A Review of Observer Codes for Recording the Condition of Sharks and Seabirds

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Abstract

This paper provides a review of coding systems used by observers to classify the condition of sharks and seabirds interacting with longline fisheries. As for most observer data, the ultimate use of the information is generally understood but not precisely specified, and thus it is difficult to judge whether collected data will be fit for future purposes. It is also necessary to make some assumptions about observer training and onboard time budgeting when designing data collection programmes. With these issues in mind, four tuna regional fisheries management organizations' requirements for observer-collected shark and seabird condition data are reviewed, and several recent advances in understanding how interactions relate to mortality are discussed. A number of conclusions are drawn for the further consideration of CCSBT's Ecologically-Related Species Working Group.

1 Introduction

Interactions with bycatch species of no commercial value are clearly a problem for fishing operations because they impede efficiency and raise costs. Interactions per se however do not necessarily harm bycatch populations unless there are mortalities resulting from those interactions and particularly if those mortalities exceed sustainable limits. Therefore while fisheries operators and economists will be more concerned with interaction rates, biologists and managers face a much more difficult proposition in needing to understand mortality rates. This is because only a portion of the total mortalities will be visible from the deck of the fishing vessel and delayed mortalities occurring after the animal is released cannot always be predicted. It is neither correct to assume to that all released animals die, nor is it correct to assume that they all survive, and determining the actual proportion which die is a difficult but critical component of bycatch population analyses.

Recent advances in satellite telemetry have opened up the possibility of tracking released animals to determine whether they survive, and several studies have been conducted or are underway for sharks (Campana et al. 2015, Escalle et al. 2016). Data from such studies can be used in combination with data on interaction rates and observed (from the deck) mortalities to estimate total mortalities. However, there will be many fisheries for which such post-release survival tagging studies cannot be conducted due to cost or logistics. For these fisheries it is much more uncertain, but still highly desirable, to have some record of the condition of the animal at release in order to inform estimates of total mortality.

In its simplest form, condition can be recorded as either 'dead' or 'alive'; there is the potential to capture more information if categories for injuries are included. Recording injuries will be particularly important if there is an intention to extrapolate post-release mortality study results across fisheries because some tagging studies only tag sharks which are considered to be in good condition, whereas others tag both healthy and injured sharks. As different survival rates would be expected for injured and uninjured sharks, extrapolation of these rates will require knowing, or assuming, the proportion of animals injured in each fishery.

This paper presents a review of condition classification systems used or recommended for regional and national tuna longline fishery observer programmes. While it is essential to consider how these codes can be used by analysts, the methodology for estimating mortalities will be left to the analysts to formulate and is not discussed here (e.g. whether to consider that animals classified as "injured" represent mortalities). Instead, this paper weighs the scientific value of various options for condition coding against the practical constraints to making accurate and consistent condition

classifications. Options from various observer programmes are discussed below, along with species-specific considerations for sharks and seabirds.

2 Condition Classes used by t-RFMO Observer Programmes

One of the themes in the Joint Tuna Regional Fisheries Management Organizations (Joint t-RFMO or Kobe) Technical Working Group-Bycatch has been that coding schemes should be harmonized across organizations to promote interoperability of data (Anon. 2015). The Scientific Observer Program Standards of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) require that the condition classes for bycatch distinguish between 'dead and damaged', 'dead and undamaged', 'alive and vigorous', 'unknown' states. Further guidance provides that "individuals that are discarded with significant injuries and are not considered likely to survive should be included in the number of dead individuals". In considering whether this guidance should be modified or expanded, CCSBT requested a review of condition classes used in other observer programmes including those from other t-RFMOs. The following sections provide the requested review.

2.1 Atlantic

Scientific data on tuna longline fisheries operating in international waters of the Atlantic Ocean are collected by national observer programmes. The International Commission for the Conservation of Atlantic Tunas (ICCAT) has adopted observer data reporting formats, called ST09 forms, that national observer programmes should use to report their data to ICCAT. These formats specify that the condition of bycatch should be recorded at landing (at the vessel) and upon release under the following codes: 'alive (no apparent injuries)', 'alive (minor injuries)', 'alive (severe injuries)' and 'dead'. ICCAT notes that, to date, very few data have been received in these formats. In response to a concern that the formats are overly complex, ICCAT is currently considering ways of simplifying them in the hope of increasing data submissions (ICCAT 2016).

2.2 Indian Ocean

The Indian Ocean Tuna Commission (IOTC) requires its members to maintain at least 5% observer coverage (by set) for each gear type within their fleet[1]. Data from observer trips are to be reported to the IOTC Secretariat in accordance with an agreed observer data reporting template. This template requires the reporting of condition for all discarded animals at the point of release (only) using the codes 'alive but unknown condition', 'alive - active, healthy', 'alive – injured, distressed', 'alive - very weak, dying', 'dead', and 'unknown' (IOTC 2015, 2016).

2.3 Eastern Pacific

IATTC implemented requirements for 5 percent longline coverage for vessels longer than 20 m, with recording of seabird, sea turtle and shark interactions, by national observer programmes in January 2013 (IATTC 2011). There are standardized forms for collecting data and reporting to the Secretariat. The condition codes to be used vary based on whether the discarded animal is a shark or a seabird. Sharks' condition is to be recorded once, upon release/discard, under disposition codes 'returned to the sea alive' or 'returned to the sea dead'. For seabirds, there are condition codes of 'entangled alive', 'entangled dead', hooked alive', 'hooked dead', 'sighted' and 'other', as

[1] Coverage requirements apply differently depending on the size of the fishing vessel and its location of fishing.

well as disposition codes which can be used to provide additional information as 'returned to the sea alive', 'returned to the sea dead', 'released with minor injuries', 'released with grave injuries' and 'released with hook still present', as well as several other potentially applicable dead-kept categories (IATTC 2014).

2.4 Western and Central Pacific

Pacific islands longline observer programmes have been operating in the western and central Pacific since the mid-1990s coordinated by the Forum Fisheries Agency (FFA) and the Pacific Community (SPC). In 2006, a regional observer programme (ROP) under the Western and Central Pacific Fisheries Commission was created to coordinate observer activities for trips that occur partially or wholly outside national waters. There are thus two sets of regional data collection standards under the Pacific Islands Regional Fisheries Observer (PIRFO) and WCPFC ROP programmes, as well as other data collection standards under other national programmes (e.g. Australia, Japan, New Zealand and the United States).

Under the PIRFO programme the condition of most sharks, with the exception of oceanic whitetip, silky and whale sharks (considered species of special interest (SSI)), are recorded under condition codes 'alive', 'alive, healthy', 'alive, injured/distressed', 'alive, but dying', 'dead' or 'condition unknown' (SPC 2017a) both at capture and at release. The condition of SSIs (oceanic whitetip, silky and whale sharks, and all seabirds) are recorded both at capture and at release under one of the codes shown in Table 1 (SPC 2017b).

Table 1. Condition codes for Species of Special Interest (SSI)—including oceanic whitetip, silky and whale sharks and all seabirds--under the Pacific Islands Regional Fisheries Observer (PIRFO) programme (SPC 2014b).

	Codes for Live SSIs		**Codes for Dead SSIs**		**Codes for SSIs with Condition Unknown**
A0	Alive but unable to describe condition	D	Dead	U	Condition unknown
A1	Alive and healthy	D1	Entangled, dead	U1	Entangled, unknown condition
A2	Alive, but injured or distressed	D2	Hooked externally, dead	U2	Hooked externally, condition unknown
A3	Alive, but unlikely to live	D3	Hooked internally, dead	U3	Hooked internally, condition unknown
A4	Entangled, okay	D4	Hooked with hook position unknown	U4	Hooked with hook position unknown, condition unknown
A5	Entangled, injured				
A6	Hooked externally, injured				
A7	Hooked internally, injured				
A8	Hooked with hook position unknown, injured				

Under the WCPFC ROP, the condition of sharks except for oceanic whitetip and silky sharks, are recorded at capture and at release, under codes 'alive but unable to describe condition', 'alive and healthy', 'alive and injured/distressed', 'alive but unlikely to survive', 'dead' or 'unknown'. The condition of oceanic whitetip and silky sharks, as well as all seabirds, is recorded at capture and at release using these codes plus codes for 'hooked in mouth'; 'hooked deeply (throat/stomach)'; or 'hooked externally' (at capture) or 'hook and line removed' (at release) (WCPFC 2016). All national

observer programs for WCPFC-managed fisheries should comply with the WCPFC ROP minimum standard data fields, so it is expected that most national observer programmes follow either the more expansive PIRFO model or the WCPFC ROP model (a minimum standard which may be supplemented).

3 New Developments in Condition Classes

One national observer programme, the United States' Pacific Islands Regional Observer Programme, is currently trialling a new condition coding scheme specifically for the purposes of coordinating observer-based condition coding with the results of an ongoing shark post-release mortality tagging study[2]. The major innovation of this condition coding system is not the codes themselves--it uses the familiar 'dead', 'alive but unknown', 'alive in good condition', 'alive but injured', and 'dead' classes—rather, it provides detailed criteria for assigning a shark to a given class (Table 2). It is also using observer-filmed GoPro video footage and other tools to explore the consistency of observer condition coding. The United States study is also testing a variety of handling codes to help determine the degree to which sharks may be injured by activities occurring between being brought to the vessel and release (M. Hutchinson, pers. comm.).

Table 2. Condition codes being trialed under a United States National Oceanic and Atmospheric Administration – Joint Institute of Marine and Atmospheric Research study of shark interactions and mortalities in Pacific Island longline fisheries (see Footnote 2).

Code	Description
Dead	Animal showed no signs of life. This code is also the default condition when an animal's disposition is observed but cannot be established.
Alive in Good Condition	Animal appears lively and healthy with no obvious signs of injury or lethargy (animal should appear active). This condition code is used when **ALL** of the following criteria are observed and met: **1)** no bleeding, **2)** shark is actively swimming, **3)** not upside down and/or sinking, **4)** no external injury, **5)** not hooked in the esophagus, stomach or the gills.
Alive Injured	Animal was alive but there was clear evidence of serious injury. The serious injury category is met when **ONE OR MORE** of the following injury criteria exists: **1)** the hook has been swallowed (e.g. the bend of the hook is not in the tissue surrounding the jaw but has been ingested posterior to the esophageal sphincter or deeper), **2)** bleeding is seen from the vent and/or gills, **3)** stomach is everted (please specify in comments), or **4)** other damage occurred.
Alive	Animal was observed to exhibit signs of life, but its level of activity or injury could not be established or the criteria for the AG or AI codes are not met. This code is the default for any live animals that could not be further categorized for any reason including the animal was too far away to discern whether or not the 'Alive in Good Condition' or 'Alive Injured' criteria were met.
Unknown	The animal's condition is not observed.

Another scheme describing criteria for classifying sharks under similar condition codes was developed by a Canadian group (WWF Canada 2012, summarized in Clarke et al. (2013)).

[2] See the Report of the Expert Workshop on Shark Post-Release Mortality Tagging Studies – Review of Best Practice and Survey Design (Annex B)
http://www.fao.org/fileadmin/user_upload/common_oceans/docs/Tuna/Report.pdf

While this review has discovered more information available about sharks than about seabirds, this may be a function of the recent proliferation of studies on shark post-release mortality and/or a reflection of the author's greater familiarity with the shark literature. Nevertheless many of the same issues are relevant for seabirds and as documented in a recent all-taxa report commissioned by the New Zealand government there are several potential ways to improve observer-collected data on bycatch mortalities (Pierre et al. 2015a). One example given in the report (for rays) entails scoring each animal against a matrix with columns scaling from 1 (least severe) to 4 (most severe) across four rows of condition categories consisting of activity level during capture, wounds, abrasion, and activity level during release. Such a scheme would undoubtedly provide more in-depth data for analysis than some of the schemes described above, but it would likely require considerable resources to develop a suitable matrix for each bycatch species, as well as more time and training required for observers to do the scoring properly. With specific regard to seabird issues, the Pierre et al. (2015a) study and a similar study by the same authors dedicated to seabird issues (Pierre et al. 2015b) suggested that it might be necessary to collect further data on what types of injuries are occurring and how they can be documented before prescribing more specific data collection protocols.

Recent Agreement on the Conservation of Albatrosses and Petrels (ACAP) recommendations for recording the condition of seabirds interacting with fishing gear mention the use of condition categories for 'dead', 'alive' and 'injured' as well as some indication of whether the seabird was released alive. ACAP also recommends that birds with serious injuries (i.e. fractured wing bone, leg bone or beak, an open wound, several primary feather shafts broken, etc) should be classified as 'dead' as they are unlikely to survive.

4 Conclusions regarding an Optimal Condition Classification System

Based on the preceding review, and the independent technical analysis of the author, the following conclusions are offered for the consideration of the CCSBT Ecologically-Related Species Working Group:

- As the current CCSBT bycatch condition codes only offer categories for 'dead' and 'alive', to bring these codes into alignment with the majority of the other tuna RFMOs one or more categories of 'injured' should be developed and implemented. If not, at a minimum, a clear definition of "significant injuries and [ ] not considered likely to survive" should be developed and agreed.

- Most of the tuna RFMOs allow for an animal's condition to be coded as either lightly injured or severely injured (although there are notable exceptions, i.e. IATTC for sharks, like CCSBT, does not provide for any injured states, but this may be a reflection of the usual practice of shark catch retention). If observer data are to be used in future with post-release mortality tagging studies, it would be worthwhile for CCSBT to consider codes for both lightly (i.e. taggable) and severely injured (i.e. non-taggable) states. If it is not planned to use observer data in conjunction with tagging studies, it may be preferable to create just one "injured" code (e.g. for seabirds) since many, if not most, injuries will be life-threatening.

- Observers are not veterinarians and cannot be expected to accurately assess an animal's health status without clear and simple diagnostics. Therefore, regardless of how many injured states are provided for, CCSBT should provide detailed but straightforward guidance on which characteristics would assign an animal to an injured category (see examples cited above).

- Handling codes (e.g. dragged, cut free, body part cut, gaffed, dehooked, trailing gear left attached, etc.)[3] are a separate topic and so were not directly considered in this paper on condition codes. Nevertheless, collecting information on both the animal's condition and how it is handled would provide very useful data for estimating mortalities. WCPFC's 'hooked in mouth', 'hooked deeply (throat/stomach)', 'hooked externally' or 'hook and line removed' could be an easily-implemented option. Clear handling codes, used in conjunction with a simple "injured" condition code, may provide better information than a more complex condition coding system based on biological diagnostics and no handling codes.

- Some of the tuna RFMOs (ICCAT and WCPFC) provide for the animal's condition at capture and upon release. This is considered to be useful in assessing whether the recorded condition is due to hooking/hauling or onboard handling (or both) and should not be onerous for observers to record (unless bycatch is high and multiple animals are being handled at once)[4].

5 Acknowledgements

The author would like to thank Paul de Bruyn (ICCAT), Sarah Martin (IOTC) and Nick Vogel (IATTC) for their time spent discussing their organizations' condition codes. The work of Melanie Hutchinson (NOAA-JIMAR) with the Pacific Islands Regional Fisheries Observer Programme is gratefully acknowledged as a leading source of inspiration in this field. Igor Debski of the New Zealand Department of Conservation and Karen Baird of New Zealand Forest and Bird provided useful pointers to seabird references. This paper was prepared as a contribution from the ABNJ (Common Oceans) Tuna Project, a Global Environment Facility (GEF)-funded, Food and Agriculture Organization of the United Nations (FAO)-implemented initiative.

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[3] See the Report of the Expert Workshop on Shark Post-Release Mortality Tagging Studies – Review of Best Practice and Survey Design (Annex B) http://www.fao.org/fileadmin/user_upload/common_oceans/docs/Tuna/Report.pdf

[4] It is not considered that the time between capture and release is in itself an issue, particularly if before and after condition is recorded and thus the effects of that time passing (either positive (e.g. recovery) or negative (e.g. asphyxiation) are captured. Therefore, it is not recommended for observers to record handling time per se.

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