COMMISSION
EIGHTH REGULAR SESSION
Tumon, Guam, USA
26-30 March 2012

PERFORMANCE ASSESSMENT OF RFMO BYCATCH GOVERNANCE: CRITERIA SUITE DESIGN AND RESULTS FOR ASSESSMENT OF THE WCPFC

WCPFC8- 2011-OP/02

Paper prepared by Eric Gilman and Kelvin Passfield

WCPFC Information Paper

Performance Assessment of RFMO Bycatch Governance: Criteria Suite Design and Results for Assessment of the Western and Central Pacific Fisheries Commission

Eric Gilman[1] and Kelvin Passfield[2]

[1] Hawaii Pacific University, EricLGilman@gmail.com
[2] Kelvin Passfield, Vice Chair Marine and Coastal Ecosystems, IUCN CEM, kelvin.passfield@gmail.com

1. Introduction

This Information Paper to WCPFC presents a criteria suite for assessing Regional Fisheries Management Organization bycatch governance, and results from assessment of the Western and Central Pacific Fisheries Commission against the criteria. These materials are to be a part of a 2012 publication, *Performance Assessment of Regional Fisheries Management Organization Bycatch Governance in Marine Capture Fisheries,* in the technical report series of the International Union for the Conservation of Nature (IUCN) Commission on Ecosystem Management and Oceania Regional Office, which will be distributed to RFMO Secretariats and their Member States.

The criteria suite against which assessments are being undertaken is comprised of five broad categories. These are (i) data collection (data collection protocols, observer coverage, and dataset quality); (ii) bycatch data open access; (iii) ecological risk assessment; (iv) control measures for bycatch and discards, fishing mortality in derelict gear, and problematic pollution from discharge of catch, offal and spent bait at sea; and (v) surveillance and enforcement.

For this study, bycatch is defined broadly as being comprised of: (i) retained catch of non-targeted but commercially valuable species (incidental catch or by-product); (ii) discarded catch, whether the reason for discarding is economic or regulatory, or results from vessel and gear characteristics; plus (iii) unobserved mortalities (pre-catch, post-release, ghost fishing, collateral, cumulative/synergistic).

2. Criteria Suite

Basic information on the history, member States, cooperating non-members, managed fisheries and species, whether or not the RFMO mandate includes non-target species, and area of competence, is reported for each RFMO.

Five broad criteria are used to assess each RFMO's governance of bycatch. Criteria suites employed in previous assessments of RFMO, national and individual fishery ecological sustainability and other publications relevant to assessing the effectiveness of governance of bycatch, including discarded bycatch (Caddy, 1996; Pitcher, 1999; Garcia, 2000; Pitcher and Preikshot, 2001; Small, 2005; Caddy et al., 2007; Lodge et al., 2007; United Nations, 2007; CCSBT, 2008a,b; NEAFC, 2008; ICCAT, 2009d; IOTC, 2009; Cullis-Suzuik and Pauly, 2010; FAO 1995, 2006, 2010b,c; Marine Stewardship Council, 2010) were reviewed to design the criteria suite definitions and scaling of scores used in this study. An effort was made to minimize the number of criterion by lumping governance properties as practicable; however, in some cases, it was necessary to split criterion into sub-criteria to capture disparate aspects of bycatch governance.

Information from publically available materials from RFMO Secretariats were sought first to assess RFMOs against the criteria suite, consistent with international standards on transparency in decision-making on environmental issues (UNEP, 1992 [Principle 10]; FAO,

1995 [Articles 6.13, 7.1.9]; United Nations, 1995 [UNFA Article 12], 2006a, 2006b, 2010). Additional information was obtained from peer-reviewed and grey literature and through correspondences with regional experts, including secretariat staff from each of the 14 RFMOs included in the study.

Scaling of criteria was designed to represent the continuum from none or nominal governance to best practice optimal governance. Scaling was therefore not designed to account for preconceived expectations of RFMO progress, for instance, to facilitate having resulting scores range across the full scale from 0-100%. However, results are also presented relative to the RFMO with the highest overall score. Scores for the two criteria that contain multiple sub-criteria are calculated as the mean of the percent of total possible points achieved against each sub-criterion (e.g., if criteria 1A, 1B and 1C scores are 20%, 35% and 70%, then the score for criterion 1 is the mean of the three sub-criteria scores, 41.7%). An overall RFMO score is calculated as the average of the percentages determined for criteria 1-5. The five criteria are assigned equal weights, as each represents a critical, fundamental component of effective bycatch governance.

For each RFMO, the standard deviation of the mean for the overall score is determined. The mean and SD of the mean for the 14 RFMOs' scores for each criterion, sub-criterion and overall score are also reported. This provides an understanding of the degree of variance in scores within and between RFMOs.

2.1. Criterion 1: Data collection for Regionally Observed Fisheries

Criterion 1 includes three sub-criteria covering the following aspects of effective RFMO monitoring of bycatch in marine capture fisheries: data collection protocols, observer coverage rates, and the quality of regional observer program datasets (FAO, 1995 [Articles 6.4, 6.11, 7.2.2, 7.4.1, 7.4.4, 7.7.3, 8.4.3, 12.4]; Caddy, 1996; Pitcher and Preikshot, 2001; United Nations, 1995 [Article 10(f)], 2007; Cullis-Suzuki and Pauly, 2010; Marine Stewardship Council, 2010; Gilman, 2011).

2.1.1. Criterion 1A. Bycatch Data Collection Protocols

This sub-criterion assesses the adequacy of regional observer data collection protocols to provide fundamental information on the bycatch of target and non-target species (FAO, 1995 [Articles 6.4, 6.11, 7.4.4, 8.4.3, 12.4], 2010b; Caddy, 1996; Pitcher and Preikshot, 2001; Kelleher, 2005; Lodge et al., 2007; United Nations, 2007; Gilman et al., 2006b, 2007a, 2008a,b; Cullis-Suzuki and Pauly, 2010; Marine Stewardship Council, 2010; Gilman, 2011), and minimum information needed to assess the efficacy of binding bycatch- related conservation and management measures (FAO, 1995 [Article 7.4.1], 2010b; Marine Stewardship Council, 2010) (Table 2). A maximum of 25 or 22 points are attainable for assessment against sub-criterion 1A for an RFMO that includes vs. does not include hook-and-line fisheries in a regional observer programme, respectively. The criterion assesses the adequacy of the observer data that the RFMO intends to be collected via a regional observer programme; separate criterion assess the quality of the regional observer programme dataset and observer coverage rates of RFMO-managed fisheries.

Table 2. Criterion 1A. Assessment of RFMO regional observer programme data collection protocols for bycatch, including discards, and to assess the performance of relevant binding conservation and management measures.

Factor	Points for positive response
Non-target fish and non-fish species are included in the RFMO's mandate.	1
Data for at least 1 individual bycatch species or group but ≤50% of	1

documented vulnerable bycatch species are intended to be collected in fisheries with regional observer coverage.	
Data for >50% but <75% of documented vulnerable bycatch species are intended to be collected in fisheries with regional observer coverage.	2
Data for ≥75% of documented vulnerable bycatch species are intended to be collected in fisheries with regional observer coverage.	3
The number and/or weight of at least 1 documented vulnerable bycatch species is intended to be routinely collected by regional observers.	1
At least one item of information but ≤50% of the items of information needed to assess performance standards of relevant binding conservation and management measures is intended to be collected by regional observers.	1
>50% but <75% of the items of information needed to assess performance standards of relevant binding conservation and management measures are intended to be collected by regional observers.	2
≥75% of the items of information needed to assess performance standards of relevant binding conservation and management measures are intended to be collected by regional observers.	3
Information on fishing effort is intended to be routinely collected for fisheries with regional observer coverage.	1
Date and location of fishing operations are intended to be routinely captured by regional observers.	1
Information on whether catch is retained or discarded is intended to be routinely captured by regional observers for at least 1 individual bycatch species or group but ≤50% of documented vulnerable bycatch species.	1
Information on whether catch is retained or discarded is intended to be routinely captured by regional observers for >50% but <75% of documented vulnerable bycatch species.	2
Information on whether catch is retained or discarded is intended to be routinely captured by regional observers for ≥75% of documented vulnerable bycatch species.	3
Data records are intended to be to the species-level for at least 1 bycatch species but ≤50% of documented vulnerable bycatch species in fisheries with regional observer coverage.	1
Data records are intended to be to the species-level for >50% but <75% of documented vulnerable bycatch species in fisheries with regional observer coverage.	2
Data records are intended to be to the species-level for ≥75% of documented vulnerable bycatch species in fisheries with regional observer coverage.	3
Information on length or other proxy for age class is intended to be collected by regional observers for at least 1 vulnerable bycatch species but ≤25% of identified vulnerable bycatch species.	1
Information on length or other proxy for age class is intended to be collected for >25% but <50% of identified vulnerable bycatch species.	2
Information on length or other proxy for age class is intended to be collected for ≥50% of identified vulnerable bycatch species.	3
Information on the disposition of discards (e.g., alive vs. dead, and possibly degree of injury) is intended to be collected for at least 1 vulnerable bycatch species but ≤50% of identified vulnerable bycatch species.	1

Information on the disposition of discards (e.g., alive vs. dead, and possibly degree of injury) is intended to be collected for >50% but <75% of identified vulnerable bycatch species..	2
Information on the disposition of discards (e.g., alive vs. dead, and possibly degree of injury) is collected for ≥75% of identified vulnerable bycatch species.	3
For hook-and-line fisheries with regional observer coverage, information on gear attached to individuals of vulnerable species that are discarded alive is intended to be collected for at least 1 vulnerable bycatch species but ≤50% of identified vulnerable bycatch species.	1
For hook-and-line fisheries with regional observer coverage, information on gear attached to individuals of vulnerable species that are discarded alive is intended to be collected for >50% but <75% of identified vulnerable bycatch species.	2
For hook-and-line fisheries with regional observer coverage, information on gear attached to individuals of vulnerable species that are discarded alive is intended to be collected for ≥75% of identified vulnerable bycatch species.	3

Information used for assessment:

- Are non-target fish and non-fish species included in the RFMO's mandate?
- In fisheries required to have regional observer coverage, for what proportion do the RFMO's data collection protocols call for catch data (i.e., data on both retained and discarded non-target species) to be routinely collected for known shark, sea turtle, seabird, marine mammal, or other documented vulnerable bycatch species?
- Does the RFMO's data collection protocols by regional observers call for information on the number and/or weight of documented vulnerable bycatch species to be routinely collected?
- Identify minimum data requirements to assess the performance of legally binding conservation and management measures (described in Criterion 4).
- Identify gaps in information intended to be collected by regional observers that is required to assess the performance of bycatch conservation and management measures. What percent of required minimum information is not intended to be routinely collected by in the regional observer programme according to the RFMO's data collection protocols?
- Does the information intended to be collected by onboard observers per the RFMO's data collection protocols meet bycatch data collection requirements that are explicitly stated in binding conservation and management measures (described in Criterion 4)?
- Does the RFMO's protocol for observer data collection call for the routine collection of information on fishing effort?
- For how many of documented vulnerable bycatch species (compiled under Criteria 3 and 4) is information on whether the catch was retained vs. discarded intended to be routinely by observers of the regional observer programme?
- Does the RFMO's data collection protocols for the regional observer programme call for information on the date and location of fishing operations to be routinely captured?
- For what proportion of bycatch species of vulnerable species groups (identified under Criteria 3 and 4) are regional observers intended to have record be at the species level?
- For what proportion of identified vulnerable species groups is information on length intended to be collected under the regional observer programme? If other information is intended to be routinely collected by regional observers that provides a proxy for age class, identify the measurement method.

- For what proportion of vulnerable species groups (identified under Criteria 3 and 4) is information on the disposition of individuals that are discarded (alive vs. dead) intended to be routinely collected under the regional observer programme?
- For hook-and-line gear (longline, troll, pole-and-line, handline, etc.), for what proportion of vulnerable species groups (identified under Criteria 3 and 4) is information on fishing gear remaining attached to individual organisms that are discarded alive intended to be routinely collected under the regional observer programme (e.g., hooked and location of hooking, entangled, leader attached, weights attached, length of fishing line attached)?

2.1.2. Criterion 1B. Regional Observer Coverage Rates

This sub-criterion assesses the adequacy of regional onboard observer coverage rates to monitor discards and retained and transshipped bycatch (FAO, 1995 [Articles 7.2.2, 7.7.3]; Marine Stewardship Council, 2010) (Table 3). An RFMO scientific body may have recommended a schedule for gradual increase in observer coverage rates, whereby a fishery may be deemed to meet the scientific recommendation if it has a regional coverage rate consistent with that recommended in the schedule. A maximum of 11 points is possible for assessment against Criterion 1B.

Table 3. Criterion 1B. Assessment of RFMO onboard observer coverage rates to monitor discards and retained and transshipped bycatch.

Factor	Points for positive response
At least one but <25% of managed fisheries (fisheries covered by the RFMO) have ≥5% regional onboard observer coverage.	1
≥25% but <50% of managed fisheries have ≥5% regional onboard observer coverage.	2
≥50% but <75% of managed fisheries have ≥5% regional onboard observer coverage.	3
≥75% but <100% of managed fisheries have ≥5% regional onboard observer coverage.	4
All managed fisheries have ≥5% regional onboard observer coverage.	5
The RFMO's scientific body has recommended regional onboard observer coverage rates for each managed fishery, and the regional onboard observer coverage rates meet scientific advice for at least 1 managed fishery but <25% of managed fisheries.	1
The RFMO's scientific body has recommended regional onboard observer coverage rates for each managed fishery, and the regional onboard observer coverage rates meet scientific advice for ≥25% but <50% of managed fisheries.	2
The RFMO's scientific body has recommended regional onboard observer coverage rates for each managed fishery, and the regional onboard observer coverage rates meet scientific advice for ≥50% but <75% of managed fisheries.	3
The RFMO's scientific body has recommended regional onboard observer coverage rates for each managed fishery, and the regional onboard observer coverage rates meet scientific advice for ≥75% of managed fisheries.	4
There is international exchange of observers in the regional onboard	2

observer programme.	

Information used for assessment:

- What recommendations on regional observer coverage rates have the RFMO's scientific body or the Commission made for fisheries under the RFMO's mandate?
- Does a regional observer programme exist?
- What are regional onboard observer coverage rates in each fishery managed by the RFMO?
- If there have been recommendations for onboard observer coverage rates by the RFMO's scientific body, then for how many of the fisheries managed by the RFMO do current observer coverage rates meet the scientific body's recommendations? Recommended observer coverage rates made by an RFMO scientific body might include a schedule for increasing coverage, such that current coverage rates might not meet the final recommended level, but might meet the rate specified in the recommended schedule for gradual increase. [Recommended coverage rates may reflect rates needed to meet objectives of analyses, taking into account required levels of accuracy and precision, the rate of bycatch interactions, amount of fishing effort, and distribution of discarded catch (Hall, 1999; McCracken, 2005; Gilman, 2011)].
- For each fishery under the RFMO's mandate, are international onboard observers assigned through a regional programme, or are they assigned by national fisheries management authorities?

2.1.3. Criterion 1C. Regional Observer Programme Dataset Quality and Bycatch Reporting

This sub-criterion assesses the following aspects of data quality of an RFMO's regional observer programme dataset: (i) interoperability of national datasets contributed to an RFMO, or otherwise existence of a single regional database with records collected from covered national fisheries; (ii) time series length; (iii) seasonal distribution of records; (iv) spatial distribution of records; (v) whether Member States regularly report their observer programme data to the RFMO; and (vi) whether there are countries with fisheries under the RFMO's mandate that are not Members or Cooperating Non-Members, which reduces dataset quality if these countries do not report bycatch data (Pitcher and Preikshot, 2001; Kelleher, 2005; United Nations, 2007; Gilman et al., 2008a,b; NEAFC, 2008; Marine Stewardship Council, 2010; Gilman, 2011) (Table 4).

An RFMO's regional observer programme dataset could consist of a single dataset of pooled records from national fisheries, or collective national observer programme datasets that are provided by Member States to the RFMO. A maximum of 11 points is possible for assessment against sub-criterion 1C. As with sub-criterion 1A, this criterion assesses data quality of regional observer programme datasets, and does not assess coverage rates of managed fisheries or vessel classes of a fishery, addressed in sub-criterion 1B.

Table 4. Criterion 1C. Assessment of RFMO observer programme data quality.

Factor	Points for positive response
A regional observer programme database with records of bycatch exists.	1
Either (i) the regional observer programme database is comprised of records pooled from observed national fisheries; or (ii) individual national observer programme datasets reported to the RFMO are in a standardized format that	1

permits pooling.	
The regional observer programme dataset is <5 years long.	1
The regional observer programme dataset is ≥5 but ≤15 years long.	2
The regional observer programme dataset is >15 years long.	3
Seasonal coverage is balanced and there are minor or no gaps in seasonal coverage.	1
Spatial coverage is balanced and there are minor or no gaps in spatial coverage.	1
All countries with fisheries under the RFMO's mandate are Members or Cooperating Non-Members.	1
>50% but <70% of the RFMO's Members reported required observer data to the regional programme in each of the previous three years, or for the full duration of the regional observer programme, whichever period is shorter.	1
≥70% but <90% of the RFMO's Members submitted data to the regional programme in each of the previous three years, or for the full duration of the regional observer programme, whichever period is shorter.	2
≥90% of Members submitted data to the regional programme in each of the previous three years, or for the full duration of the regional observer programme, whichever period is shorter.	3

Information used for assessment:

- Does a regional observer programme database exist? If yes, does the database include records on bycatch?
- If there is a regional observer programme, is there a dataset owned or managed by the RFMO Secretariat comprised of records pooled from observed national fisheries (e.g., the RFMO manages an observer programme, placing international observers on Parties' vessels, from which data are reported directly to the RFMO, or Parties submit national observer programme datasets to the RFMO, where they are pooled into a single regional database)? If individual national observer programme datasets are not pooled into a single regional dataset, then are national datasets submitted to the RFMO in standardized formats prescribed by the RFMO that enable pooling (e.g., are units of effort and taxonomic levels and names of catch consistent between the datasets)?
- What is the length in years of the regional observer programme dataset?
- Have observer data been collected evenly across seasons for observed fisheries? Are there gaps in seasonal observer coverage of managed fisheries?
- Have observer data been collected evenly across fishing grounds for each observed fishery? Are there gaps in spatial observer coverage of managed fisheries?
- Which countries with fisheries under the RFMO's mandate are not Members or Cooperating Non-Members?
- For each fishery that is a part of the regional observer programme, are certain vessel classes exempt from carrying onboard observers, or are Members not required to provide data on certain vessel classes to the RFMO?
- Which Member States do not routinely report required observer data on bycatch to the RFMO (FAO, 1995 [Articles 8.4.3, 12.4]; Small, 2005)? More specifically, either in each of the last three years, or for the full duration of the regional observer programme, whichever period is shorter, how many Members have not submitted regional observer data to the RFMO?

2.2. Criterion 2. Open access to regional observer programme datasets

This criterion aims to assess the provision of public access to RFMO-held datasets of primary or amalgamated regional observer records (Table 5) (FAO, 1995 [Articles 7.1.9, 7.4.2, 7.4.7]; Caddy, 1996; Cullis-Suzuki and Pauly, 2010; Gilman, 2011; Gilman et al., 2011). A maximum of 15 points is possible for assessment against Criterion 2.

Table 5. Criterion 2. Assessment of RFMO provision of open access to regional observer programme datasets..

Factor	Points for positive response
There is a regional observer programme dataset containing records of bycatch, and datasets of amalgamated and not primary data records are open access and records are amalgamated by >5 degree cells.	1
There is a regional observer programme dataset containing records of bycatch, and datasets of amalgamated and not primary data records are open access and records are amalgamated by ≤5 degree cells.	2
A publically available dataset of amalgamated records collected by regional observers did not eliminate information on fishing effort, fishing gear, fishing methods, date of setting and hauling, or taxonomic information on bycatch.	4
Some but not all data on bycatch collected in the regional observer programme that are open access are primary (non-amalgamated) data.	6
All data made open access by the RFMO regional observer programme are primary data.	10
Primary or amalgamated observer data for at least 1 but < 50% of fisheries included in the regional observer programme are open access.	1
Primary or amalgamated observer data for ≥50% but <75% of fisheries included in the regional observer programme are open access.	3
Primary or amalgamated observer data for ≥75% of fisheries included in the regional observer programme are open access.	5

Information used for assessment:

- Does a regional observer programme dataset containing records on bycatch exist?
- What confidentiality rules have been adopted on access to data on bycatch and discards that the RFMO owns or holds as a custodian?
- Are primary or amalgamated data collected in the regional observer programme made available as an open public resource?
- If only a dataset of amalgamated records from the onboard observer programme is made publically available, is the dataset of amalgamated records at a resolution of ≤5 degree cells, >5 degree cells, or is information on resolution of records in the publically available dataset not specified?
- If only amalgamated records from a regional onboard observer programme are made available to the public, has the amalgamation of records prevented any research applications that would have been feasible with the primary data? E.g., is the resolution of amalgamated data insufficient to identify spatial trends in bycatch, or has information on any factors known to significantly affect bycatch rates been eliminated from the publically available dataset (e.g., standard unit of fishing effort, fishing gear and methods, timing of fishing operations, taxonomic level) (Chaloupka and Balazs, 2005; Sullivan et al., 2006; Gilman et al., 2008b)?

- Of the fisheries that are included in the regional observer programme, for how many are primary or amalgamated datasets open access?

2.3. Criterion 3: Ecological risk assessment

Criterion 3 aims to assess whether or not an RFMO has conducted adequate ecological risk assessment to understand the effect of fishing activities on bycatch species (FAO, 1995 [Articles 7.2.2, 7.2.3, 12.10], 2010b; Caddy, 1996; Garcia, 2000; Lodge et al., 2007; NEAFC, 2008; Cullis-Suzuki and Pauly, 2010; Marine Stewardship Council, 2010) and to enable an understanding of broader effects of bycatch across facets of biodiversity (i.e., how does bycatch fishing mortality, including discards, affect marine biodiversity, from genetic diversity to ecosystem integrity) (NEAFC, 2008; Cullis-Suzuki and Pauly, 2010; Marine Stewardship Council, 2010; Bjorndal et al., 2011) (Table 6). A maximum of 8 points is possible for assessment against Criterion 3.

Therefore, this criterion considers comprehensive ecological risk assessment of the effects of fisheries to consider broad effects of fishing mortality from retained, discarded and unobserved bycatch, including: (i) effects of age-class-specific fishing mortality on abundance and genetic diversity of populations and stocks of bycatch species, (ii) the relative degree of risk interactions in the fishery poses to a population or stock, taking into account cumulative age-class-specific mortality sources; and (iii) effects of fishing mortality on trophic dynamics and regulation of ecosystem processes and structure (Cullis-Suzuki and Pauly, 2010; Marine Stewardship Council, 2010; Bjorndal et al., 2011).

Ecological risk assessment of the effects of fishing can be undertaken employing a hierarchical approach with three levels along a continuum from a qualitative first order to quantitative rigorous assessment. Level 1 and 2 ecological risk assessments are useful mainly where there are data deficiencies with the fishery or species being assessed (Kirby, 2006; Coelho et al., 2011). Level 1 involves a qualitative assessment based on expert and stakeholder opinion. Level 2 involves a semi-quantitative assessment, for example, through a productivity (natural growth rate of a population in the absence of fishing mortality – an indicator of a population's relative resistance to fishing mortality and ability to recover from depletion) – susceptibility (does a population overlap with the fishery temporally and spatially, what proportion of each age class overlaps the fishery, what is the probability that this species interacts with fishing vessels, will be captured, and will suffer injury or mortality in the fishery being assessed) analysis (PSA). And, Level 3 is a quantitative assessment documenting population-level effects from mortality levels in a fishery in question, with large data requirements (Sainsbury and Sumaila, 2001; Kirby, 2006; Hobday et al., 2007; Marine Stewardship Council, 2010; Coelho et al., 2011).

Table 6. Criterion 3. Ecological risk assessment.

Factor	Points for positive response
Level 1 ecological risk assessment for the effects of fishing on bycatch species and/or the effects of bycatch on the integrity of the ecosystem has been conducted for at least 1 fishery but <50% of fisheries managed by the RFMO, results supported more rigorous, quantitative assessment, but Level 2 and 3 assessments have not been conducted.	1
Level 1 ecological risk assessment for the effects of fishing on bycatch species and/or the effects of bycatch on the integrity of the ecosystem has been conducted for ≥50% of fisheries managed by the RFMO, results	2

supported more rigorous, quantitative assessment, but Level 2 and 3 assessments have not been conducted.	
Level 2 and/or 3 assessment has been conducted for either the effects of fishing on bycatch species or the effects of bycatch on the integrity of the ecosystem, but not both, for at least 1 fishery.	2
Level 2 semi-quantitative assessment for both the effects of fishing on bycatch species, and the effects of bycatch on the integrity of the ecosystem has been conducted for at least 1 fishery but <50% of fisheries managed by the RFMO, with findings suggesting that more rigorous Level 3 assessment is warranted but has not been conducted.	3
Level 2 semi-quantitative assessment for both the effects of fishing on bycatch species, and the effects of bycatch on the integrity of the ecosystem has been conducted for ≥50% of fisheries managed by the RFMO, with findings suggesting that more rigorous Level 3 assessment is warranted but has not been conducted.	4
Level 1 qualitative assessment for both the effects of fishing on bycatch species, and the effects of bycatch on the integrity of the ecosystem has been conducted for at least 1 fishery but <50% of fisheries managed by the RFMO, with findings suggesting that more rigorous quantitative assessment is not warranted.	5
Level 2 semi-quantitative assessment for both the effects of fishing on bycatch species, and the effects of bycatch on the integrity of the ecosystem has been conducted for at least 1 fishery but <50% of fisheries managed by the RFMO, with findings suggesting either that more rigorous Level 3 assessment is not warranted or that Level 3 assessment is warranted and it is planned or in progress.	5
Level 1 qualitative assessment for both the effects of fishing on bycatch species, and the effects of bycatch on the integrity of the ecosystem has been conducted for ≥50% of fisheries managed by the RFMO, with findings suggesting that more rigorous quantitative assessment is not warranted.	6
Level 2 semi-quantitative assessment for both the effects of fishing on bycatch species, and the effects of bycatch on the integrity of the ecosystem has been conducted for ≥50% of fisheries managed by the RFMO, with findings suggesting either that more rigorous Level 3 assessment is not warranted or that Level 3 assessment is warranted and it is planned or in progress.	6
Level 3 assessment for both the effects of fishing on bycatch species, and the effects of bycatch on the integrity of the ecosystem, has been conducted at least 1 fishery but <50% of fisheries managed by the RFMO.	7
Level 3 assessments for both the effects of fishing on bycatch species, and the effects of bycatch on the integrity of the ecosystem, have been conducted for ≥50% of fisheries managed by the RFMO.	8

Information used for assessment:

- Identify each ecological risk assessment study that has been conducted by the RFMO. Identify the level of assessment conducted, per Hobday et al. (2007), Kirby (2006), and Sainsbury and Sumaila (2001).
- For each fishery managed by the RFMO, identify whether an ecological risk assessment has been conducted that assesses the effects of the fishery on bycatch species and/or the effects of bycatch removals on ecosystem integrity.

- Describe the results of each ecological risk assessment. Describe the findings in terms of what ecological risks each assessed fishery poses, identify whether more rigorous ecological risk assessment was recommended. If a more rigorous assessment was recommended, has it been conducted, in progress, or planned to be conducted?

2.4. Criterion 4. Conservation and management measures to control problematic bycatch and discards

This criterion includes three components related to the control of bycatch in marine capture fisheries. The first sub-criterion assesses the adequacy of legally binding measures in mitigating problematic bycatch, excluding ecological risks from derelict fishing gear and pollution from discards (FAO, 1995 [Articles 6.2, 6.4, 7.2.2d, 7.2.2g, 7.5.2, 7.6.9, 7.7.2, 7.7.3]; Garcia, 2000; United Nations, 2007; Marine Stewardship Council, 2010). The second sub-criterion assesses the adequacy of binding measures in mitigating ecological risks from lost and abandoned derelict fishing gear (FAO, 1995 [Article 7.2.2g, 7.6.9]; Caddy, 1996; Garcia, 2000; United Nations, 2007). And, the third sub-criterion assesses the adequacy of binding measures in mitigating problematic pollution resulting from discharges of discarded catch, offal from processed catch, and spent bait (FAO, 1995 [Article 7.2.2g]; Caddy, 1996; Garcia, 2000; United Nations, 2007).

Scaling considers whether: (i) There are binding measures that mitigate problematic bycatch identified through ecological risk assessments; (ii) For fisheries managed by the RFMO for which the ecological effects of bycatch are not known because ecological risk assessments have not been conducted, and adverse ecological effects from bycatch in these gear types are documented in other regions, which might also occur in the fisheries managed by this RFMO, are there precautionary binding measures to mitigate these potentially occurring adverse ecological effects; (iii) Binding measures to mitigate bycatch and discards include measurable performance standards; (iv) Of binding bycatch and discard measures that contain quantitative performance standards, have the measures been assessed for efficacy; (v) For binding bycatch and discard measures that have been determined to be lacking in effectiveness (either through assessment against measurable performance standards stated in the measure or otherwise through other scientifically rigorous assessment), have steps been taken or are steps in progress to improve efficacy; and (vi) Does the RFMO have provisions that allow Members to opt out of binding measures (e.g., reservations or other forms of opt-out) (FAO, 1995 [Article 7.6.8], 2010b; Gilman, 2011).

2.4.1. Criterion 4A. Conservation and Management Measures to Mitigate Problematic Bycatch and Discards

Table 7 is used to assess RFMO performance in adopting binding measures to mitigate problematic bycatch (FAO, 1995 [Articles 6.2, 6.4, 7.2.2d, 7.2.2g, 7.6.9]; Garcia, 2000; Lodge et al., 2007; United Nations, 2007; Marine Stewardship Council, 2010; Gilman, 2011). The sub-criterion considers the broad, full suite of adverse ecological effects that can result from bycatch (Section 1.1). However, this sub-criterion excludes consideration of adverse ecological effects from derelict fishing gear and pollution from discards, which are addressed in the subsequent two sub-criteria. A maximum of 18 points is possible for assessment against Criterion 4A.

Table 7. Criterion 4A. Conservation and management measures to mitigate bycatch, and efficacy.

Factor	Points for positive response

One or more bycatch problem has been identified to occur in one or more fisheries managed by the RFMO, and binding measures are in place to mitigate at least one identified problem but <50% of the number of identified problems.	1
One or more bycatch problem has been identified to occur in one or more fisheries managed by the RFMO, and binding measures are in place to mitigate ≥50% but <75% of the number of identified problems.	3
One or more bycatch problem has been identified to occur in one or more fisheries managed by the RFMO, and binding measures are in place to mitigate ≥75% of the number of identified problems.	5
Ecological risk assessments and other studies assessing bycatch have been conducted, or otherwise information on bycatch in these gear types from other regions is considered, and findings strongly support that there is no problematic bycatch occurring in fisheries managed by the RFMO for which there are no binding conservation and management measures to mitigate bycatch.	6
At least one but <50% of binding measures to mitigate bycatch include measurable performance standards.	1
≥50% but <75% of binding measures to mitigate bycatch include measurable performance standards.	2
≥75% of binding measures to mitigate bycatch include measurable performance standards.	3
Of binding bycatch measures that contain quantitative performance standards, at least one measure but <50% of the measures have been assessed for efficacy.	1
Of binding bycatch measures that contain quantitative performance standards, ≥50% but <75% of the measures have been assessed for efficacy.	2
Of binding bycatch measures that contain quantitative performance standards, ≥75% of the measures have been assessed for efficacy.	3
All binding bycatch measures that contain performance standards have been determined to be effective in meeting the stipulated performance standards.	3
For all binding bycatch measures that have been determined to be lacking in effectiveness (either through assessment against measurable performance standards stated in the measure or otherwise through other scientifically rigorous assessment), steps have been taken or are in progress to improve efficacy.	2
There is no provision that allows RFMO Members to opt out of binding measures.	3

Information used for assessment:

- Based on the review of ecological risk assessments conducted under Criterion 3, list each bycatch problem for each fishery managed by the RFMO.
- List bycatch problems that have been documented to occur in fisheries managed by the RFMO from studies other than ecological risk assessments. If there is limited information on the effects of the managed fisheries on species subject to bycatch and the ecological effects from bycatch removals, then list the occurrence of problematic

bycatch that occurs in the same gear types as documented in other regions, which is likely to also occur in the fisheries managed by this RFMO?

- Using Table 8, summarize active legally binding conservation and management measures that mitigate bycatch, and identify any quantitative and measurable performance standards included in each measure (e.g., target reference points for bycatch species or species groups, such as Maximum Sustainable Yield or the more precautionary Maximum Economic Yield; limit reference points for the impacts of fishing on bycatch fish species; limits on catch rates or levels for protected or threatened bycatch species; minimum sink rate for hook-and-line terminal tackle; minimum depth for gear when soaking [United Nations, 1995; Garcia, 2000; Mace, 2001; Lodge et al., 2007; Cullis-Suzuki and Pauly, 2010; Gilman, 2011]).
- From the responses to the first two bullets, list each individual documented bycatch problem.
- For what proportion of potentially existing or documented bycatch problems (considering both the adverse effects on species subject to bycatch and effects of bycatch removals on ecosystem integrity) in fisheries managed by the RFMO are binding conservation and management measures in effect (i.e., are measures based on the best scientific evidence available) (FAO, 1995 [Article 12.13]; Caddy, 1996)?
- What proportion of binding bycatch measures contain quantitative, measurable performance standards?
- For what proportion of conservation and management measures that include measurable performance standards has efficacy been assessed?
- For each binding bycatch measure that contains performance standards, which have been determined to be effective in meeting the stipulated performance standards?
- Of the binding bycatch measures that have been determined to be lacking in effectiveness either through assessment against measurable performance standards stated in the measure or otherwise through other scientifically rigorous assessment (e.g., Gilman et al., 2007a, 2008b), for how many have steps been taken or are in progress to improve efficacy?
- Does the RFMO allow Member States to opt out of binding conservation and management measures (e.g., reservations or other forms of opt-out)? If yes, is information available documenting whether or not members are employing the opt out provision so as to not employ measures relevant to this criterion, or otherwise is information on employment of the opt out provision not available?

Table 8. Template table format to identify active RFMO legally binding conservation and management measures related to the mitigation of problematic bycatch, identify any performance standards and assess if these are quantitative and measureable or not, describe data requirements for performance assessment, and identify minimum surveillance resources to determine compliance.

Measure	Stipulated Performance Standards, Measurable or Subjective	Data Collection Needed for Implementation	Minimum surveillance resources necessary: (a) dockside inspection, (b) at-sea inspection, (c) VMS, (d) onboard observers, (e) vessel list, (f) other (specify)
Seabirds			
Sea turtles			
Marine mammals			
Shark and relatives			
Juvenile and small/undersized target species			
Unmarketable sizes and species of non-target species of fish			
Other or multiple bycatch species group(s)			

2.4.2. Criterion 4B. Conservation and Management Measures to Mitigate Bycatch in Derelict Fishing Gear

Table 9 is used to assess the adequacy of RFMO binding measures to mitigate bycatch caused by lost, abandoned and discarded derelict fishing gear (FAO, 1995 [Article 7.2.2g, 7.6.9]; Caddy, 1996; Garcia, 2000; United Nations, 2007). This criterion does not assess habitat effects from derelict fishing gear, which is outside the scope of this assessment. A maximum of 14 points is possible for assessment against Criterion 4B.

Table 9. Criterion 4B. Conservation and management measures to mitigate bycatch in lost, abandoned and discarded gear.

Factor	Points for positive response
For fisheries managed by the RFMO for which there is either evidence that ghost fishing is problematic or otherwise there is no knowledge of the degree of ecological risk from ghost fishing, binding measures to mitigate ghost fishing are in place for at least one but <50% of these fisheries.	1
For managed fisheries for which there is either evidence that ghost fishing is problematic or otherwise there is no knowledge of the degree of ecological risk from ghost fishing, binding measures to mitigate ghost fishing are in place for ≥50% but <75% of these fisheries.	2
For managed fisheries for which there is either evidence that ghost fishing is problematic or otherwise there is no knowledge of the degree of ecological risk from ghost fishing, binding measures to mitigate ghost fishing are in place for ≥75% of these fisheries.	3
Rigorous scientific assessments have been conducted and findings strongly support that there are no adverse ecological effects from bycatch in lost, abandoned, or discarded derelict fishing gear in all of the fisheries managed by the RFMO, and/or there is information that supports that ghost fishing is very unlikely to be a problem in these fisheries, based on information on these gear types from other regions.	Criterion is excluded from this RFMO's assessment
At least one but <50% of binding measures to mitigate ghost fishing include measurable performance standards.	1
≥50% but <75% of binding measures to mitigate ghost fishing include measurable performance standards.	2
≥75% of binding measures to mitigate ghost fishing include measurable performance standards.	3
Of binding ghost fishing mitigation measures that contain quantitative performance standards, at least one measure but <50% of the measures have been assessed for efficacy.	1
Of binding ghost fishing mitigation measures that contain quantitative performance standards, ≥50% but <75% of the measures have been assessed for efficacy.	2
Of binding ghost fishing mitigation measures that contain quantitative performance standards, ≥75% of the measures have been assessed for efficacy.	3
For all binding ghost fishing mitigation measures that have been determined to be lacking in effectiveness (either through assessment against measurable performance standards stated in the measure or otherwise through other scientifically rigorous assessment), steps have been taken or are in progress to improve efficacy.	2
There is no provision that allows RFMO Members to opt out of binding measures.	3

Information collected to assess RFMOs against this criterion was:

- Have studies been conducted that determined whether or not problematic ghost fishing occurs in fisheries managed by the RFMO? In which fisheries managed by

the RFMO has problematic ghost fishing been determined to occur, not occur, or otherwise there is no knowledge of the degree of ecological risk from ghost fishing?

- For fisheries managed by the RFMO that have not undergone assessment for problematic ghost fishing, is there information available that problematic ghost fishing in these gear types is documented to occur in other regions, and might also occur in the fisheries managed by this RFMO? Conversely, is there information that supports that ghost fishing is very unlikely to be a problem based on information on these gear types from other regions?
- Summarize active legally binding conservation and management measures related to lost and abandoned derelict fishing gear and ghost fishing, and identify any quantitative performance standards included in each measure (Table 10).
- For what proportion of fisheries where ghost fishing is documented to be problematic or otherwise are data deficient and ghost fishing is likely to be a problem based on information on these gear types from other regions, have binding measures been adopted to mitigate ghost fishing?
- Of binding measures that contain quantitative performance standards, what proportion has been assessed for efficacy?
- For what proportion of the binding measures that have been determined to be lacking in effectiveness (either through assessment against measurable performance standards stated in the measure or otherwise through other scientifically rigorous assessment) have steps been taken or are in progress to improve efficacy?
- Does the RFMO allow Member States to opt out of binding conservation and management measures?

Table 10. Template table format to identify active RFMO legally binding conservation and management measures related to mitigating bycatch in lost, abandoned and discarded derelict fishing gear, identify any performance standards and assess if these are quantitative and measureable or not, describe data requirements for performance assessment, and identify requirements for surveillance.

Measure	Stipulated Performance Standards, Measurable or Subjective	Data Collection Needed for Implementation	Minimum surveillance resources necessary (a) dockside inspection, (b) at-sea inspection, (c) VMS, (d) onboard observers, (e) vessel list, (f) other (specify)

2.4.3. Criterion 4C. Conservation and Management Measures to Mitigate Problematic Pollution from the Discharge of Catch, Offal and Spent Bait During Fishing Operations at Sea

Table 11 is used to assess RFMOs for the adequacy of binding measures to mitigate problematic pollution resulting from discharges of discarded catch, offal from processed catch, and spent bait at sea (FAO, 1995 [Article 7.2.2g]; Caddy, 1996; Garcia, 2000; United Nations, 2007).

This sub-criterion is not intended to consider potential adverse ecological effects from discards made at port, but is limited to considering pollution effects from discarding during fishing operations at sea. A maximum of 14 points is possible for assessment against Criterion 4C.

Table 11. Criterion 4C. Conservation and management measures to mitigate problematic pollution from the discharge of catch, offal and spent bait during fishing operations at sea**.**

Factor	Points for positive response
For managed fisheries for which there is either evidence of adverse pollution effects from the discharge of discarded catch, offal from processed catch, and spent bait, or otherwise it is hypothesized that these fisheries might result in problematic pollution effects because fishing grounds occur in areas where adverse pollution effects are likely to result from discharges, and/or discharges are spatially concentrated, binding measures to mitigate pollution are in place for at least one but <50% of these fisheries.	1
For managed fisheries for which there is either evidence of adverse pollution effects from the discharge of discarded catch, offal from processed catch, and spent bait, or otherwise it is hypothesized that these fisheries might result in problematic pollution effects because fishing grounds occur in areas where adverse pollution effects are likely to result from discharges, and/or discharges are spatially concentrated, binding measures to mitigate pollution are in place for ≥50% but <75% of these fisheries.	2
For managed fisheries for which there is either evidence of adverse pollution effects from the discharge of discarded catch, offal from processed catch, and spent bait, or otherwise it is hypothesized that these fisheries might result in problematic pollution effects because fishing grounds occur in areas where adverse pollution effects are likely to result from discharges, and/or discharges are spatially concentrated, binding measures to mitigate pollution are in place for ≥75% of these fisheries.	3
Rigorous scientific assessments have been conducted and findings strongly support that there are no adverse pollution effects from discharges of discarded catch, offal from processed catch, and spent bait occurring in all of the fisheries managed by the RFMO for which there are no binding conservation and management measures to mitigate pollution effects, and/or fishing grounds do not occur in areas where adverse pollution effects are likely to result from discharges, and/or the fisheries are understood to have nominal levels of discharges that are not spatially concentrated but instead are disbursed over broad areas.	Criterion is excluded from this RFMO's assessment
At least one but <50% of binding measures to mitigate problematic pollution from discharges include measurable performance standards.	1
≥50% but <75% of binding measures to mitigate problematic pollution from	2

discharges include measurable performance standards.	
≥75% of binding measures to mitigate problematic pollution from discharges include measurable performance standards.	3
Of binding discharge pollution mitigation measures that contain quantitative performance standards, at least one measure but <50% of the measures have been assessed for efficacy.	1
Of binding discharge pollution mitigation measures that contain quantitative performance standards, ≥50% but <75% of the measures have been assessed for efficacy.	2
Of binding discharge pollution mitigation measures that contain quantitative performance standards, ≥75% of the measures have been assessed for efficacy.	3
For all binding discharge pollution mitigation measures that have been determined to be lacking in effectiveness (either through assessment against measurable performance standards stated in the measure or otherwise through other scientifically rigorous assessment), steps have been taken or are in progress to improve efficacy.	2
There is no provision that allows RFMO Members to opt out of binding measures.	3

Information used for assessment:

- Have studies been conducted that determined whether or not problematic pollution results from discharges of discarded catch, offal from processed catch, and spent bait from fisheries managed by the RFMO? Which fisheries managed by the RFMO have been determined to cause or not cause problematic pollution due to these discharges?
- For fisheries managed by the RFMO that have not undergone assessment for adverse pollution from the discharges of discarded catch, offal from processed catch and spent bait, is there information available that documents whether or not the fisheries either: (i) occur in areas where adverse pollution effects from the these discharges are likely to result; (ii) the fisheries are understood to have potentially problematic levels of these discharges; and/or (iii) only nominal discharge levels occur, but they are spatially concentrated?
- Summarize active legally binding conservation and management measures related to pollution from the discharge of discarded catch, offal from processed catch, and spent bait, and identify any quantitative performance standards included in each measure (Table 12).
- For what proportion of fisheries where pollution from discharges is documented to be problematic or otherwise are data deficient and pollution is likely to be a problem (fisheries occur in areas where adverse pollution effects from the discharge of discarded catch, offal from processed catch, and spent bait are likely to result, and the fisheries are understood to discharge more than nominal levels) have binding measures been adopted to mitigate pollution effects from discharges?
- Of binding measures that contain quantitative performance standards, what proportion has been assessed for efficacy?
- For what proportion of the binding measures that have been determined to be lacking in effectiveness (either through assessment against measurable performance standards stated in the measure or otherwise through other scientifically rigorous assessment) have steps been taken or are in progress to improve efficacy?

- Does the RFMO allow Member States to opt out of binding conservation and management measures?

Table 12. Template table format to identify active RFMO legally binding conservation and management measures related to discharge of discarded catch, offal from processed catch, and spent bait, identify any performance standards and assess if these are quantitative and measureable or not, describe data requirements for performance assessment, and identify minimum surveillance resources to determine compliance.

Measure	Stipulated Performance Standards, Measurable or Subjective	Data Collection Needed for Implementation	Minimum surveillance resources necessary (a) dockside inspection, (b) at-sea inspection, (c) VMS, (d) onboard observers, (e) vessel list, (f) other (specify)

2.5. Criterion 5. Surveillance and enforcement

This criterion assesses the adequacy of RFMO measures for surveillance and enforcement of legally binding conservation and management measures on bycatch, including RFMO requirements for member States to (i) employ surveillance activities that enable assessment of compliance with bycatch measure by a Member's fisheries and by the Member; (ii) Members employ enforcement procedures prescribed by the RFMO; (iii) Members impose penalties/sanctions for detected infringements prescribed by the RFMO; (iv) Members report to the RFMO on enforcement activities and conclusions; and (v) the RFMO can impose sanctions against Members and/or non-Members in response to detected violations of binding measures. The criterion further considers (vi) whether RFMO procedures to assess the performance of surveillance and enforcement activities exist and the findings from any assessments of efficacy (FAO, 1995 [Articles 6.10, 7.7.3, 7.7.4, 8.1.4]; Caddy, 1996; Garcia, 2000; Small, 2005; Lodge et al., 2007; United Nations, 2007; NEAFC, 2008; Cullis-Suzuki and Pauly, 2010; Marine Stewardship Council, 2010) (Table 13). A maximum of 20 points is possible for assessment against Criterion 5.

Table 13. Criterion 5. Measures and resources for surveillance and enforcement.

Factor	Points for positive response
At least 1 but ≤25% of requirements of binding measures on bycatch that facilitate surveillance can be assessed for compliance via surveillance methods that the RFMO requires member States to employ.	1
>25% but <50% of requirements of binding measures on bycatch that facilitate surveillance can be assessed for compliance via surveillance methods that the RFMO requires member States to employ.	2
≥50% but <75% of requirements of binding measures on bycatch that facilitate surveillance can be assessed for compliance via surveillance methods that the RFMO requires member States to employ.	3
≥75% of requirements of binding measures on bycatch that facilitate surveillance can be assessed for compliance via surveillance methods that the RFMO requires member States to employ.	4
The RFMO requires parties to report to the RFMO on their enforcement procedures and conclusions.	3
The RFMO requires parties to take specified enforcement procedures when an infraction of a binding conservation and management measure occurs.	3
The RFMO requires parties to impose specified sanctions when an infraction of a binding conservation and management measure occurs.	3
The RFMO has a formal procedure to review and assess the effectiveness of surveillance and enforcement activities and adapt surveillance and enforcement methods if warranted.	3
Summary information on detected infringements of binding measures on bycatch are made available by the RFMO, and resulted in sanctions prescribed by the RFMO for >25% but <50% of detected infringements.	1
Summary information on detected infringements of binding measures on bycatch are made available by the RFMO, and resulted in sanctions prescribed by the RFMO for ≥50% but <75% of detected infringements.	2
Summary information on detected infringements of binding measures on bycatch are made available by the RFMO, and resulted in sanctions	3

prescribed by the RFMO for ≥75% but <100%of detected infringements.	
Summary information on detected infringements of binding measures on bycatch are made available by the RFMO, and resulted in sanctions prescribed by the RFMO for 100%of detected infringements.	4

Information used for assessment:

- Does the RFMO require member States to employ specified surveillance activities? For example, surveillance for compliance with bycatch conservation and management measures might be conducted via aircraft and patrol vessels, dockside inspections, VMS, vessel registers (e.g., positive and negative lists to deter IUU fishing), and observer programmes of some RFMOs (Lodge et al., 2007; Gilman et al., 2008b). Onboard observer coverage is identified as a requisite method for surveillance only when compliance with a measure can be assessed only through analyses of observer programme data.
- What minimum methods permit effective surveillance of the requirements stipulated in binding conservation and management measures on bycatch (record this information in Tables 8, 10, and 12)? For example, measures to support surveillance of lost and discarded fishing gear includes requirements for marking fishing gear, employing internationally agreed systems, so that the owner of derelict gear can be identified (Caddy, 1996). For the surveillance methods required to determine compliance with these requirements, which of these methods does the RFMO require vs. not require member States to employ?
- Are there RFMO requirements for member States to (i) take specified enforcement/prosecution procedures, (ii) impose specified penalties/sanctions against vessels that have been found to have committed a violation of a conservation and management measures, and (iii) report to the RFMO on these enforcement procedures and conclusions? Enforcement actions are likely to vary depending on the seriousness of the violation, and might include fines, seizure of illegal gear and catch, sequestration of the vessel, suspension or withdrawal of authorization to fish, and reduction or withdrawal of fishing quota. And (iv) can the RFMO impose sanctions against Members and/or non-Members in response to detected violations?
- Does the RFMO have procedures to review the effectiveness of surveillance and enforcement activities, and recommend actions related to compliance with binding measures on a regular basis? Has the RFMO established a compliance committee with a mandate that includes evaluating compliance performance, and assessing efficacy of measures on surveillance and enforcement?
- Is there evidence that detected infringements of the RFMO's legally binding bycatch and discards measures regularly result in sanctions? How many violations of bycatch and discards measures are documented by the RFMO, and of these, how many resulted in the assessment of sanctions as required in RFMO measures?

Appendix 14. Western and Central Pacific Fisheries Commission (WCPFC)

Excerpt from:

Gilman, E., Passfield, K., Nakamura, K. 2012 (In Prep.). *Performance Assessment of Regional Fisheries Management Organization Bycatch Governance in Marine Capture Fisheries*. International Union for the Conservation of Nature, Commission on Ecosystem Management and Oceania Regional Office, Gland, Switzerland and Suva, Fiji. ISBN: 978-2-8317-1361-8.

SUMMARY	
Criteria Suite Scores	
Overall	42 (±7 SD of the mean)%[1]
Criterion 1: Data collection	62%[2]
Criterion 1A. Regional Observer Programme Bycatch Data Collection Protocols	96%
Criterion 1B. Regional Observer Coverage Rates	36%
Criterion 1C. Regional Observer Programme Dataset Quality	55%
Criterion 2. Open access to regional observer programme datasets	47%
Criterion 3. Ecological risk assessment	25%
Criterion 4. Conservation and management measures	30%[2]
Criterion 4A. Conservation and Management Measures to Mitigate Bycatch	39%
Criterion 4B. Conservation and Management Measures to Govern Lost and Abandoned Gear	29%
Criterion 4C. Conservation and Management Measures to Govern Problematic Localized Pollution from the Discharge of Catch, Offal and Spent Bait During Fishing Operations at Sea	21%
Criterion 5. Surveillance and enforcement	45%

[1] Mean of five criteria scores
[2] Mean of sub-criteria scores

HISTORY

The Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean, which entered into force on 19 June 2004, established the Western and Central Pacific Fisheries Commission (WCPFC) (Lugten, 2010; WCPFC, 2010b). The Convention was concluded after seven negotiation sessions over six years, which began in 1994 (WCPFC, 2010b. A series of Preparatory Conferences occurred during the period between the conclusion of the Convention in 2000 and its entry into force (WCPFC, 2010b, 2011b).

MEMBERSHIP

The following States, political and economic union of States, and fishing entity are WCPFC members: Australia, China, Canada, Cook Islands, European Union, Federated States of Micronesia, Fiji, France, Japan, Kiribati, Korea, Republic of Marshall Islands, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Chinese Taipei, Tonga, Tuvalu, United States of America, and Vanuatu (WCPFC, 2011b). The following are WCPFC Participating Territories: American Samoa, Commonwealth of the Northern

Mariana Islands, French Polynesia, Guam, New Caledonia, Tokelau, and Wallis and Futuna. The following States are WCPFC Cooperating Non-members: Belize, Ecuador, El Salvador, Indonesia, Mexico, Senegal, Vietnam, Panama, and Thailand (WCPFC, 2011b). Commission Members, Cooperating non-Members and participating Territories are collectively referred to in WCPFC materials as CCMs.

MANAGED SPECIES AND FISHERIES

The convention applies to all species of highly migratory fish stocks (defined as all fish stocks of the species listed in Annex I of the 1982 Law of the Sea Convention occurring in the convention area and such other species of fish as the WCPFC may determine) within the Convention Area, except sauries (United Nations, 1982; Lugten, 2010). These are:

- Albacore tuna: *Thunnus alalunga*.
- Bluefin tuna: *Thunnus thynnus*.
- Bigeye tuna: *Thunnus obesus*.
- Skipjack tuna: *Katsuwonus pelamis*.
- Yellowfin tuna: *Thunnus albacares.*
- Blackfin tuna: *Thunnus atlanticus*.
- Little tuna: *Euthynnus alletteratus*; *Euthynnus affinis*.
- Southern bluefin tuna: *Thunnus maccoyii*.
- Frigate mackerel: *Auxis thazard*; *Auxis rochei*.
- Pomfrets: Family *Bramidae*.
- Marlins: *Tetrapturus angustirostris; Tetrapturus belone; Tetrapturus pfluegeri; Tetrapturus albidus; Tetrapturus audax; Tetrapturus georgei; Makaira mazara; Makaira indica; Makaira nigricans.*
- Sail-fishes: *Istiophorus platypterus*; *Istiophorus albicans*.
- Swordfish: *Xiphias gladius*.
- Dolphin: *Coryphaena hippurus*; *Coryphaena equiselis*.
- Oceanic sharks: *Hexanchus griseus*; *Cetorhinus maximus*; Family *Alopiidae*; *Rhincodon typus*; Family *Carcharhinidae*; Family *Sphyrnidae*; Family *Isurida*.
- Cetaceans: Family *Physeteridae*; Family *Balaenopteridae*; Family *Balaenidae*; Family *Eschrichtiidae*; Family *Monodontidae*; Family *Ziphiidae*; Family *Delphinidae*.

Main fisheries managed by WCPFC, listed in order of weight of tunas captured, are: (i) purse seine, (ii) pelagic longline, (iii) pole and line, (iv) troll, and (v) other small-scale tuna fishing methods, including artisanal methods (e.g., handline, small traps, set nets, coastal gillnets, ring nets, small seiners) (Miyake et al., 2010; WCPFC, 2010b, 2011b).

AREA OF APPLICATION

The WCPFC Convention Area, shown in Fig. A1.14-1, is defined in the Convention Article 3 (WCPFC, 2000). The Convention Area comprises all waters of the Pacific Ocean bounded to the south and to the east by a line drawn from the south coast of Australia due south along the 141°E meridian to its intersection with the 55°S parallel; thence due east along the 55°S parallel to its intersection with the 150°E meridian; thence due south along the 150°E meridian to its intersection with the 60°S parallel; thence due east along the 60°S parallel to its intersection with the 130°W meridian; thence due north along the 130°W meridian to its intersection with the 4°S parallel; thence due west along the 4°S parallel to its intersection with the 150°W meridian; thence due north along the 150°W meridian (WCPFC, 2000). A portion of the WCPFC

Convention Area overlaps with that of IATTC (bounded by 150 degrees longitude W, 130 degrees longitude W, 4 degrees latitude S, and 50 degrees latitude S); vessels of IATTC members that are not also WCPFC members are not subject to WCPFC measures when fishing in this overlap zone, and vice versa (IATTC and WCPFC, 2011).

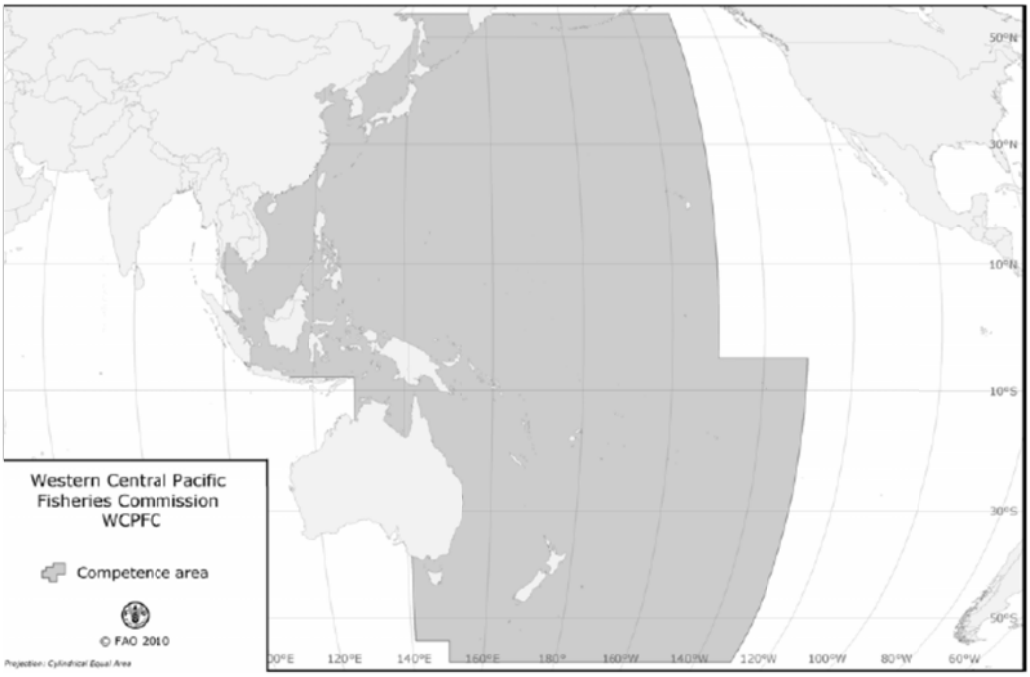

Fig. A1.14-1. WCPFC convention area (Lugten, 2010; authorized for reproduction by FAO).

INFORMATION TO ASSESS PERFORMANCE AGAINST THE CRITERIA SUITE FOR GOVERNANCE OF BYCATCH AND DISCARDS

Criterion 1A. Bycatch Data Collection Protocols for Regionally Observed Fisheries
Score: 24 of 25 possible points, 96%.

A maximum of 25 points are attainable for assessment of WCPFC against sub-criterion 1A as this includes longline and other hook-and-line fisheries in the regional observer programme.

Table A1.14-1 provides details on the assessment outcome for criterion 1A.

Table A1.14-1. Assessment of WCPFC regional observer programme data collection protocols for bycatch, including discards, and performance of conservation and management measures.

Factor	Points for positive response
Non-target fish and non-fish species are included in the RFMO's mandate.	1
Data for ≥75% of documented vulnerable bycatch species are intended to be collected in fisheries that have regional observer coverage.	3
Information on the number and/or weight of at least 1 of documented vulnerable bycatch species is intended to be routinely collected for the regional observer programme.	1
≥75% of the items of information needed to assess performance standards	3

of relevant binding conservation and management measures are intended to be collected by regional observers.	
Information on fishing effort is intended to be routinely collected for fisheries with regional observer coverage.	1
Date and location of fishing operations are intended to be routinely captured for the regional observer programme.	1
Information on whether catch is retained or discarded is intended to be routinely captured by regional observers for ≥75% of documented vulnerable bycatch species.	3
Data records are intended to be to the species-level for ≥75% of documented vulnerable bycatch species in fisheries with regional observer coverage.	3
Information on length or other proxy for age class is intended to be collected for ≥50% of identified vulnerable bycatch species.	3
Information on the disposition of discards (e.g., alive vs. dead, and possibly degree of injury) is intended to be collected for ≥75% of identified vulnerable bycatch species.	3
For hook-and-line fisheries included in the regional observer programme, information on gear attached to individuals of vulnerable species that are discarded alive is intended to be collected for 57% (>50% but <75%) of identified vulnerable bycatch species.	2

Information used for assessment:

- Are non-target fish and non-fish species included in the RFMO's mandate?

  Yes, under the Convention, Commission members are obligated to (i) "assess the impacts of fishing, other human activities and environmental factors on target stocks, non-target species, and species belonging to the same ecosystem or dependent upon or associated with the target stocks," (ii) "adopt measures to minimize waste, discards, catch by lost or abandoned gear, pollution originating from fishing vessels, catch of non-target species, both fish and non-fish species …and impacts on associated or dependent species," and (iii) "protect biodiversity in the marine environment" (WCPFC, 2000 [Article 5 (d-f)]).

- In fisheries required to have regional observer coverage, for what proportion do the RFMO's data collection protocols call for catch data (i.e., data on both retained and discarded non-target species) to be routinely collected for known shark, sea turtle, seabird, marine mammal, or other documented vulnerable bycatch species?

  Data are to be collected by regional observers for all retained and discarded target and bycatch species in WCPO pelagic longline and purse seine fisheries (SPC/FFA, 2009; WCPFC, No Date).

  Of the WCPFC-managed fisheries, regional observer coverage is required in purse seine and longline fisheries; troll and pole-and-line fisheries are exempt from participation in the regional observer programme (WCPFC, 2007c). There is currently some level of regional observer coverage in pelagic longline and purse seine fisheries, and no regional coverage of other gear types (SPC, 2009; WCPFC, 2011c).

  The *WCPFC ROP Minimum Standard Data Fields & Instructions* identifies minimum data standard fields that regional observers are to capture (WCPFC, No Date). This form

calls for regional observers to record the FAO species code for all captured fish, sea turtles, seabirds and marine mammals (WCPFC, No Date).

Furthermore, WCPFC Form Gen-2, which is a part of the longline, purse seine, pole and line, and troll observer workbooks, includes data fields for the following species of special interest (SPC/FFA, 2009):

- Loggerhead turtle
- Green Turtle
- Eastern Pacific Green Turtle
- Leatherback Turtle
- Hawksbill Turtle
- Flatback Turtle
- Olive Ridley Turtle
- All turtles
- Common Dolphin
- Risso's Dolphin
- Bottlenose Dolphin
- Spinner Dolphin
- Striped Dolphins
- Rough toothed dolphins
- Spotted Dolphins
- All dolphins
- False Killer Whale
- Short-Finned Pilot Whale
- Pygmy Killer Whale
- Melon Headed Whale
- Sei Whale
- Humpbacked whale
- Brydes Whale
- Toothed Whales
- Baleen Whales
- All marine mammals
- Whale Shark
- All birds.

- Does the RFMO's data collection protocols by regional observers call for information on the number and/or weight of documented vulnerable bycatch species to be routinely collected?

  Observers are tasked with recording the number of caught organisms and lengths for individual organisms in both longline and purse seine fisheries using recommended measurements (WCPFC, No Date). And, WCPFC observers Work Book form Gen-2 includes data fields for length, to be recorded for each specimen. Catch is to be sampled randomly to avoid bias by sex, species, size, condition, etc. (SPC/FFA, 2009). Observer forms do not include capturing weight of the catch in purse seine and longline fisheries (WCPFC, No Date), however, weights can be estimated based on length data for most marine species.

- Identify minimum data requirements to assess the performance of legally binding conservation and management measures (described in Criterion 4, recorded in Tables

A1.14-7, A1.14-9, and A1.14-11)

The information has been added to Tables A1.14-7, 9, and 11. Data requirements for the assessment of these binding measures are:

- For all WCPFC-managed fisheries, location of fishing effort;
- For longline vessels, presence onboard and design of bird mitigation equipment;
- For longline and purse seine vessels, presence onboard of sea turtle handling and release equipment;
- Longline fishing gear terminal tackle design, including hook and bait type;
- Longline vessel fishing methods in areas where bird mitigation measures are required (e.g., deck position of mainline and branchline deployment, time of day of setting, deployment of terminal tackle through underwater setting device);
- For all WCPFC-managed fisheries not targeting sharks, shark handling and release methods and disposition of discarded sharks (to monitor compliance with the requirement for releasing sharks alive that are caught incidentally and are not used for food or other purposes);
- For all WCPFC-managed fisheries, methods employed for handling and releasing caught turtles;
- For all WCPFC-managed fisheries, weight of landed shark fins and weight of remainder of shark carcasses;
- For purse seine vessels, weight of bigeye and yellowfin tuna landings and discards by purse seine vessel Flag State, set type, set date, and set location;
- Purse seine set type and date for sets made in PNA Members' EEZs and on the high seas in the area bounded by 20^0N and 20^0S;
- Purse seine days fished in EEZ's of PNA members;
- Real-time locations of all anchored and drifting FADs;
- Record of tuna discards by species by purse seine vessels operating within the area bounded by 20ºN and 20ºS (to monitor compliance with bigeye, yellowfin and skipjack tuna full retention requirement);
- Weight of bigeye and yellowfin tuna landings and discards by purse seine vessels operating north of 20ºN and south of 20ºS;
- Weight of bigeye and yellowfin tuna landings and discards by non-artisanal troll, pole-and-line, and other non-artisanal fisheries;
- Location of data buoys;
- Catch levels of North Pacific striped marlin north of the equator;
- Catch levels of swordfish south of 20^oS;
- Design of drift gillnet gear in use and/or stowed onboard;
- List of vessels authorized to fish in the Convention Area.

Information on the location of vessels during fishing operations is needed for all WCPFC-managed fisheries in order to document the location in the Convention Area of (i) swordfish catch as being south or north of 20^oS., north Pacific striped marlin catch as being north or south of the equator, (iii) fishing with large scale drift gillnets as being on the high seas or in EEZs, (iv) sets of all gear types in relation to the location of data buoys, (v) purse seine sets in relation to nearest FAD (during temporal FAD closures) and in relation to closed high seas pockets, and (v) location of longline sets to determine if the location is within the areas where seabird bycatch mitigation methods are required (Table A1.14-7).

- Identify gaps in information intended to be collected by regional observers that is required to assess the performance of bycatch conservation and management measures. What percent of required minimum information is not intended to be routinely collected by in the regional observer programme according to the RFMO's data collection protocols?

  Provided that observers collect all data per the *WCPFC ROP Minimum Standard Data Fields & Instructions* and Form Gen 2 (WCPFC, No Date; SPC/FFA, 2009), of the 20 information items listed in the previous bullet, the following 5 are not routinely captured by regional onboard observers in fisheries where regional onboard observer coverage exists:
  - For longline and purse seine vessels, presence onboard of sea turtle handling and release equipment;
  - Longline vessel fishing methods in areas where bird mitigation measures are required (e.g., deck position of mainline and branchline deployment, deployment of terminal tackle through underwater setting device, offal discharge/retention practices);
  - Methods employed for releasing caught turtles. SPC/FFA (2009) includes a field "describe onboard handling", but does not call for recording information on discard methods;
  - Real-time locations of all anchored and drifting FADs;
  - Design of drift gillnet gear in use and/or stowed onboard.

  Weights of discards by species would be estimated from observer-collected length measurements. It is assumed that the locations of data buoys are monitored by organizations that manage them, and that domestic fishery management authorities and WCPFC could there determine the distance of set locations from data buoys.

  While outside the scope of this portion of the performance assessment, gaps in monitoring occurs for all data collection methods required to be applied to all WCPFC-managed fisheries. This is because regional observer coverage occurs only on longline and purse seine vessels, as there is no regional observer coverage in other WCPFC-managed fisheries, including troll, pole-and-line, and 'other' fisheries (bullet three under criterion 1B) (SPC, 2009).

- Does the information intended to be collected by onboard observers per the RFMO's data collection protocols meet bycatch data collection requirements that are explicitly stated in binding conservation and management measures (described in Criterion 4)?

  Yes, all explicitly required regional observer data collection methods called for in CMMs are captured in WCPFC observer data collection forms. For example, during the purse seine FAD time/area closure, CCM 2008-01 requires observers from the Regional Observer Program to monitor vessel deployment or servicing of FADs or associated electronic devices, and fishing on schools in association with FADs (WCPFC, 2008a). Observer data collection protocols call for recording information on purse seine set type (SPC/FFA, 2009; WCPFC, No Date, 2009i), and FAD activity, including FAD servicing (WCPFC, 2009i).

- Does the RFMO's protocol for observer data collection call for the routine collection of information on fishing effort?

  Yes, observer data collection protocols call for capturing fishing effort (WCPFC, No Date).

- For how many of documented vulnerable bycatch species (compiled under Criteria 3 and 4) is information on whether the catch was retained vs. discarded intended to be routinely by observers of the regional observer programme?

  Observers are to record whether each individual caught organism is retained vs. discarded (WCPFC, No Date).

- Does the RFMO's data collection protocols for the regional observer programme call for information on the date and location of fishing operations to be routinely captured?

  Yes, observers are to record the date and time of the start and end of sets, and latitude and longitude of each fishing activity (setting, hauling) (WCPFC, No Date).

- For what proportion of bycatch species of vulnerable species groups (identified under Criteria 3 and 4) are regional observers intended to have record be at the species level?

  All organisms are to be recorded to the species level (WCPFC, No Date). However, where the observer may not be able to identify down to species level, Form Gen 2 allows for listing 'species of special interest' by species groups, e.g., all toothed whales, birds (SPC/FFA, 2009).

- For what proportion of identified vulnerable species groups is information on length intended to be collected under the regional observer programme? If other information is intended to be routinely collected by regional observers that provides a proxy for age class, identify the measurement method.

  Observers are to record lengths for all species of catch (WCPFC, No Date). Form Gen 2 also contains a field for length measurement for each observed organism for species of special interest (SPC/FFA, 2009).

- For what proportion of vulnerable species groups (identified under Criteria 3 and 4) is information on the disposition of individuals that are discarded (alive vs. dead) intended to be routinely collected under the regional observer programme?

  Observers are to record the condition of discards, as well as the condition when caught, in longline fisheries (WCPFC, No Date). In purse seine fisheries, regional observers are tasked to record the condition of 'species of special interest' upon landing on deck and condition of discards, but not for other species (WCPFC, No Date). Similarly, Form Gen 2 has a data field for describing the condition (alive, dead, unlikely to survive, etc) of all discarded catch of species of special interest (SPC/FFA, 2009).

- For hook-and-line gear (longline, troll, pole-and-line, handline, etc.), for what proportion of vulnerable species groups (identified under Criteria 3 and 4) is information on fishing gear remaining attached to individual organisms that are discarded alive intended to be routinely collected under the regional observer programme (e.g., hooked and location of hooking, entangled, leader attached, weights attached, length of fishing line attached)?

  Form Gen 2 has a data field for codes to describe the condition (hooked, tangled, etc.) of species of special interest (turtles, seabirds, marine mammals, whale sharks)

when landed on deck and when discarded (SPC/FFA, 2009). The *WCPFC ROP Minimum Standard Data Fields & Instructions* does not call for the capture of information on gear remaining attached to discarded organisms (WCPFC, No Date).

As summarized in bullet 4 under criterion 4A, the following are identified or potential bycatch problems in WCPO longline and purse seine fisheries:

- Purse seine: Sharks, juvenile tunas, other unmarketable species and sizes of fish, sea turtles, cetaceans;
- Pelagic longline: Elasmobranchs, seabirds, sea turtles, cetaceans, juvenile swordfish, other species of non-targeted fish.

Of these, information on terminal tackle attached to discarded organisms is to be collected for sharks, turtles, cetaceans, and seabirds, but not for tunas, swordfish and other fish species.

Criterion 1B. Regional Observer Coverage Rates
Score: 4 of 11 possible points, 36%.

Table A1.14-2A provides details on the assessment outcome for criterion 1B.

Table A1.14-2A. Assessment of WCPFC onboard observer coverage rates to monitor discards and retained and transshipped bycatch.

Factor	Points for positive response
At least one but <25% of managed fisheries (fisheries covered by the RFMO) have ≥5% regional onboard observer coverage. Only purse seine fisheries have ≥5% regional onboard observer coverage.	1
The RFMO's scientific body has recommended target onboard observer coverage rates for each managed fishery, and the regional onboard observer coverage rates meet scientific advice for ≥50% but <75% of managed fisheries. Required 100% onboard observer coverage rates for purse seine vessels operating between 20oN and 20oS since 1 Jan. 2010 is close to compliance. WCPFC has not been able to assess compliance with the requirement for 100% observer coverage of longline transshipments at sea, which commenced in 2011, due to a lack of capacity to track the presence of carrier vessel occurrence in the Convention Area, which intend to transship at sea.	3
There is no required or routine international exchange of observers in the regional onboard observer programme.	0

Information used for assessment:

- What recommendations on observer coverage rates have been made by the RFMO's scientific body or the Commission for fisheries under the RFMO's mandate?

  Pursuant to CMM 2007-01, by 30 June 2012, CCMs are to provide ≥5% coverage of the effort in each fishery under the jurisdiction of WCPFC (WCPFC, 2007c). The CMM stated that the Northern Committee shall make recommendations to the Commission on the implementation of the Regional Observer Program by fishing vessels fishing for fresh fish north of 20^{o} north, and that the recommended date for

implementation of regional observer coverage of vessels fishing for fresh fish in this area would be no later than 31 December 2014 (i.e., these vessels might not be required to have regional onboard observer coverage until 2015) (WCPFC, 2007c). Furthermore, small vessels, the minimum size of which shall be determined, and troll and pole-and-line skipjack or albacore vessels are exempt from participating in the Regional Observer Programme (WCPFC, 2007c).

Pursuant to CMM 2008-01, as of the FAD seasonal closure in 2009, and from 1 January 2010 onwards, there is to be 100% onboard observer coverage by observers from the Commission's Regional Observer Program of purse seine vessels operating in the area bounded by 20ºN and 20ºS, excluding vessels that operate only in the EEZ of only one coastal State (and not on the high seas or in the EEZ of a second coastal State) (WCPFC, 2008a).

CMM 2009-06 requires 100% Regional Observer Programme coverage of transshipment activities (WCPFC, 2009g).

- Does a regional observer programme exist?

  Yes, the Convention establishes general provisions for a regional observer programme (WCPFC, 2000 [Article 28]); CMM 2006-07 formalized the process to establish the Commission Regional Observer Progam (WCPFC, 2006a); and CMM 2007-01 established the programme (WCPFC, 2007c).

- What are regional onboard observer coverage rates in each fishery managed by the RFMO?

  The Secretariat of the Pacific Community provided summary statistics for 2009 observer coverage rates in WCPO pelagic fisheries as follows: 5.4% in regional purse seine, 0.3% in regional pelagic longline, and 0% in regional troll, pole-and-line, gillnet, drift gillnet, and 'other' fisheries (SPC, 2009).

  Table A1.14-2B summarizes 2010 Regional Observer Programme onboard observer coverage rates of CCM's pelagic longline and purse seine fisheries operating in the WCPFC Convention Area, based on CCM self-reporting in submitted Part 1 reports to the Commission. No information was provided in the Part 1 reports on onboard observer coverage rates of other WCPFC-managed fisheries employing other gear types (WCPFC, 2011c).

  Table A1.14-2B. Regional Observer Program onboard observer coverage rates of WCPFC-managed longline and purse seine fisheries, 2010 (as reported in CCM's Part 1 Reports; WCPFC 2011c).

	2010 Observer Coverage Rate	
Members, Participating Territories and Cooperating Non-Members	**Pelagic longline**	**Purse seine**
Australia	3.6	2.3
Belize	0	NA
Canada	NA	NA
China	Not reported	Not reported

Chinese Taipei	Not reported (25 trips observed)		Not reported (6 trips observed)	
Cook Islands		10	NA	
Ecuador	No Report		No Report	
El Salvador	NA			100
EU	Not reported			89
Fiji	No Report		No Report	
France	No Report		No Report	
French Polynesia		6.5	NA	
FSM		0.2		100
Indonesia		0		0
Japan	Not reported		Not reported	
Kiribati	Not reported		Not reported	
Korea		0		0
Mexico	No Report		No Report	
Nauru	No Report		No Report	
New Caledonia		9	NA	
New Zealand		19		9
Niue	No Report		No Report	
Palau	No Report		No Report	
Philippines	Not reported		Not reported	
PNG	Not reported		20 (foreign access fleet)	
RMI		0		100
Samoa	No Report		No Report	
Senegal	No Report		No Report	
Solomon Islands		1.47		99.53
Tokelau	No Report		No Report	
Tonga	No Report		No Report	
Tuvalu	Not reported		Not reported	
USA	27.4% (HI), 25% (Am Samoa)			100%
Vanuatu	100 (locally based foreign vessels)		100 (locally based foreign vessels)	
Vietnam	Not reported		Not reported	
Wallis and Futuna	No Report		No Report	

- If there have been recommendations for onboard observer coverage rates by the RFMO's scientific body, then for how many of the fisheries managed by the RFMO do current observer coverage rates meet the scientific body's recommendations? Recommended observer coverage rates made by an RFMO scientific body might include a schedule for increasing coverage, such that current coverage rates might not meet the final recommended level, but might meet the rate specified in the recommended schedule for gradual increase. [Recommended coverage rates may reflect rates needed to meet objectives of analyses, taking into account required levels

of accuracy and precision, the rate of bycatch interactions, amount of fishing effort, and distribution of discarded catch (Hall, 1999; McCracken, 2005; Gilman, 2011)].

The recommendations for observer coverage rates of non-purse seine fisheries are not yet in effect. The requirement for 100% onboard observer coverage by observers from the Commission's Regional Observer Program of purse seine vessels operating in the area bounded by 20ºN and 20ºS is currently in effect as of the FAD seasonal closure in 2009, and from 1 January 2010 onwards, as is the requirement for 100% monitoring of longline transshipments at sea, which commenced in 2011 (WCPFC, 2008a).

Available information prevents determining if regional observer coverage rates of purse seine vessels operating in the Convention Area between by 20ºN and 20ºS reached 100% as of 1 January 2010, because data as reported did not enable a determination of whether vessels lacking a regional observer were either not in 20ºN - 20ºS portion of the Convention Area, or were fishing entirely in their own EEZ where a regional observer is not required, however, available information indicates that observer coverage was close to 100% in this area (WCPFC, 2011d). WCPFC's Technical and Compliance Committee reported that, "It is not known if all carrier vessels transshipping at sea are carrying an observer, as it is impossible for the Commission Secretariat to know how many carriers maybe (sic) in the area, and how many of these intend to transship at sea," (WCPFC, 2011d).

- For each fishery under the RFMO's mandate, are international onboard observers assigned through a regional programme, or are they assigned by national fisheries management authorities?

  CCMs are required to source observers for their vessels as determined by the Commission (WCPFC, 2007c). Observers may be sourced from national programmes and sub-regional programmes that are approved as observer providers to the Regional Observer Programme, and vessels may carry observers of their own nationality if the observers have been approved by the WCPFC Secretariat (WCPFC, 2007c).

Criterion 1C. Dataset Quality
Score: 6 of 11 possible points, 55%.

Table A1.14-3 provides details on the assessment outcome for criterion 1C.

Table A1.14-3. Assessment of WCPFC observer program data quality.

Factor	Points for positive response
A regional observer programme database with records of bycatch exists.	1
Either (i) the regional observer programme database is comprised of records pooled from observed national fisheries; or (ii) individual national observer programme datasets reported to the RFMO are in a standardized format that permits pooling.	1
The regional observer programme dataset is <5 years long.	1
It is assumed that ≥90% of Members reported regional observer data in 2010. All CCMs with regional observer coverage of purse seine trips in	3

2010 reported data to the WCPFC data service provider, although data from 33% of observed trips had yet to be reported. Regional observer coverage of longline trips was <1% in 2010, and CCMs reported "very little" trip data in that year; however, it is not known how many CCMs, if any, with regional observer coverage of longline trips, did not report the data.	

Information used for assessment:

- Does a regional observer programme database exist? If yes, does the database include information on the capture of bycatch?

  Yes. The Secretariat of the Pacific Community (SPC) Oceanic Fisheries Program provides database management services under contract to WCPFC, and is the custodian of regional observer program datasets submitted by WCPFC CCMs (Secretariat of the Pacific Community, 2011). Because the Regional Observer Program data collection protocols include the collection of information on bycatch, including discarded bycatch, from purse seine, longline and pole-and-line fisheries (WCPFC, No Date; SPC/FFA, 2009), it is assumed that the regional observer programme database includes fields for these records.

- If there is a regional observer programme, is there a dataset owned or managed by the RFMO Secretariat comprised of records pooled from observed national fisheries (e.g., the RFMO manages an observer programme, placing international observers on Parties' vessels, from which data are reported directly to the RFMO, or Parties submit national observer programme datasets to the RFMO, where they are pooled into a single regional database)? If individual national observer programme datasets are not pooled into a single regional dataset, then are national datasets submitted to the RFMO in standardized formats prescribed by the RFMO that enable pooling (e.g., are units of effort and taxonomic levels and names of catch consistent between the datasets)?

  SPC pools/integrates the individual datasets submitted as part of the Regional Observer Program (Secretariat of the Pacific Community, 2011).

- What is the length in years of the regional observer programme dataset?

  4 years. The WCPFC Regional Observer Program was initiated in 2007 (WCPFC, 2007c).

- Have observer data been collected evenly across seasons for observed fisheries? Are there gaps in seasonal observer coverage of managed fisheries?

  Purse seine regional observer coverage is required to be 100% between 20^{o}N and 20^{o}S, and thus achieves even seasonal distribution in this portion of the Convention Area. Observer coverage rates on purse seine vessels operating outside of this area, and on longline vessels, are low and likely do not obtain even temporal distribution.

  Historically, observer coverage held by SPC has not been distributed evenly spatially, temporally (by year or season) or by fleet (Gilman, 2006); given that Regional Observer Program coverage of WCPFC longline fisheries remains <1%, it is assumed that the historical uneven spatial and temporal coverage continues.

- Have observer data been collected evenly across fishing grounds for each observed fishery? Are there gaps in spatial observer coverage of managed fisheries?

  Purse seine vessels operating between 20°N and 20°S are required to have 100% onboard observer coverage; purse seine coverage outside of this area has a target coverage rate of 5%. Required minimum observer coverage rates under the Regional Observer Program for longline vessels fishing for fresh fish north of 20° north have yet to be established.

  Furthermore, the WCPFC Regional Observer Programme is intended to provide coverage of vessels fishing in the Convention Area that either fish (i) on the high seas, (ii) on the high seas plus in the EEZ of one or more coastal State, or (iii) in the EEZs of two or more coastal States, but not coverage of vessels operating only in the EEZ of one coastal State (WCPFC, 2007c). Thus, in concept, vessels/fisheries under WCPFC's mandate that operate in the Convention Area but only in the EEZ of one costal State may not have regional observer coverage.

- Which countries with fisheries under the RFMO's mandate are not Members or Cooperating Non-Members?

  Democratic People's Republic of Korea (DPRK) has applied to become a Cooperating Non-Member but the Commission has not approve the application (WCPFC, 2011a).

- For each fishery that is a part of the regional observer programme, are certain vessel classes exempt from carrying onboard observers, or are Members not required to provide data on certain vessel classes to the RFMO?

  Small vessels, the minimum size of which has yet to be determined, are exempt from participating in the Regional Observer Program (WCPFC, 2007c).

- Which Member States do not routinely report required observer data on bycatch to the RFMO (FAO, 1995 [Articles 8.4.3, 12.4]; Small, 2005)? More specifically, either in each of the last three years, or for the full duration of the regional observer programme, whichever period is shorter, how many Members have not submitted regional observer data to the RFMO?

  Regional observer providers report observer data directly to the Secretariat of the Pacific Community (SPC), the data service provider for WCPFC, and SPC has reported that there is a backlog in some regional observer programme observer data being submitted to SPC for data entry (WCPFC, 2011f). There were 23 programmes authorized by WCPFC to be WCPFC Regional Observer Programme Observer Providers as of 16 October 2011, which are national fishery management authorities and the Pacific Islands Forum Fisheries Agency (WCPFC, 2011f). For purse seine trips observed by a regional observer in 2010, SPC has yet to receive 33% (581 of a total of 1751 observed trips) of data from observed trips (WCPFC, 2011f). Of the eight national observer programmes that provided the regional observer coverage of the purse seine trips, all had reported a portion of trip data to SPC (WCPFC, 2011f). Similar information was not reported for longline observed trips, however, the 5% regional observer coverage of longline effort takes effect on 30 June 2012, and WCPFC reported that in 2010 the observer coverage rate was <1%, and there was "very little" longline data reported to SPC (WCPFC, 2011f). Pursuant to CMM 2007-

01, by 30 June 2012, CCMs are to also provide ≥5% coverage of the effort in all other WCPFC-managed fisheries (WCPFC, 2007c), however, WCPFC (2011f) did not identify CCM's reporting regional observer data from non-purse seine nor non-longline fisheries in 2010, likely due to low or no regional observer coverage of these fisheries.

Given that standardized forms have been developed to provide minimum data collection protocols by regional observers, it is assumed that all CCMs participating in the WCPFC Regional Observer Program report data records on bycatch. However, datasets containing neither primary nor amalgamated observer records are publically available. WCPFC fishery-dependent datasets that are publically available do not identify the method for the collection of the available amalgamated records (i.e., from onboard observers, dockside monitoring, logbooks, research surveys, VMS, etc., or pooled from combined monitoring methods).

Criterion 2. Open access to bycatch data
Score: 7 of 15 possible points, 47%.

Table A1.14-4 provides details on the assessment outcome for criterion 2.

Table A1.14-4. Assessment of WCPFC provision of open access to regional bycatch and discards datasets.

Factor	Points for positive response
There is a regional observer programme dataset containing records of bycatch, and datasets of amalgamated and not primary data records are open access and records are amalgamated by ≤5 degree cells.	2
Primary or amalgamated observer data for ≥75% of fisheries included in the regional observer programme are open access.	5

Information used for assessment:

- Does a regional observer programme dataset containing records on bycatch exist?

  Yes, SPC pools and manages the WCPFC regional observer programme dataset. The regional observer program dataset includes records of catch and retention/discarding of bycatch.

- What confidentiality rules have been adopted on access to data on bycatch and discards that the RFMO owns or holds as a custodian?

  The WCPFC Regional Observer Programme is mandated to ensure the confidentiality of non-aggregated data and other information deemed by the Commission to be of a confidential nature, and the release of data from the programme is to be conducted in accordance with the Commission's *Rules and Procedures for Access to, and Dissemination of, Data Compiled by the Commission* (WCPFC, 2007c,d). According to these Rules of Procedures, operational-level catch effort data, which are data records collected both via logbooks and observers, are categorized as high risk (WCPFC, 2007d).

- Are primary or amalgamated data available as an open public resource?

  Only amalgamated data are publically available (WCPFC, 2011e). The publically available dataset pools data records from logbook and observer monitoring, and it is not possible to determine the source of an individual record.

  It may be possible for researcher to obtain observer data by submitting a WCPFC Data Request Form and Confidentiality Agreement. If WCPFC provided the confidential dataset, the data would be aggregated by at least 5x5 for data collected from longline fisheries and 1x1 for data collected from purse seine fisheries, and the dataset would be processed to remove records as necessary in order to comply with a "minimum three vessel" rule, such that data will be released only for those strata covered by at least three vessels.

- If only a dataset of amalgamated records from the onboard observer programme is made publically available, is the dataset of amalgamated records at a resolution of $\leq$5 degree cells, >5 degree cells, or is information on resolution of records in the publically available dataset not specified?

  Data are amalgamated by 5^{o} x 5^{o} cells (WCPFC, 2011e).

- If only amalgamated records from a regional onboard observer programme are made available to the public, has the amalgamation of records prevented any research applications that would have been feasible with the primary data? E.g., is the resolution of amalgamated data insufficient to identify spatial trends in bycatch, or has information on any factors known to significantly affect bycatch rates been eliminated from the publically available dataset (e.g., standard unit of fishing effort, fishing gear and methods, timing of fishing operations, taxonomic level) (Chaloupka and Balazs, 2005; Sullivan et al., 2006; Gilman et al., 2008b)?

  The public domain dataset is not adequate for fundamental research applications. This is due to the limited fields available in the dataset (year, month, coordinates of the southwest corner of the 5^{o} cell, effort [e.g., hooks set in that cell in that month], and catch only for principal market species and 'other'), low resolution of amalgamation, and pooling of records from both logbook and observer monitoring with no separation of these different sources within the database (WCPFC, 2011e).

- Of the fisheries that are included in the regional observer programme, for how many are primary or amalgamated datasets open access?

  Regional Observer Program coverage occurs in purse seine and longline fisheries. Amalgamated data are available for both of these fisheries.

Criterion 3: Ecological risk assessment
Score: 2 of 8 possible points, 25%.

Table A1.14-5 provides details on the assessment outcome for criterion 3.

Table A1.14-5. Assessment of WCPFC ecological risk assessment.

Factor	Points for

	positive response
Level 2 and/or 3 assessment has been conducted for either the effects of fishing on bycatch species or the effects of bycatch on the integrity of the ecosystem, but not both, for at least 1 fishery.	2

Information used for assessment:

- Identify each ecological risk assessment study that has been conducted by the RFMO. Identify the level of assessment conducted, per Hobday et al. (2007), Kirby (2006), and Sainsbury and Sumaila (2001).

  Level 2 assessments have been conducted for WCPFC-managed longline and purse seine tuna fisheries for 236 species and 79 species groups of target and bycatch species (Kirby, 2006). These represent all species and species groups that had been observed caught in WCPO tuna longline and purse seine fisheries as documented in records of the Secretariat of the Pacific Community database, which pools several WCPO observer programmes (Kirby, 2006). The species groups were used by observers when identification to the species level was not possible (Kirby, 2006).

  The 2006 level 2 Productivity-Susceptibility Analyses were updated in 2007 for deep- and shallow-set pelagic longline fisheries (Kirby and Hobday, 2007). The assessment of relative risk was conducted for (i) all 233 species observed caught, (ii) a subset of all 190 fish species observed caught, and (iii) a subset of all 99 species of special interest of birds, mammals, reptiles and sharks. The methods employed included a component that assessed the vertical overlap of assessed species and fishing gear terminal tackle, but did not account for geo-spatial (horizontal) overlap in species' distributions and fishing grounds.

  A level 2 assessment was conducted for the effects of WCPFC-managed longline tuna fisheries on seabirds (Kirby et al., 2009). The assessment identified where the distributions of seabird species determined to be at risk of capture in pelagic longline fisheries overlapped, both spatially and temporally, with pelagic longline fishing effort in the WCPFC Convention Area, and employed selected life history parameters for each included seabird species as indicators of productivity and susceptibility, identifying areas where the highest risk of population-level effects from bycatch in longline fisheries was predicted to occur (Kirby et al., 2009).

  Small (2005) conducted a partial Level 2 risk assessment, by assessing the overlap of 14 RFMO areas with albatross distributions

- For each fishery managed by the RFMO, identify whether an ecological risk assessment has been conducted that assesses the effects of the fishery on bycatch species and/or the effects of bycatch removals on ecosystem integrity.

  Ecological risk assessments have been conducted for WCPFC-managed longline and purse seine fisheries (summarized in the previous bullet). Thus, risk assessments have been conducted for 2 of 5 managed fisheries (no assessments for pole and line, troll, and other small-scale gears).

- Describe the results of each ecological risk assessment. Describe the findings in terms of what ecological risks each assessed fishery poses, identify whether more rigorous ecological risk assessment was recommended. If a more rigorous

assessment was recommended, has it been conducted, in progress, or planned to be conducted?

Kirby (2006) found several shark species to be the highest risk group in both longline and purse seine fisheries, with silky shark being of highest risk in both fisheries, as well as short-finned mako, porbeagle, and oceanic whitetip sharks due to being frequently captured and having low fecundity relative to, for example, blue sharks and hammerhead sharks. Most caught sharks are retained: 31% and 39% of caught sharks were discarded alive in longline and purse seine fisheries, respectively (Kirby, 2006). Of teleosts, Kirby (2006) found target tunas and billfish, plus wahoo and mahi mahi, to have highest risk scores, due to high susceptibility as they are targeted, and not due to low productivity. No non-target teleost species were identified as high-risk (Kirby, 2006). Several additional shark species were found to be of high risk, when assessing only condition at capture, age classes subject to fishing mortality, and fate of captures (collectively referred to as susceptibility) and life history characteristics (productivity), but based on information on fishing mortality, these species experience nominal fishing mortality in these fisheries and hence are of low risk of experiencing population-level effects from these fisheries.

Kirby and Hobday (2007) found species of albatrosses and petrels to be of high or medium relative risk in pelagic longline deep- and shallow-set fisheries (relative to all species caught, and relative to other special interest species). Turtles were relatively high risk relative to all species caught, and medium risk relative to other special interest species, except for leatherback turtles, which ranked low and medium risk relative to all species, and relative to other special interest species, respectively, due to leatherbacks having a lower age at maturity, occurring deeper in the water column, and a large proportion of caught leatherbacks being retrieved alive and discarded compared to other marine turtles (Kirby and Hodbay, 2007). Rays were high risk relative to other fish species, and several shark species were high risk relative to all caught species, due in part to only 30% of sharks being discarded alive without being finned (Kirby and Hobday, 2007). Most sharks did not rank as high risk relative to other fish because predominantly juvenile sharks are caught. Principal market species had a medium relative risk due to relatively high susceptibility. Blue marlin, frigate mackerel, longtail (tonggol) tuna, Spanish mackerel, and sailfish were of high risk relative to all caught species (Kirby and Hobday, 2007).

Areas with the highest probability of species-level population effects from bycatch in WCPFC-managed pelagic longline fisheries generally occurred along a broad swatch from New Zealand northeast to the Hawaii archipelago (Kirby et al., 2009). The ten most at risk seabird species were six tropical gadfly petrels (genuses *Pterodroma* and *Pseudobulweria*), one tropical shearwater, and three mainly temperate albatross species. The next 15 ranked at-risk seabird species were primarily IUCN-listed threatened species of petrels and albatrosses (Kirby et al., 2009). Interactions between the relatively small-sized tropical petrels and shearwater species and longline fisheries is not well understood; i.e., it is not currently known if these species are captured in longline fisheries.

Small (2005) found that WCPFC was the second ranked RFMO in terms of overlap with albatross distribution.

Criterion 4A. Conservation and Management Measures to Mitigate Problematic Bycatch
Score: 7 of 18 possible points, 39%

Table A1.14-6 provides details on the assessment outcome for criterion 3.

Table A1.14-6. Assessment of WCPFC conservation and management measures to mitigate bycatch, and efficacy.

Factor	Points for positive response
One or more bycatch problem has been identified to occur in one or more fisheries managed by the RFMO, and binding measures are in place to mitigate at least one identified problem but <50% of the number of identified problems.	1
≥50% but <75% of binding measures to mitigate bycatch include measurable performance standards.	2
Of binding bycatch measures that contain quantitative performance standards, at least one measure but <50% of the measures have been assessed for efficacy.	1
There is no provision that allows RFMO Members to opt out of binding measures.	3

Information used for assessment:

- Based on the review of ecological risk assessments conducted under Criterion 3, list each bycatch and discard problem for each fishery managed by the RFMO.

  Ecological risk assessments of WCPFC-managed longline and purse seine fisheries have identified the following bycatch problems:
  - Pelagic longline: silky, short-finned mako, porbeagle, oceanic whitetip and other shark species, species of seabirds (albatrosses, petrels and shearwaters), sea turtle species, and several non-target teleosts (blue marlin, frigate mackerel, longtail tuna, Spanish mackerel, and sailfish) (Small, 2005; Kirby, 2006; Kirby and Hobday, 2007; Kirby et al., 2009)
  - Purse seine: silky, short-finned mako, porbeagle, oceanic whitetip and other shark species (Kirby, 2006)

- List bycatch problems that have been documented to occur in fisheries managed by the RFMO from studies other than ecological risk assessments. If there is limited information on the effects of the managed fisheries on species subject to bycatch and the ecological effects from bycatch removals, then list the occurrence of problematic bycatch that occurs in the same gear types as documented in other regions, which is likely to also occur in the fisheries managed by this RFMO?

  WCPFC-managed fisheries for tunas and tuna-like species may have the following bycatch problems:
  - Purse seine: Sharks (primarily silky and oceanic white tip), juvenile bigeye and yellowfin tunas, other unmarketable species and sizes of fish, sea turtles, cetaceans (Clarke, 2011a,b; Clarke et al., 2011; Gilman, 2011; Lawson, 2011);
  - Pelagic longline: Elasmobranchs, seabirds, sea turtles, cetaceans, juvenile swordfish, other species of non-targeted fish (Petersen et al., 2007; Bugoni et al., 2008; Williams et al., 2009; FAO, 2010a; Clarke, 2011a,b; Clarke et al., 2011; Gilman, 2011; Lawson, 2011).

- Pole-and-line: Seabirds (Bugoni et al., 2008).
- Trolling: Seabirds (Bugoni et al., 2008).
- Gillnet: Sea turtles, elasmobranchs, marine mammals, coastal seabirds, waterbirds (Melvin et al., 2001; Read et al., 2006; Gilman et al., 2009; Kiszka et al., 2009; Zydelis et al., 2009; FAO, 2010a).
- Traps: Elasmobranchs, other mostly marketable finfish species (mostly Scianidae and Sparidae) (Neves dos Santos et al., 2002; Storia et al., 2011).
- Driftnet fisheries: Elasmobranchs, cetaceans and other marine mammals, seabirds, sea turtles, sharks, unmarketable species and sizes of finfish (Northridge, 1991; Goni, 1998; Silvani et al., 1999; Uhlmann et al., 2005).
- Pelagic handline fisheries: Seabirds (Bugoni et al., 2008).

Williams et al. (2009) summarizes sea turtle interaction rates, and condition of the turtles upon gear retrieval, from observer programme data of WCPFC-managed pelagic longline and purse seine tuna fisheries. Turtle interaction rates were higher in tropical vs. temperate areas. Leatherback/loggerhead turtle encounters being more prevalent in sub-tropical to temperate waters, while species encountered in tropical/sub-tropical waters include Olive Ridley, green, loggerhead, hawksbill, flatback and leatherback turtles (Williams et al., 2009). Sea turtle interaction rates were higher in shallow/night-set longline fisheries relative to deep/daytime-set fisheries. Sea turtle interaction rates based on turtles captured per set were substantially lower in purse seine fisheries relative to longline fisheries. Nominal sea turtle catch rates were highest in animal-associated purse seine sets (1.6 turtles/100 sets), followed by sets on anchored FADs (0.78 turtles/100 sets), then sets on drifting logs (0.78 turtles/100 sets), followed by unassociated sets (0.61 turtles/100 sets), and were lowest for sets made on drifting FADs (0.28 turtles/100 sets) (Williams et al., 2009). Sea turtle interactions in pole-and-line, troll and other tuna fisheries was considered to be non-existent or otherwise information was not available (Williams et al., 2009).

Several recent assessments have been conducted of shark catches in WCPFC-managed longline and purse seine fisheries, focusing on up to 13 key shark species as designated by the Scientific Committee of WCPFC (CMM 2010-07): blue (*Prionace glauca*); shortfin (*Isurus oxyrinchus*) and longfin (*I. paucus*) makos; oceanic whitetip (*Carcharhinus longimanus*); silky (*C. falciformis*); bigeye (*Alopias superciliosus*), common (*A. vulpinus*) and pelagic (*A. pelagicus*) threshers; porbeagle (*Lamna nasus*); scalloped (*Sphyrna lewini*), smooth, (*S. zygaena*), and great (*S. mokarran*); hammerheads; and winghead (*Eusphyra blochii*) (Clarke, 2011a,b; Clarke et al., 2011; Lawson, 2011). The designation of these key shark species was based on several factors, including: (i) high risk from fishing activities based on the WCPFC's Ecological Risk Assessment project; (ii) ease of identification; and (iii) frequency of reporting in annual catch data provided by Commission members and cooperating non-members (Clarke and Harley, 2010).

Networks of thousands of artificial drifting and anchored FADs used in WCPFC-managed tuna fisheries aggregate pelagic species from surrounding waters, and possibly act as 'ecological traps' of these species by altering their natural spatial and temporal distributions, habitat associations, migration patterns and residence times (Marsac et al., 2000; Bromhead et al., 2003; Hallier and Gaertner, 2008; Dagorn et al., 2010; Gilman, 2011).

- Using Table A1.14-7, summarize active legally binding conservation and management measures that mitigate bycatch, and identify any quantitative and measurable performance standards included in each measure (e.g., target reference points for bycatch species or species groups, such as Maximum Sustainable Yield or the more precautionary Maximum Economic Yield; limit reference points for the impacts of fishing on bycatch fish species; limits on catch rates or levels for protected or threatened bycatch species; minimum sink rate for hook-and-line terminal tackle; minimum depth for gear when soaking [United Nations, 1995; Garcia, 2000; Mace, 2001; Lodge et al., 2007; Cullis-Suzuki and Pauly, 2010; Gilman, 2011]).

  This information has been recorded in Table A1.14-7.

  CMM 2010-05 requires CCMs to annually report bycatch levels of South Pacific albacore, and CMM 2005-03 requires CCMs to annually report total catch levels of North Pacific albacore from the Convention Area north of the equator, but the measures do not require the employment of albacore bycatch mitigation measures (WCPFC, 2005a, 2010e).

- From the responses to the first two bullets, list each individual documented bycatch problem.

  A summary of the bycatch problems in WCPFC-managed fisheries as identified in the first two bullets follows:
  - Purse seine: Sharks, juvenile tunas, other unmarketable species and sizes of fish, sea turtles, cetaceans;
  - Pelagic longline: Elasmobranchs, seabirds, sea turtles, cetaceans, juvenile swordfish, other species of non-targeted fish.
  - Pole-and-line: Seabirds.
  - Trolling: Seabirds.
  - Other small-scale tuna fishing methods, including artisanal methods (gillnet, traps, small-scale driftnets, handline): Sea turtles, elasmobranchs, marine mammals, seabirds, waterbirds, bony fish.

- For what proportion of potentially existing or documented bycatch problems (considering both the adverse effects on species subject to bycatch and effects of bycatch removals on ecosystem integrity) in fisheries managed by the RFMO are binding conservation and management measures in effect (i.e., are measures based on the best scientific evidence available) (FAO, 1995 [Article 12.13]; Caddy, 1996)?

  There are WCPFC binding CMMs in effect to address 9 of the 19 bycatch problems identified in the previous bullet. The bycatch problems that are not addressed by a CMM are: cetaceans and other unmarketable species and sizes of fish in purse seine fisheries; cetaceans and juvenile swordfish in longline fisheries; seabirds in pole-and-line fisheries; seabirds in troll fisheries; and marine mammals, seabirds, waterbirds, bony fish in other small-scale tuna fisheries. Measures related to managing bycatch of North Pacific striped marlin and swordfish from the south Pacific (WCPFC, 2009h, 2010f) were considered to address pelagic longline bycatch of 'other' non-target fish species.

- What proportion of binding bycatch mitigation measures contain quantitative, measurable performance standards?

50% (4 of 8) (Table A1.14-7).

- For what proportion of conservation and management measures that include measurable performance standards has efficacy been assessed?

Efficacy has been assessed against performance standards for one of four measures containing quantitative performance standards.

CMM 2008-01 is intended to improve the sustainability of exploitation of yellowfin and bigeye WCPO stocks, includes a temporal closure on purse seine sets on FADs, and has been assessed for compliance. Higher bycatch rates of juvenile bigeye and yellowfin occurs in purse seine sets on floating objects relative to sets on unassociated sets (Gilman, 2011). The efficacy of 2009-01 in terms of reducing juvenile bigeye and yellowfin tuna bycatch fishing mortality in purse seine fisheries is as yet undetermined, however, the number of purse seine sets on FADs in 2009 was the second highest level on record despite the temporal closure (Secretariat of the Pacific Community, 2010), and hence based on this, efficacy of the measure to address this bycatch problem is likely low.

The WCPFC binding measures on sharks contains a quantitative performance standard of a 5% limit of ratio of weight of retained shark fins to carcasses (WCPFC, 2010a). Insufficient monitoring, in particular in pelagic longline fisheries, hampers efforts to assess compliance and hence achievement of the shark measure's stipulated standard. Furthermore, the form of the fins (frozen vs. dried) and form of the carcass (whole weight, dressed or partially dressed) is not specified in the measure, which precludes defining a clear method to assess compliance (Fowler and Seret, 2010). Furthermore, the 5% limit of ratio of weight of retained shark fins to carcasses, even if it did lend itself to being monitored for compliance, may not achieve the measure's explicit objective of achieving sustainable shark fishing mortality if there is market demand for shark meat, as has been documented to be increasing in some regions (Gilman et al., 2008a; Gilman, 2011).

No assessments of combined WCPFC-managed fisheries presented information on temporal trends in total shark fishing mortality by weight or number, which would provide a direct measure for assessing efficacy of the shark measure in meeting the implicit objective of reducing shark fishing mortality. This could be estimated via fleet-wide estimates of the total number of sharks retained (whole or just fins), dead discards, plus unobserved mortalities.

Clarke (2011a) investigated the efficacy of the WCPFC shark measure (CMM 2010-07, WCPFC, 2010a) in terms of reducing fishing mortality of eight key shark species, and concluded that the effectiveness is unclear. Since the first WCPFC shark finning measure came into effect in February 2007, based on observer data of WCPFC-managed longline fisheries included in the Secretariat of the Pacific Community pooled dataset, the proportion of caught sharks that were released remained roughly the same in 2007 and 2008 relative to 2006, and the proportion of caught sharks that were finned and carcass discarded also experienced only a small change, increasing slightly (42% in 2006, 53% and 58% in 2007 and 2008, respectively) (Clarke, 2011a), suggesting that, for longline fisheries, the efficacy of the measure in meeting the objective of achieving full utilization is not being met. Analysis of purse seine observer data, however, revealed declining proportion of caught sharks that were finned and increasing proportion being discarded (Clarke, 2011a), indicating that the measure has been effective in both increasing full utilization and reducing shark fishing mortality in purse seine fisheries. The

assessment also reviewed available information on the status of these species' stocks in the WCPO, concluding that concern is warranted for blue sharks as the stock may have become overfished since the most recent assessment by Kleiber et al. (2009), and concluded that the WCPO oceanic white tip population is in a depleted state. Information on stock status of the other key shark species were determined to either be inconclusive due to data-deficiencies, or there was no strong evidence of overexploitation from interpretation of temporal trends in relative abundance (standardized catch rates) and length distributions (Clarke, 2011a).

The Secretariat of the Pacific Community (SPC), the data provided to WCPFC, conducted a one-day workshop on "Monitoring the effectiveness of WCPFC Conservation and Management Measures for bycatch" (Kirby, 2009). The workshop identified any stated explicit standard for efficacy as well as implicit standards for WCPFC measures on sharks, seabirds and sea turtles. Implicit standards were identified in part via information from individuals involved with drafting the measure. The workshop participants then identified scientific monitoring and analysis required to assess the efficacy of measures against these performance standards. In the case of the WCPFC shark measure, the workshop participants concluded that, "The shark CMM would be more transparent, less prone to creative compliance, more open to substantive compliance, and more amenable to further scientific monitoring and analysis, if the desired outcome was explicitly expressed in terms of a decrease in fishing mortality by comparison to a reference year/period," (Kirby, 2009). This was based on the determination that the implicit objective of the shark measure is to reduce shark fishing mortality. Adherence to the 5% fin to carcass ratio may be a less effective standard to achieve reduced shark fishing mortality than a standard that stipulates scientifically-based, species-specific limit reference points (Gilman, 2011).

Measures limiting total annual catch levels of South Pacific swordfish (WCPFC, 2009h) and North Pacific striped marlin (WCPFC, 2010f) have been assessed annually in that CCMs have reported retained catch levels of these species from designated areas through Part 1 and 2 reports to the Commission. However, due to low onboard observer coverage rates in longline fisheries, records of total catch levels (both retained and discarded catch) of these species are unavailable in order to assess the efficacy of the measures against their performance standards.

- For each binding bycatch measure that contains performance standards, which have been determined to be effective in meeting the stipulated performance standards?

None of the four measures containing performance standards has been determined to definitively be achieving their performance standards.

Insufficient monitoring, in particular in pelagic longline fisheries, hampers efforts to assess compliance and hence achievement of the swordfish, striped marlin and shark measures' standards. Furthermore, the 5% limit of ratio of weight of retained shark fins to carcasses, while lending itself to being monitored for compliance, may not achieve the measure's explicit objective of achieving sustainable shark fishing mortality in IATTC-managed fisheries (Gilman, 2011). The restrictions on shark finning practices has limited potential to control shark fishing mortality levels if WCPFC-managed fisheries have markets for shark meat, this in addition to problems in compliance due to limited resources for surveillance and enforcement (Gilman et al., 2008a; Gilman, 2011).

Available information on the status of some WCPO shark stocks suggests that the WCPFC shark measure has not resulted in reduced shark fishing mortality. The north Pacific blue shark (*Prionace glauca*) stock's biomass is close to its MSY-based

reference point and the exploitation fishing mortality rate is approaching the MSY-based reference point, based on data through 2002 (Kleiber et al., 2009), while more recent observations of declining trends in standardized catch rates and increased targeting of blue sharks by some commercial longline fisheries suggest further declines in abundance have occurred since 2002 (Gilman et al., 2008a; Clarke, 2011). Stock assessments of other Pacific pelagic sharks caught in longline and purse seine tuna fisheries have yet to be conducted but are planned (Clarke and Harley, 2010; Clarke et al., 2010). Oceanic white tip standardized catch rates from Pacific longline and purse seine fisheries have demonstrated declining temporal trends (Minami et al., 2007; Clarke, 2011; Clarke et al., 2011a,b; Walsh and Clarke, 2011).

- Of the binding bycatch measures that have been determined to be lacking in effectiveness either through assessment against measurable performance standards stated in the measure or otherwise through other scientifically rigorous assessment (e.g., Gilman et al., 2007a, 2008b), for how many have steps been taken or are in progress to improve efficacy?

  One of four. A new CMM is planned to be adopted in 2011 to replace CMM 2008-01. Consideration to replace the seasonal FAD closure with a fill purse seine closure may result in increased compliance and hence efficacy of the measure in meeting performance standards, if adopted and effectively implemented.

- Does the RFMO allow Member States to opt out of binding conservation and management measures (e.g., reservations or other forms of opt-out)? If yes, is information available documenting whether or not members are employing the opt out provision so as to not employ measures relevant to this criterion, or otherwise is information on employment of the opt out provision not available?

  No, WCPFC members cannot opt out of binding measures (WCPFC, 2000 [Article 20]).

Table A1.14-7. Active WCPFC legally binding conservation and management measures related to the mitigation of problematic bycatch, identify any performance standards and assess if these are quantitative and measureable or not, describe data requirements for performance assessment, and identify minimum surveillance resources to determine compliance.

Measure	Stipulated Performance Standards, Measurable or Subjective	Data Collection Needed for Implementation	Minimum surveillance resources necessary: (a) dockside inspection, (b) at-sea inspection, (c) VMS, (d) onboard observers, (e) vessel list, (f) other (specify)
Seabirds			
Longline vessels, when in areas south of 30^{o} S. latitude and north of 23^{o} N. latitude, must employ at least two seabird bycatch mitigation measures from a list of eight alternatives, one of which must be either: (i) side setting in combination with a bird curtain and weighted branch lines (counts as 2 measures; can only be selected for vessels fishing north of 23 degrees N. latitude), (ii) night setting, (iii) tori line (paired tori lines count as 2 measures), or (iv) weighted branch lines. The second method can be a second measure from this first list, or otherwise one of the following must be selected: (v) blue-dyed bait, (vi) mainline shooter, (vii)	No performance standards are stipulated to assess the measure's effectiveness.	Longline fishing gear terminal tackle design; Longline vessel presence onboard and design of bird mitigation equipment (e.g., tori pole and line, bird curtain, underwater setting chute, blue dye); Longline vessel fishing practices (e.g., timing of setting, location on deck where mainline is set, offal discharge practices, baited hooks set through underwater setting chute); Location of longline fishing vessels when operating; List of longline vessels authorized to fish in the Convention Area.	a, b, c, e

underwater setting chute, or (viii) management of offal discharge (WCPFC, 2007a). Vessels ≤24m in overall length fishing north of 23° N. latitude are exempt (WCPFC, 2007a).			
Sea turtles			
CCMs shall require vessels to: (i) Applicable to all WCPFC-managed fisheries, bring aboard, if practicable, any captured hard-shell sea turtle that is comatose or inactive as soon as possible and foster its recovery according to WCPFC handling and mitigation guidelines, prior to returning the turtle to the water. (ii) Purse seine vessels shall ensure, to the extent practicable, that they avoid encircling sea turtles, and if a sea turtle is encircled or entangled in a FAD or other gear, take practicable measures to safely release the turtle; (iii) If a sea turtle is entangled in a purse seine, stop net roll as soon as the turtle comes	No performance standards are stipulated to assess the measure's effectiveness.	For longline and purse seine vessels, sea turtle handling and release equipment onboard; For all fisheries, fishing practices for handling and releasing turtles observed captured; Hook and bait type used on shallow-set longline vessels; List of longline and purse seine vessels authorized to fish in the Convention Area.	a, b, e

out of the water; disentangle the turtle without injuring it before resuming the net roll, and to the extent practicable, assist the recovery of the turtle before returning it to the water; (iv) Purse seine vessels shall carry and employ dip nets, when appropriate, to handle turtles; (v) Longline vessels shall carry and use dip nets, line cutters and de-hookers to handle and promptly release sea turtles caught or entangled, in accordance with WCPFC guidelines; (vi) As of 1 January 2010, longline swordfish vessels employing shallow sets (CCMs are to establish and enforce their own definitions of shallow-set gear), shall use only large circle hooks (CCMs are to establish their own definition of 'large circle hook') with an offset of ≤ 10 degree, whole finfish for bait, and any other method determined to effectively mitigate turtle bycatch rates. Fisheries			

determined to have 'minimal' observed sea turtle interactions (to be defined by the WCPFC Scientific Committee) over a three-year period and a level of observer coverage of ≥10% during each of those three years are exempt from these requirements (WCPFC, 2008b).			
Marine mammals			
None	NA	NA	NA
Shark and relatives			
CCM's vessels are required to: (i) keep all parts of retained sharks, excluding head, guts and skins, to the point of first landing or transshipment; (ii) have onboard fins that total ≤ 5% of the weight of sharks onboard, up to the first point of landing, or otherwise ensure compliance with the 5% rule through certification, observer monitoring, require that vessels land sharks with fins attached to the carcass, or other method (WCPFC, 2010a). Vessels targeting tunas and tuna-like species	5% limit of ratio of weight of retained shark fins to carcasses.	Weight of landed shark fins and weight of remainder of shark carcasses; Shark discard practices; List of longline and purse seine vessels authorized to fish in the Convention Area	a, b, e

not directed at sharks shall release sharks alive that are caught incidentally and are not used for food or other purposes (WCPFC, 2010a).			
Juvenile and small/undersized target species			
A binding measure on yellowfin and bigeye tunas requires: (i) 30% reduction in bigeye tuna fishing mortality by purse seine vessels (juvenile bigeye is typically bycatch in purse seine tuna fisheries) over a three year period commencing when the measure came into effect in 2009, in the portion of the Convention Area bounded by 20^0N and 20^0S; (ii) Except for small developing State members and participating territories, purse seine effort in terms of days fished on the high seas are not to exceed the 2004 levels or the average of 2001-2004; (iii) In 2009-2011, for Forum Fisheries Agency members belonging to the Parties to the Nauru	Stated as objectives, the measure includes three quantitatively assessable standards related to bycatch in purse seine fisheries, which occurs primarily on sets on floating objects: (i) Maintain bigeye and yellowfin tuna stocks at levels capable of producing maximum sustainable yield; (ii) Between 2009-2012 achieve a minimum 30% reduction in bigeye tuna fishing mortality from the annual average during the period 2001-2004 or 2004; (iii) No increase in yellowfin tuna fishing mortality from the average during the period 2001-2004 or 2004 (WCPFC, 2008a).	Weight of bigeye and yellowfin tuna landings and discards recorded by purse seine vessel Flag State, set type, set date, and set location; Purse seine set type from 1 August – 30 September 2009, and from 1 July – 30 September 2010-2011, in PNA Members' EEZs and on the high seas in the area bounded by 20^0N and 20^0S; Purse seine days fished in EEZ's of PNA members in 2009-2011; Starting 1 January 2010, location of purse seine sets in relation to the closed high seas pockets; Location of purse seine sets and distance from nearest FAD; Starting 1 January 2010, record of tuna discards by species by purse seine vessels operating within the area bounded by 20ºN	c, d, e, f (real-time locations of all anchored and drifting FADs) Note that under (d), 100% onboard observer coverage would be required in all purse seine, longline, troll, pole-and-line, and other non-artisanal fisheries that take ≥2,000 mt of bigeye and/or yellowfin tuna in order to observe the weight of retained and discarded bigeye and yellowfin tunas to determine compliance with the requirement for bigeye and yellowfin fishing mortality levels to not exceed the average level for the period 2001-2004 or 2004 (WCPFC, 2008a [paragraph 39]).

Agreement (PNA), purse seine days fished within EEZs of PNA members are to be no greater than 2004 levels; (iv) In 2009, temporal closure on purse seine sets on FADs and other floating objects (per more detailed definitions in WCPFC, 2009a) from 1 August – 30 September in PNA Members' EEZs and on the high seas in the area bounded by 20^0N and 20^0S, plus during this period all purse seine vessels must carry an onboard observer from the Regional Observer Program. In 2010-2011, the FAD/floating object sets closure is from 1 July – 30 September; (v) In 2009, members can implement a purse seine catch limit with 100% onboard observer coverage as an alternative to the FAD temporal closure. The catch limit must result in a reduction in purse seine bigeye catch weight in the area bounded by 20^0N and 20^0S by a minimum of		and 20ºS; Weight of bigeye and yellowfin tuna landings and discards by purse seine vessels operating north of 20ºN and south of 20ºS; Weight of bigeye and yellowfin tuna landings and discards by non-artisanal troll, pole-and-line, and other non-artisanal fisheries; List of vessels authorized to fish in the Convention Area.	

10% relative to the average catch weight from 2001-2004; (vi) Two high seas pockets (areas wholly enclosed by EEZs) are closed to purse seine fishing starting 1 January 2010; (vii) By 1 July 2009, submit to the Commission FAD Management Plans that at a minimum meet the Suggested Guidelines for Preparation for FAD Management Plans; (viii) Full retention of bigeye, yellowfin and skipjack tunas by all purse vessels operating within the area bounded by 20ºN and 20ºS from 1 January 2010 (juvenile bigeye and yellowfin tuna are typically bycatch in purse seine tuna fisheries); (ix) As of 1 January 2010, 100% onboard observer coverage by observers from the Commission's Regional Observer Program of purse seine vessels operating in the area bounded by 20ºN and 20ºS, excluding vessels that operate only in the EEZ of only one			

coastal State (and not on the high seas or in the EEZ of a second coastal State); (x) Beginning in 2009, CCMs shall take necessary measures to ensure that the total capacity of their respective other commercial tuna fisheries for bigeye and yellowfin tuna, including purse seining that occurs north of 20ºN or south of 20ºS, but excluding artisanal fisheries and those fisheries taking less than 2,000 tonnes of bigeye and yellowfin, shall not exceed the average level for the period 2001-2004 or 2004. (WCPFC, 2008a). Also, as part of these measures, there are requirements related to controlling longline catches of bigeye and yellowfin tunas (WCPFC, 2008a, 2009a), but these requirements are not related to bycatch and discards and hence are not summarized here.			

Fishing within 1 nm of a data buoy is prohibited in the Convention Area (WCPFC, 2009f). The CMM stipulates that the measure may contribute to meeting the Commission objective of reducing fishing mortality of juvenile bigeye and yellowfin tunas (WCPFC, 2009f).	No performance standards are stipulated to assess the measure's effectiveness.	Location of fishing effort; Location of data buoys; List of vessels authorized to fish in the Convention Area.	c, e
A measure requires phased reduction of catch levels of North Pacific striped marlin (WCPFC, 2010f), a non-target species in tuna and swordfish-targeting fisheries.	Annual catch limits of north Pacific striped marlin from north of the equator in the Convention Area are established for each CCM for 2011-2013 based on percent reductions from the highest catch between 2000-2003.	Location of fishing effort; Catch levels of North Pacific striped marlin north of the equator; List of vessels authorized to fish in the Convention Area.	c, d, e
A measure establishes individual CCM total allowable catch limits (TACs) for swordfish from within the Convention Area south of 20^{o}S (WCPFC, 2009h); swordfish may be a non-target incidental catch in some fisheries, e.g., longline tuna fisheries. Exceeding the TAC in a given year results in a concomitant reduction in the TAC for the subsequent year (WCPFC, 2009h).	Limit annual catch of swordfish from the Convention Area south of 20^{o}S to the amount caught during any one year during the period 2000-2006.	Location of fishing effort; Catch levels of swordfish south of 20^{o}S; List of vessels authorized to fish in the Convention Area.	c, d, e

Unmarketable sizes and species of non-target species of fish			
None	NA	NA	NA
Other or multiple bycatch species group(s)			
Use of large scale drift gillnets (>2.5 km in length) on the high seas in the WCPFC Convention Area is prohibited (WCPFC, 2008c).	No performance standards are stipulated to assess the measure's effectiveness.	Design of drift gillnet gear in use and/or stowed onboard; Location of fishing effort; List of vessels authorized to fish in the Convention Area.	b, c, e

Criterion 4B. Conservation and Management Measures to Mitigate Bycatch in Derelict Fishing Gear
Score: 4 of 14 possible points, 29%

Table A1.14-8 provides details on the assessment outcome for criterion 3.

Table A1.14-8. Assessment of WCPFC conservation and management measures to mitigate bycatch in lost, abandoned, and discarded gear.

Factor	Points for positive response
For fisheries managed by the RFMO for which there is either evidence that ghost fishing is problematic or otherwise there is no knowledge of the degree of ecological risk from ghost fishing, binding measures to mitigate ghost fishing are in place for at least one but <50% of these fisheries.	1
There is no provision that allows RFMO Members to opt out of binding measures.	3

Information used for assessment:

- Have studies been conducted that determined whether or not problematic ghost fishing occurs in fisheries managed by the RFMO? In which fisheries managed by the RFMO has problematic ghost fishing been determined to occur, not occur, or otherwise there is no knowledge of the degree of ecological risk from ghost fishing?

  Ghost fishing via entanglement in the appendages of abandoned, lost and discarded FADs used by purse seine and other gear types has been identified as problematic in some regions of the WCPFC Convention Area (e.g., Chanrachkij et al., 2008; Gilman, 2011). However, the rate of FAD abandonment, loss and discarding in the western and central Pacific and other regions is poorly understood (FAO, 2009e). Pelagic longline operators are hypothesized to routinely deliberately discard tangled and damaged line at sea during setting operations (FAO, 2009e). Otherwise, information on the ecological risk from ghost fishing by WCPFC-managed fisheries is not well understood.

- For fisheries managed by the RFMO that have not undergone assessment for problematic ghost fishing, is there information available that problematic ghost fishing in these gear types is documented to occur in other regions, and might also occur in the fisheries managed by this RFMO? Conversely, is there information that supports that ghost fishing is very unlikely to be a problem based on information on these gear types from other regions?

  Of WCPFC-managed fisheries, ghost fishing may be problematic from pelagic longline gear, coastal handline gear, purse seine FADs, traps and various net gear, but not likely from purse seine netting, troll, or offshore pole-and-line gears (FAO, 2009e; Gilman, 2011). However, there is insufficient information to determine with any certainty the levels and degree of ecological risk from ghost fishing that occurs in WCPFC-managed fisheries.

  In general, fisheries that employ passive fishing gear (e.g., pelagic and demersal longlines, gillnets, trammel nets, traps) are likely to cause ghost fishing, while fisheries that employ active gear (e.g., purse seine, trawl) are less likely to result in ghost fishing as the catching process of active gears ceases when the gear is no longer attached to

the vessel (NEAFC, 2008a; NAFO, 2008; SEAFO, 2009e; FAO, 2005a, 2009e, 2010d). However, there are many exceptions to this general rule. For instance, ghost fishing has been observed in seine nets and there is evidence of marine mammal entanglement in trawl net fragments, and coastal habitat degradation from derelict trawl nets (Jones, 1995; Donohue et al., 2001; Matsuoka et al., 2005).

- Summarize active legally binding conservation and management measures related to lost and abandoned derelict fishing gear and ghost fishing, and identify any quantitative performance standards included in each measure (Table A1.14-9);

  A binding measure banning high seas large-scale drift gillnetting is in effect, which contributes to reducing ghost fishing by this gear type (Table A1.14-9). Measures on gear marking have been considered but a binding measure has not been adopted.

- For what proportion of fisheries where ghost fishing is documented to be problematic or otherwise are data deficient and ghost fishing is likely to be a problem based on information on these gear types from other regions, have binding measures been adopted to mitigate ghost fishing?

  1 of 6. Assuming that ghost fishing has a high probability of being problematic in pelagic longline gear, coastal handline gear, purse seine FADs, traps, coastal net gear, and high seas net gear, then the one WCPFC binding measure indirectly related to ghost fishing by high seas large-scale drift gillnets addresses one of these six.

- Of binding measures that contain quantitative performance standards, what proportion has been assessed for efficacy?

  The binding measure banning high seas large-scale drift gillnets does not containing quantitative performance standards.

- For what proportion of the binding measures that have been determined to be lacking in effectiveness (either through assessment against measurable performance standards stated in the measure or otherwise through other scientifically rigorous assessment) have steps been taken or are in progress to improve efficacy?

  Not applicable, the one binding measure has not undergone an assessment of performance, and the measure lacks quantitative performance standards.

- Does the RFMO allow Member States to opt out of binding conservation and management measures?

  No, WCPFC members cannot opt out of binding measures (WCPFC, 2000 [Article 20]).

- Table A1.14-9. Active WCPFC legally binding conservation and management measures related to mitigating bycatch in lost, abandoned and discarded derelict fishing gear, whether the measure is legally binding, identify any performance standards and assess if these are quantitative and measureable or not, describe data requirements for performance assessment, and identify requirements for surveillance.

Measure	Stipulated Performance Standards, Measurable or Subjective	Data Collection Needed for Implementation	Minimum surveillance resources necessary (a) dockside inspection, (b) at-sea inspection, (c) VMS, (d) onboard observers, (e) vessel list, (f) other (specify)
Use of large scale drift gillnets (>2.5 km in length) on the high seas in the WCPFC Convention Area is prohibited (WCPFC, 2008c). One stated rationale for banning large scale drift gillnets is to avoid ghost fishing (WCPFC, 2008c).	No performance standards are stipulated to assess the measure's effectiveness.	Design of drift gillnet gear in use and/or stowed onboard; Spatial location of fishing vessels when operating; List of vessels authorized to fish in the Convention Area.	b, c, e

Criterion 4C. Conservation and Management Measures to Mitigate Problematic Pollution from the Discharge of Catch, Offal and Spent Bait During Fishing Operations at Sea
Score: 3 of 14 possible points, 21%

Table A1.14-10 provides details on the assessment outcome for criterion 3.

Table A1.14-10. Assessment of WCPFC conservation and management measures to mitigate problematic pollution from the discharge of catch, offal and spent bait during fishing operations at sea.

Factor	Points for positive response
There are no relevant binding measures. Discharges of discarded catch, offal from processed catch and spent bait during fishing operations at sea from some WCPFC-managed fisheries may result in adverse ecological problems.	0
There is no provision that allows RFMO Members to opt out of binding measures.	3

Information used for assessment:

- Have studies been conducted that determined whether or not problematic pollution results from discharges of discarded catch, offal from processed catch, and spent bait from fisheries managed by the RFMO? Which fisheries managed by the RFMO have been determined to cause or not cause problematic pollution due to these discharges?

  No relevant assessments were identified.

- For fisheries managed by the RFMO that have not undergone assessment for adverse pollution from the discharges of discarded catch, offal from processed catch and spent bait, is there information available that documents whether or not the fisheries either: (i) occur in areas where adverse pollution effects from the these discharges are likely to result; (ii) the fisheries are understood to have potentially problematic levels of these discharges; and/or (iii) only nominal discharge levels occur, but they are spatially concentrated?

  No information was identified via materials available on the RFMO's website on risks from pollution from discards from managed fisheries.

  Purse seine fisheries on FADs can have relatively large levels of discharges at sea. Discharges from pelagic fisheries in deep sea areas may result in problematic alterations to benthic communities, and locking biomass up in bottom currents for centuries before recycling to the euphotic zone of the pelagic ecosystem (Hall et al., 2000). Small-scale gillnet and other coastal fisheries may also result in ecological problems from discharges. In general, large inputs of organic matter from discards at sea can increase natural nutrient levels in nutrient-poor benthic ecosystems, and in fisheries where discards are spatially concentrated, and especially in areas of low current flow, may cause localized hypoxia or anoxia of the seabed, which, if prolonged, causes avoidance and mortalities, alters benthic community composition, and alters ecosystem processes and structure (FAO, 1995 [Article 7.2.2g]; Goñi,

1998; Hall et al., 2000; Stevens et al., 2000; Gray et al., 2002; FAO, 2003a,b; Franco et al., 2008; Levin et al., 2009; Haselmair et al., 2010).

- Summarize active legally binding conservation and management measures related to pollution from the discharge of discarded catch, offal from processed catch, and spent bait, and identify any quantitative performance standards included in each measure (Table A1.14-11).

  There are no relevant binding measures.

- For what proportion of fisheries where pollution from discharges is documented to be problematic or otherwise are data deficient and pollution is likely to be a problem (fisheries occur in areas where adverse pollution effects from the discharge of discarded catch, offal from processed catch, and spent bait are likely to result, and the fisheries are understood to discharge more than nominal levels) have binding measures been adopted to mitigate pollution effects from discharges?

  No relevant information was identified for managed fisheries documenting problematic pollution, or are identified as being likely to cause problematic pollution, and there are no relevant binding measures.

- Of binding measures that contain quantitative performance standards, what proportion has been assessed for efficacy?

  Not applicable, there are no relevant binding measures.

- For what proportion of the binding measures that have been determined to be lacking in effectiveness (either through assessment against measurable performance standards stated in the measure or otherwise through other scientifically rigorous assessment) have steps been taken or are in progress to improve efficacy?

  Not applicable, there are no relevant binding measures.

- Does the RFMO allow Member States to opt out of binding conservation and management measures?

  No, WCPFC members cannot opt out of binding measures (WCPFC, 2000 [Article 20]).

- Table A1.14-11. Active WCPFC legally binding conservation and management measures related to discharge of discarded catch, offal from processed catch, and spent bait, whether the measure is legally binding, identify any performance standards and assess if these are quantitative and measureable or not, describe data requirements for performance assessment, and identify minimum surveillance resources to determine compliance.

Measure	Stipulated Performance Standards, Measurable or Subjective	Data Collection Needed for Implementation	Minimum surveillance resources necessary (a) dockside inspection, (b) at-sea inspection, (c) VMS, (d) onboard observers, (e) vessel list, (f) other (specify)
None	NA	NA	NA

Criterion 5. Surveillance and enforcement
Score: 9 of 20 possible points, 45%

Table A1.14-12 provides details on the assessment outcome for criterion 5.

Table A1.14-12. Assessment of WCPFC measures and resources for surveillance and enforcement.

Factor	Points for positive response
≥50% but <75% of requirements of binding measures on bycatch that facilitate surveillance can be assessed for compliance via surveillance methods that the RFMO requires member States to employ.	3
WCPFC requires CCMs to report to the RFMO on their enforcement procedures and conclusions.	3
WCPFC does not require CCMs to take specified enforcement procedures when an infraction of a binding conservation and management measure occurs.	0
WCPFC does not require CCMs to impose specified sanctions when an infraction of a binding conservation and management measure occurs.	0
The RFMO has a formal procedure to review and assess the effectiveness of surveillance and enforcement activities and adapt surveillance and enforcement methods if warranted.	3
Summary information on detected infringements of binding measures on bycatch and discards and resulting sanctions/prosecution of detected infringements by CCMs was not available via materials on the WCPFC website.	0

Information used for assessment:

- Does the RFMO require member States to employ specified surveillance activities? For example, surveillance for compliance with bycatch conservation and management measures might be conducted via aircraft and patrol vessels, dockside inspections, VMS, vessel registers (e.g., positive and negative lists to deter IUU fishing), and observer programmes of some RFMOs (Lodge et al., 2007; Gilman et al., 2008b). Onboard observer coverage is identified as a requisite method for surveillance only when compliance with a measure can be assessed only through analyses of observer programme data.

  In 2007, WCPFC3 adopted a Conservation and Management Measure for the Commission VMS, revised and replaced by CMM 2007-02 at WCPFC4 (WCPFC, 2007b), as required under the Convention (WCPFC, 2000 [Article 24(8-9)]). Standard Operating Procedures (SOPs) for the Commission's VMS were adopted in 2009 (WCPFC, 2009c). As of April 2009, vessels operating in the Convention Area were required to install an Automatic Location Communicator (a type of vessel monitoring system), which transmits a signal to a land-based receiving station where fisheries managers can view and track the location of fishing vessels (WCPFC, 2010b). VMS enables assessment of compliance with time/area restrictions on fishing effort. Based on the most recent available Secretariat quarterly report (second quarter of 2010), there are approximately 2,800 vessels registered on the VMS with monthly monitoring at about 1,800 vessels on the high seas (WCPFC, 2010c). Under CMM 2007-02, all

vessels operating in the Convention Area are to maintain VMS transmission when they move into a section of the Convention Area (bounded by 20°N and 175°E) where a VMS implementation date has yet to be established, from elsewhere in the Convention Area. With respect to the area north of 20°N and west of 175°E, the system will be activated at a date to be determined by the Commission.

CMM 2010-02 created stringent surveillance mechanisms for vessels operating in a high seas pocket (bounded by the EEZs of the Cook Islands, French Polynesia and Kiribati) in order to provide real-time tracking of vessels authorized to fish in the area (WCPFC, 2010g).

Under the Convention and CMM 2009-01, WCPFC Members are obligated to maintain and report a record of fishing vessels authorized to fish in the Convention Area in international waters, and the Commission Secretariat is mandated to maintain a centralized/pooled list of authorized vessels (WCPFC, 2000 [Article 24(4-7)], 2009d, 2010b). CMM 2004-03 provides specifications for vessel marking, where WCPFC Identification Numbers assigned to each CCM's authorized vessels are maintained as a part of the Commission's record of authorized vessels (WCPFC, 2004a). CMM 2009-08 identifies a mechanism for notifying the Commission of vessel charter arrangements (WCPFC, 2009e). In addition, the Commission maintains an IUU List, and members are prohibited from engaging in fishing activities or other related transactions with vessels that are on this negative list (WCPFC, 2010b,d).

The WCPFC Regional Observer Program provides data that could be used to assess compliance with and the efficacy of binding conservation and management measures (WCPFC, 2010b).

The Convention calls for boarding and inspection procedures of fishing vessels on the high seas by patrol vessels registered with the Commission by CCMs, and CMM 2006-08 adopted the boarding and inspection procedures on the high seas of the Convention Area, with a purpose of ensuring compliance with CMMs (WCPFC, 2000 [Article 25], 2006b, 2010b). This binding measure allows fishing vessels to be boarded and inspected by the patrol vessels of other WCPFC members (WCPFC, 2006b, 2010b).

- What minimum methods permit effective surveillance of the requirements stipulated in binding conservation and management measures on bycatch (record this information in Tables A1.14-7, A1.14-9, and A1.14-11)? For example, measures to support surveillance of lost and discarded fishing gear includes requirements for marking fishing gear, employing internationally agreed systems, so that the owner of derelict gear can be identified (Caddy, 1996). For the surveillance methods required to determine compliance with these requirements, which of these methods does the RFMO require vs. not require member States to employ?

  Surveillance methods necessary to implement binding CMMs, as identified in Tables A1.14-7 and A1.14-9 are:
  - Dockside inspection,
  - At-sea inspection,
  - VMS,
  - Onboard observers (100% onboard observer coverage would be required in all purse seine, longline, troll, pole-and-line, and other non-artisanal fisheries that take $\geq$2,000 mt of bigeye and/or yellowfin tuna in order to observe the weight of retained and discarded bigeye and yellowfin tunas)
  - List of authorized vessels, and

- Real-time locations of all anchored and drifting FADs

Of these requisite surveillance methods, WCPFC requires 4 of 6: VMS, authorized vessel list, and dockside and at-sea inspections. WCPFC does not require onboard observer coverage rates needed to monitoring compliance with CMM 2008-01 for annual catch limits or real-time monitoring of the locations of FADs.

- Are there RFMO requirements for member States to (i) take specified enforcement/prosecution procedures, (ii) impose specified penalties/sanctions against vessels that have been found to have committed a violation of a conservation and management measures, and (iii) report to the RFMO on these enforcement procedures and conclusions? Enforcement actions are likely to vary depending on the seriousness of the violation, and might include fines, seizure of illegal gear and catch, sequestration of the vessel, suspension or withdrawal of authorization to fish, and reduction or withdrawal of fishing quota. And (iv) can the RFMO impose sanctions against Members and/or non-Members in response to detected violations?

  Parties are required to annually report to the Commission on boarding and inspections and possible violations detected, and actions taken in response to observations of alleged violations by their vessels, including any proceedings instituted and sanctions applied (WCPFC, 2006b). The Commission is required to be notified of enforcement actions taken against vessels found to have taken an action determined to be a serious violation (WCPFC, 2006b). Under the Convention, WCPFC Members are required to annually report to the Commission information on the imposition of sanctions for any violations (WCPFC, 2000 [Article 25(8)]). WCPFC does not prescribe specific enforcement procedures or sanctions to be imposed by CCMs in response to identified violations of WCPFC binding measures.

- Does the RFMO have procedures to review the effectiveness of surveillance and enforcement activities, and recommend actions related to compliance with binding measures on a regular basis? Has the RFMO established a compliance committee with a mandate that includes evaluating compliance performance, and assessing efficacy of measures on surveillance and enforcement?

  WCPFC has a Technical and Compliance Committee, established by the Convention (WCPFC, 2000 [Article 11(1)]) and defined functions include assessing efficacy of MCS and enforcement (WCPFC, 2000 [Artlcie 14]). The Conservation and Management Measure for Compliance and Monitoring Scheme established a process to assess CCM's compliance with binding measures and calls for the Commission to adopt a range of responses to non-compliance (WCPFC, 2010h).

- Is there evidence that detected infringements of the RFMO's legally binding bycatch and discards measures regularly result in sanctions? How many violations of bycatch and discards measures are documented by the RFMO, and of these, how many resulted in the assessment of sanctions as required in RFMO measures?

  The two most recent annual reports produced by the WCPFC Technical and Compliance Committee did not review CCM identified violations of binding CMMs, CCM enforcement actions, or sanctions and penalties imposed (WCPFC, 2010i, 2011d). WCPFC Part 2 reports, which are not publically available, include sections

for CCMs to report a summary of annual surveillance activities, investigations and prosecutions. A summary of CCM surveillance and prosecution actions in 2010 Part 2 reports via WCPFC materials was not identified.