFMOs will also have practical benefits in that observers working across RFMOs will be implementing the same protocols. The joint tuna RFMO Technical By-catch Working Group mentioned earlier has established harmonisation of data collection protocols as a key element in its work plan.

Observers will normally have a range of tasks and duties, including the collection of seabird by-catch and associated data, so it is important to define clearly what data need to be collected, and the sampling strategy. Both of these depend on the specific seabird by-catch monitoring objectives of the observer programme. Assessing and monitoring seabird by-catch will require a minimum set of data to be collected, but if the objective is to assess the relative influence of a number of factors, and the efficacy of mitigation measures, on seabird by-catch rates, additional variables will be required.

Dietrich *et al.* (2007) and Black *et al.* (2007) provide a detailed description and summary of the data that should be collected as part of a seabird by-catch monitoring programme. It is useful to distinguish between critical or minimum data that are required for recording seabird by-catch, and additional data that would be desirable to collect to gain a better understanding of the factors contributing towards seabird by-catch and its reduction. Such an approach incorporates some flexibility, and takes account of the reality of observer programmes, where observers will have a multitude of tasks, including factory sampling.

Table 1 provides details of data collection fields for longline fishing provided in Dietrich et al (2007) and subsequently adapted by BirdLife International (Anderson *et al.* 2009, 2010, BirdLife International 2010). The fields in **Table 1** that are suggested as being critical for recording seabird by-catch are highlighted in **bold**. These are initial suggestions, which should be debated by the SBWG to come up with a final list.

It is suggested that the following data from **Table 1** are critical:

- Vessel characteristics, including name, registration and nationality.
- Fishing trip and event characteristics, including target fish species, trip number, event number, fishing method and gear used
- Total fishing effort, recorded as the number of hooks set, or tows in the case of trawling.
- Total fishing effort observed, recorded as the number of hooks observed during the haul. This is crucial for calculating seabird by-catch rates.

- Spatial and temporal information about the fishing operation. This is essentially the time and vessel position at the start and end of setting and hauling, and is necessary to assess the spatial and temporal extent of by-catch. The collection of this information is standard for all observer programmes, and should be easily obtained from the vessel's logbook. A key issue is the scale at which these are reported. Currently this is mostly at 5x5 degrees, which is a rather low resolution, but may be considered adequate for RFMOs.
- Mass of added weight. Line weighting is considered a critical mitigation measure for longline fisheries, and it is hoped that most RFMOs will be requiring the mandatory use of line weighting in the near future.
- Branchline length, in metres.
- Distance between weight and hook, in metres. This is an important component of the line-weighting regime and should be recorded.
- Mitigation measures used. Description about mitigation measures in place, and preferably information about how effectively they were used. These include the use of tori lines (single or paired, overall length, height of deployment, number and length of streamers), line weighting (mass of weights and distance between weights and hooks – see above.
- Seabird data and samples.
  - All seabirds caught should be identified to species level as far as possible to derive estimates of the seabird catch per unit effort for each species.
  - The fate (dead/alive/injured) and number of birds (for each species) in each of these categories should be recorded, and it should be indicated whether the bird was released alive, or discarded. Detailed injury characteristics (see below) and which part of the fishing event (set or haul) the birds were recovered from, should also be noted.
  - The condition of all birds brought onboard alive should be described. Birds that have sustained serious injuries – fractured wing bone, leg bone or beak, an open wound, several primary feather shafts broken etc – are likely to have a low chance of survival after it is released, and so should later be added to the number of dead birds.
  - Ideally, all seabird carcasses should be retained onboard (and kept frozen) for subsequent identification and examination by appropriate experts. This would allow a more accurate determination of species, sex and age class, and may also be used to determine the provenance of the caught birds. If storage space is limited, retention of the head and one of the legs would still be useful; photographs of the bird, especially the head and underwing can generally be used to help identify species. The collection of feathers from bycaught birds can be used for DNA analysis that will aid in the identification of birds and will also help to determine their provenance. It is important that all samples and photographs are properly labelled with date, time taken on board, species, vessel name, observer's name and a label number that corresponds to the unique number for the haul observed.
  - For all birds caught, details of any rings or tags should be recorded.

The following data are considered ideal to record and would contribute to a better understanding of the nature of by-catch and especially the factors that influence by-catch rates:

- Regular seabird abundance estimates. Estimates of seabird abundance during setting will allow observed seabird by-catch rates to be related to the number of birds attending the vessel. This is particularly useful as seabird abundance has been related to observed by-catch rates (e.g Gilman et al. 2003; Reid & Sullivan 2004). These estimates can therefore be used to account for spatial and temporal variation in the numbers of seabirds attending vessels, and thus allow a more accurate comparison of by-catch rates between vessels, seasons and areas. Standardised protocols have been developed for a number of fisheries.
- Interactions of seabirds with fishing operations. Detailed observations of seabird interactions with fishing gear can contribute usefully to an understanding of the circumstances that lead to by-catch, and can be used to identify and assess optimal mitigation measures. For example, some studies of mitigation measures in pelagic longline fisheries have recorded how far astern of the vessel seabirds dive for bait, and whether they were successful or not. This has highlighted that seabirds can still access baited hooks behind the protection of tori lines if the weighing regime is insufficient. It has also highlighted the importance of secondary hooking (where deeper diving seabirds bring baited hooks to the surface where they are accessible to albatrosses) in areas dominated by White-chinned Petrels and other deeper diving seabirds (e.g. Jiménez et al. 2011).

- Environmental data. Environmental factors that may influence seabird mortality rates include the sea state, wind speed and direction relative to the vessel's course, cloud cover, visibility and moon phase (for night fishing operations). Routine collection of these data (during line setting) will contribute towards a greater understand of the importance of these factors in determining by-catch.
- Information about offal management (timing in relation to setting and hauling, and position of discharge relative to the hauling bay).

The successful implementation of the data collection protocols requires that these protocols, including sampling regimes, are clearly described, that data recording forms are tailored to capture all the necessary data, and that observers are well trained to undertake the work. Seabird identification is particularly complex, especially for observers with little previous experience or interest in seabird work, and is thus a crucial component of a training programme.

Many observer programmes have developed manuals, which contain detailed descriptions of the sampling protocols, species identification guides, and annotated data collection forms with instructions how to complete these.

6. Other issues

The use of electronic monitoring technology, such as video recording equipment, has been used in a range of fisheries to monitor target and non-target catch, and could provide a cost effective means of increasing 'observer' coverage and monitoring and improving compliance with mitigation requirements, and contributing towards the assessment of by-catch. Such cameras should be directed to view line setting, the hauling bay and (discard) processing in the factory. These recordings could be reviewed after each fishing trip, and methods developed for sub-sampling. Electronic monitoring trials currently underway or planned should help inform an assessment of the utility of the technology, and the development of guidelines on the optimal use thereof.

7. Conclusion

It is recognised that observer programmes require considerable technical and financial resources to be successful, and that the collection of seabird by-catch and associated data adds to the workload of observers. However, by-catch of seabirds and other non-target species is a critical concern for RFMOs. The standardised collection and reporting of relevant data by well trained observers is recognised as the most reliable means of monitoring fisheries performance with respect to seabird by-catch and use of mitigation measures. Rigorous assessment and monitoring of seabird by-catch will require a sufficient level of observer coverage, the development and implementation of standardised data collection and reporting protocols and regular review. This paper draws on work that has been undertaken previously (e.g. Black *et al.* 2007; Anderson *et al.* 2009; BirdLife International 2010; Anderson *et al.* 2010), and serves to complement initiatives currently underway to provide advice on the harmonisation of by-catch and associated data between tuna RFMOs.

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Table 1. Recommended data to be collected in longline fisheries operations (adapted from Dietrich *et al.* 2007, FAO 2009 and Anderson *et al.* 2010). These data will be recorded for each set and haul observed. Data considered critical for assessing seabird by-catch are highlighted in bold.

Category	Variables
Temporal	Date gear deployed
	Start time of gear deployment
	End time of gear deployment
	Date gear retrieved
	Start time of gear retrieval
	End time of gear retrieval
Spatial	Latitude at beginning of gear deployment
	Longitude at beginning of gear deployment
	Latitude at beginning of gear retrieval
	Longitude at beginning of gear retrieval
	Latitude at end of gear retrieval
	Longitude at end of gear retrieval
Physical and Environmental	Sea state (Beaufort Scale)
	Moon phase
	Wind strength and direction
	Depth fished (average/target depth)
	Cloud cover (important for night setting)
Fishing operation	Unique vessel identifier
	Unique observer identifier
	Vessel length
	Setting speed (knots)
	Total number of hooks deployed
	Total number of hooks observed (crucial for calculating seabird by-catch levels)[1]
	Target species[2]
	Bait species
	Composition of bait used (%)
	Bait status (live/fresh/frozen/thawed/whole/cut)
	Mass of added weight (describe size and position of weight, e.g. 60g 2m from the hook)
Fishing gear	Groundline/mainline length[3]
	Branchline/ganglion length
	Distance between weight and hook on ganglion (when used)
	Distance between branchlines
	Line setter used (Y/N)
	Line setter speed (knots)
	Hook size
	Hook type
Catch	Total catch, actual or estimated (number and/or weight)
	Catch by species (number and/or weight)
Mitigation Measure	Tori line used (yes/no)
	Side of tori line deployment (port or starboard or both)
	Number of tori lines used
	Length of tori line (m)
	Aerial coverage achieved (m)
	Attachment height (m above water line)
	Number of streamers
	Distance between streamers
	Dumping of bait/offal (yes/no; also describe if dumping of offal took place during setting and hauling and whether offal was dumped on the opposite side of the hauling bay)
	Deck lighting astern of the vessel (yes/no)
	Bait caster used (yes/no)

	Other mitigation measures used (provide details)
By-catch	Species identification
	Number of each species captured
	Type of interaction (hooking/entanglement)
	Disposition (dead/alive/injured)
	Description of condition/viability of animal upon release (if released alive)
Other	Seabird abundance counts

1. Important to record the numbers of hooks observed specifically for seabirds. If the observer is in the factory or collecting information elsewhere they may miss seabirds being hauled aboard. Therefore it is important to be able to relate the number of birds caught to the number of hooks observed.
2. Target species may be derived in some programmes from the catch composition.
3. Groundline/mainline length is rarely an exact measurement, due to the length of the line. Instead it is either derived (by multiplying distance between floats by number of floats), estimated by the observer, or reported by the vessel.