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Advice on incorporating Un-Accounted Mortalities in stock assessment and Management Procedure evaluation and implementation

Preece A, Davies, C.R., Hillary R.

CCSBT-OMMP/1609/05, CCSBT- ESC/1609/BGD-3

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Abstract

In light of the potential impacts of catches exceeding the recommended TAC, the CCSBT Extended Commission (EC) has indicated that in 2016 it will use a “direct approach” to account for catches by non-members in the 2018-2020 TAC block. This will involve setting aside an allowance from the TAC to account for non-cooperating, non-Member catches before allocating the remainder of the global TAC to Members and Cooperating-Non-Members (CNMs). The EC also agreed that members would account for any additional sources of mortality arising from their fisheries within their national TAC allocation (termed “attributable catches”). Sources of attributable catches were agreed and members are expected to commence reporting on aspects of attributable catches in 2016.

The Extended Commission has identified 2 approaches for accounting for non-cooperating, non-member (here after referred to as non-member) fishing mortalities in TAC recommendations beyond the current 2016 decisions. These are: 1) a “Direct approach”, as above, and 2) an “MP approach” which requires re-tuning the MP with unaccounted mortality scenarios, so that the TAC recommended by the MP takes into account the uncertainties in non-Member catches.

The EC has requested that the Extended Scientific Committee (ESC) provide advice on the relative merits of these approaches in the longer term (i.e. for the 2019 setting of the 2021-2023 quota block and beyond), and how this might be influenced by, for example, increasing trend in catches by non-Member fleets as the stock rebuilds, or for other reasons (Anon 2015 EC). The EC has also asked the ESC to develop a new MP by 2019 (for the setting of the 2021-2023 TAC block and beyond). The development of a new MP will involve reconditioning operating models with the catches (2018-2020) accounted for in the 2016 “direct approach” along with all other sources of additional mortality that the ESC considers justified. Incorporating all the sources of mortality in testing and tuning a new MP is equivalent to the “MP approach”, which is consistent with the CCSBT commitment to an MP approach for management of the stock (Anon, 2015). An additional consideration that may be of concern to the EC is how to account for a proportion of the historical non-member catches becoming member or CNM catch in the future. This can be accommodated, as part of the development and tuning of a new MP, if this were likely to occur.

The data available to the ESC to consider impacts of all sources of unaccounted mortalities remains quite limited. Very little new data has become available since the 2014 ESC consideration of this issue. We note that the time-series of catches (past and future) for these sources of fishing mortalities (member and non-member) will need to be resolved and specified prior to the reconditioning of operating models in 2017, for management strategy evaluation (MSE) of the new Management Procedure (MP) and stock assessments.

1 Introduction

The development and tuning of the CCSBT Management Procedure (MP) assumed that the TAC recommended by the MP would be caught perfectly. That is, there was no allowance for implementation error (catches being greater, or less, than the recommendation from the MP). At the time of adoption of the MP it was assumed that existing uncertainties in catches had been, or would be, resolved before implementation of the TAC advice in 2011. There was no provision for uncertainty in catches by members and CMNs (included with "members" in this paper), or additional catches by non-cooperating, non-members (here after referred to as non-members). As there continued to be evidence of total catches in excess of the TAC at the time of the second MP run and TAC recommendation in 2013, the Commission requested advice from the ESC on i) the sources and, ii) the likely impacts of unaccounted mortalities on MP performance.

The ESC reviewed the potential scale and impacts of member and non-member un-accounted mortalities on the performance of the MP and assessment of stock status in 2014 (Anon., 2014; Preece et al., 2014). The OMMP Technical meeting and ESC had difficulty defining the quantities of unaccounted mortalities associated with each of the potential sources due to the limited and indirect nature of the data available for this task (Anon 2014, para 21-30, 47-68). In the absence of more informative data, scenarios were developed for catch quantities, size-classes and temporal variability of potential unaccounted mortalities by the ESC (Anon 2014, para 28). Results from these scenarios indicated that there was limited impact on the stock status advice at that time, but the scenarios had the potential to undermine the rebuilding strategy for the stock and reduce the level of the TAC over the rebuilding period (Anon., 2014, Attachment 8).

In light of the potential impacts of catches exceeding the recommended TAC, the ESC requested that the EC and Compliance Committee urgently provide more detailed information to allow the impact of unaccounted mortalities to be properly assessed (Anon., 2014, para 95).The ESC Chair formally requested that members provide the ESC with access to the CDS data, which was considered a potentially useful source of information.

The ESC reviewed the request from the EC again at its 20th meeting in Korea (Anon., 2015, paras 72-85). However, there were no new data or information available to the ESC to assess the implications any further than those completed in 2014. It was noted at that time that a proposed review of SBT in the Chinese market may provide additional information on aspects of the unaccounted mortalities for the 2016 meeting of the ESC.

In preparing to set the 2018-2020 TAC in 2016, the EC has indicated that it will use a "direct approach" to account for catches by non-members, because there is insufficient time to re-tune the current MP to take account of the additional mortality. This will involve setting aside an allowance to account for non-Member catches from the TAC before allocating the remainder of the global TAC to Members and CNMs. The EC also agreed that members would account for any additional sources of mortality arising from their fisheries, termed "attributable catches", within

their national allocation. Sources of attributable catches [1] were agreed in 2014 and members are expected to report on allowances to be set for attributable catches for 2016-17 quota year to the EC in 2016. Members have indicated that they will use the potential increase in TAC for the 2018-2020 quota block to fully account for attributable catches (Anon 2015).

The Extended Commission has identified 2 approaches for accounting for non-member fishing mortalities in TAC recommendations in 2019 and beyond (Anon, 2015, para 72):

- *"The first approach (the "Direct approach") is to estimate the non-Member catch and then set aside an allowance to take account of non-Member catch before allocating the remainder of the global TAC to Members and CNMs.*
- *The second approach (the "MP approach") is to re-tune the MP to different scenarios that cover the plausible scenarios of catches from non-Members and have the MP recommend a TAC that takes into account the uncertainties in the non-Member catch."*

The EC has requested that the ESC provide advice on the relative merits of these approaches in the longer term (i.e. for the 2019 setting of the 2021-2023 quota block and beyond), and how this might be influenced by, for example, increasing trend in participation by non-member fleets as the stock rebuilds, or for other reasons (Anon 2015 EC).

The EC has also asked the ESC to develop a new MP by 2019 (for the 2021-2023 TAC block and beyond). This will involve reconditioning operating models with the catches (i.e. 2018-2020) accounted for in the 2016 "direct approach" along with all other sources of mortality, including the new components of attributable catch. An MP tuned using these operating models is the equivalent of the "MP approach". The CCSBT has endorsed the need for an MP approach for management of the stock (Anon, 2015).

Integrating all sources of fishing mortality, historical and into the future, into the testing and tuning of an MP is central to the scientific approach to decision-rule based management advice. This ensures, to the extent possible, that the MP selected and implemented is robust to the levels of catch occurring in the fishery (i.e. is likely to meet the rebuilding objective of the EC) and provides greater certainty and stability to members on future TACs.

The direct approach proposed by the EC operates outside of the MP context, in that the historical and future catches have not been incorporated into the conditioning of operating models and tuning of the MP (if they were incorporated, it would be the "MP approach"). The "direct approach" is however, a more precautionary implementation of the recommended TAC in the absence of re-tuning, compared with making no allowance for non-member catches.

The timeframe set in 2014 for defining the total fishing mortalities to be accounted as attributable and non-member catches (Anon 2014b, para 53) did not anticipate that the 2015 EC would request development of a new MP in 2016-2019, and that this would require updated operating

[1] Attributable catch is defined as: "*A Member or CNM's attributable catch against its national allocation is the total Southern Bluefin Tuna mortality resulting from fishing activities within its jurisdiction or control including, inter alia, mortality resulting from: 1) commercial fishing operations whether primarily targeting SBT or not; releases and/or discards; recreational fishing; customary and/or traditional fishing; and artisanal fishing.*" (Anon 2014b)

models for MP testing. Some of the potential sources of additional fishing mortality identified in 2014 (Anon 2014, Attachment 5- See appendix 1) remain unresolved, and it has not been decided which sources and amounts of catch will be accounted for in a non-member catch allowance, or in member attributable catches. There is potential for additional unaccounted mortality from members and non-members, which should be accounted for if considered plausible. Both current and historical catches will need to be defined in time for the reconditioning of the operating models in 2017 for them to be included in the MSE testing of new candidate MPs. Additional fishing mortality that is not accounted for elsewhere could be included as part of the non-member UAM scenarios considered in the two approaches, as discussed below. If additional mortality is not accounted for in testing the new MP then the EC will be in a similar situation as present, where total catches are greater than the catches against which the MP was tested, which leads to consideration of exceptional circumstances in the meta-rules process and a need to re-test and review MP performance and re-tune the MP.

2 The approaches

2.1 "Direct approach".

In the case of the "direct approach", additional fishing mortalities from non-members are accounted for as an allowance from the recommended TAC, and the remainder of the TAC is allocated to members and CNMs for their attributable catches. This approach will require members reaching agreement on an amount of additional catch that will be deducted from the recommended TAC before allocation of remaining TAC to the members and CNMs.

This method operates outside of the management procedure framework because the historical and future components of these catches have not been incorporated into the testing of the MP. It requires a negotiated agreement on the TAC "allowance" to account for fishing mortalities from non-members. The performance of the MP using this method is unknown, however, it is more precautionary to account for additional mortality within the TAC than not account for it at all.

Data requirements: A single estimate of the likely current additional catch is required for the 2018-2020 TAC decision by the EC in 2016. The catch estimate has not yet been determined. Negotiated estimates of non-member catches would be needed for each implementation of the direct approach in future TAC recommendations, unless non-members provide catch data.

Selectivity: The direct approach assumes that the selectivity or length-classes taken in the additional catches matches the selectivity of the whole fishery (i.e. the combined selectivity of each fishery weighted by their relative allocation), which may or may not be true. Taking X tonnes of small fish, compared with X tonnes of large fish, will have different impacts on the rebuilding plan for the fishery depending on the age–structure of the population at the time the catches were taken. These impacts are unlikely to be accounted for in the direct approach as amount and size classes of the catch has not been decided prior to the ESC.

TAC Implications:

- The implications of using this method are that less of the MP recommended TAC will be available for member and CNM allocation, and the maximum change allowed for in the adopted MP (i.e. 3000t), may become restrictive.
    - In cases where the additional non-member catch amount is greater than the recommended increase in TAC, then it would follow that all members would incur catch reductions for their attributable catches.
    - If the TAC recommendation is a catch reduction, member's allocations will be reduced further to account for the non-member catches. If the agreed additional catch amount is greater than the maximum TAC change then it may not be possible to reduce the TAC quickly enough to maintain the expected performance of the MP.
- This approach effectively provides a *de facto* allowance to non-members for their unreported and unregulated fishing mortality. The impact of the allowance for non-member fishing mortality is shared by all members.

2016 TAC decision: The direct approach has been adopted as an interim method to account for additional mortality in the 2018-2020 TAC block, as there is insufficient time for the re-tuning of the existing MP to account for these catches. As noted above, performance of this approach is unknown, but this is more precautionary than not accounting for additional mortality.

2019 TAC decision and beyond: The EC has requested that the ESC develop a new MP for use in 2019. This involves reconditioning of operating models and evaluating the performance of candidate MPs, therefore is equivalent to the "MP approach". Given this, the direct approach is redundant after the 2016 TAC decision as a new MP that has been demonstrated to be robust to specified levels of unaccounted mortality will be is scheduled to be in place for the 2019 TAC setting.

Accounting for future trends: Determining plausible increases and decreases with changes in stock size in the future would also need to be incorporated to address the Commission's concern about trends in unaccounted mortalities as the stock rebuilds (or for other reasons). This is best done as part of the MSE testing and selection of a new MP.

Science-based management: The Commission has endorsed proceeding with science-based management of the SBT stock through an MP and has requested development of a new MP to be ready to be used to recommend the TAC for the 2021-2023 TAC block in 2019. The "direct approach" operates outside of MP, and does not fit with the intention of the EC to incorporate all major sources of uncertainty and test the robustness of the current or future candidate MPs to these uncertainties.

2.2 "MP approach"

For the "MP approach" additional fishing mortality is included as part of the total catch taken in the operating models used to test and tune the MP. This could be done using catch scenarios or an implementation error approach. When an MP has been tested and tuned in this manner, there is no need for a separate allowance for additional catches to account for their impact on the stock. The recommended TAC is only allocated amongst members for their attributable catches and is robust to a specified level of uncertainty in non-member and/or additional fishing mortality. This is not the case for the current MP, as it assumes there are no additional sources of mortality beyond the TAC.

Data: Additional catch scenarios would need to be specified that encompass both plausible historical and future catches. Amounts can be added to the historical catches (in absolutes (i.e. tonnes) or as percentages) of the fishery with the closest matching selectivity to the additional catch scenario. Alternatively a new fishery could be added to the operating models to accommodate the additional catches. For future catches, catch multipliers can be applied to the matching projection model fisheries. The most plausible scenarios could be included as a new grid element in the reference set of operating models. Additional scenarios may also be included in robustness sets of operating models, and performance testing and tuning of the MP would be across these uncertainties in additional fishing mortalities to ensure to the extent possible that the candidate MPs are robust to these other sources of mortality.

An alternative to fixed catch scenarios is using a stochastic implementation error term in the simulation models. This may be implemented as a simple random variation around the TAC or a combination of a bias and CV, which would allow the implementation of scenarios for plausible trends in unaccounted/additional mortalities. The error term is applied to the recommended TAC during testing and tuning of the MP and would represent the likely scale of non-member or any other unaccounted catches. A number of replicates would be run for each model in the reference set. This method has been used (for example) in evaluation of harvest strategies for the key target species in the Eastern tuna and Billfish Fishery in Australia (Kolody et al, 2010; Hillary et al, 2016).

Selectivity: The assumed selectivity of the additional catches would be accommodated through assigning the additional catches to the closest matching fisheries as defined in the operating models.

TAC implications: For the MP approach, the likely impacts on TACs will be that recommended TACs are lower than TACs from MPs tuned not with additional catches. However, the full maximum increase (or decrease) in TAC (3000t in the current MP) would be available for allocation to members. The uncertainty in catches, identified in the scenarios/implementation error, will be encapsulated in the MP testing and the TAC recommended by the MP should be robust to this uncertainty, if the size and length classes impacted are adequately specified. There is no "allowance" in the TAC to non-members. As with the direct approach, the impact of additional catches is shared among all members.

If the EC is concerned about allowing for potential new members in the future as part of the testing of a new MP, this could be considered when setting up the MSE projection models. As noted above, it is necessary to account for both historical and future total catches in the Operating Models used in the MSE in order for the future MP to be robust. A proportion of the historical non-member catches can be included in the data input file to the MP to allow for potential new members or CNMs. The change is to the base catch level which the MP decision rule adjusts up or down. The recommended TAC from the MP would be for all members (including the new-member(s)). If all mortalities are included in the OMs it is less likely that there will be the need to retune the MP to account for such a development (i.e. additional members to the EC).

2016 TAC decision: The Commission has stated that it will use the direct approach in 2016 TAC setting.

2019 TAC decision and beyond: The MP approach allows for the inclusion of all sources of unaccounted mortality in the OMs, and the new MP will be tuned to be robust to these uncertainties.

Accounting for future trends: Catch scenarios need to include plausible future trends in additional catches, to address the Commissions concern regarding future trends in non-member catches, or other catches, as the population increases under the rebuilding plan. If we use the same method, i.e. the additional catch multipliers, used in projections of the unaccounted mortality scenarios in 2014, this will scale the additional catches up and down as TACs increase and decrease which we could assume is indirectly linked with associated increases/decreases in the population. This wouldn't take into account changes in non-member effort or targeting of SBT. The implementation error method can also scale the additional catches in relation to changes in

TAC recommendations, and thus would indirectly take into account the potential trend in catches with increasing population size.

Science based management: The MP approach requires reconditioning of operating models, evaluation of performance and tuning the MP to be robust to additional sources of mortality and their uncertainties. Since the CCSBT has request that the ESC develop a new MP that uses new data, this work is already underway and scheduled within the CCSBT work plan, for completion prior to the next TAC decision in 2019. The CCSBT has endorsed the need for an MP approach for management of the stock, and the MP approach is consistent with this endorsement.

3 The available data

The data to inform the discussions of unaccounted mortalities and methods to account for them is limited, disputed or unavailable (Anon 2014). Very little new data has become available since the 2014 sensitivity tests on the impacts of potential unaccounted mortalities on MP and stock assessment advice (Preece et al 2014, Anon 2014).

Regardless of the method chosen for setting TACs in the future, the historical additional catches (not already accounted) need to be integrated into the updated OMs. When incorporating additional (member and non-member) catch estimates in the operating models we need to consider the data available, the method for estimating the catch amount, which fishery selectivity they reflect most closely, the years over which they are to be applied historically and how they are to vary in future with changes in stock size (Preece et al, 2014). For member's attributable catches, additional considerations for their technical implementation in the operating models include whether or not these scenarios might affect CPUE interpretation, age or length frequencies, or tag reporting rates (Preece et al 2014).

The sources of un-accounted mortality that have been considered previously by the ESC were included in table 1 from attachment 5 of the 2014 ESC report:

Source of unaccounted catch	
Unreported or uncertainty in retained catch by Members	• Small Fish Surface fishery • Artisanal catch • Large fish: members exceeding catch allowance
Mortality from releases and/or discards	Small fish Discarded catch Large fish: discarded catch
Recreational fisheries	All sizes: recreational catch
Catches by non-Members	Large fish: Non-member catch
Research Mortality Allowance	No additional -already included
Other sources of mortality	Possible depredation

In the absence of quantitative data to inform estimates, the 2014 ESC developed 4 scenarios for member and non-member unaccounted mortalities, for the sensitivity tests. The OMMP and ESC noted that the unaccounted mortality scenarios were based on very limited data for current or historical estimates and almost no information on how the unaccounted mortalities might vary over time, or continue into the future (OMMP4). The four scenarios were "added-catch", which

incorporated many sources of additional mortality (details below), and 3 hypotheses for the uncertainty in the catch from the potential bias in size sampling for the Australian surface fishery (the three scenarios were 20%, 40% and 0% historical and future catch anomalies).

The 2014 “added-catch scenario” was developed to encompass all sources of member and non-member unaccounted mortalities. It was comprised of 1000t of “small fish” (to represent recreational catches, small fish discard mortalities), 1000t of “large fish” (to represent over-quota catches by members, discard mortalities, recreational catches), and the surface fishery 20% catch anomaly and related changes in catch–at-age for that fishery. This “added catch scenario” gradually ramps up catches from 1990 to 2013. The “small fish” and “large fish” specifications are used to assign the additional catch to fisheries that take a matching or similar size range of fish. This assignment to a particular fishery in the OMs is to ensure that the impact of the potential additional catches on the stock is appropriately represented. It does not necessarily attribute the additional catches to that fishery. In the projections, the future added-catch associated with this scenario stays at the same fraction of the accounted catch assumed for 2013. The “added- catch scenario” had the largest impact on performance of the MP. Further details of the discussion of sources of UAM are in Attachment 5 of the 2014 ESC report (provided in Appendix 1 of this paper) and in the 2014 OMMP report.

Some of the catch components from these scenarios will be accounted for in member’s future allocations of attributable catches. However, the historical components of attributable catches and any future uncertainties in these will still need to be incorporated in the operating models for MP testing. Research mortality allowance is already deducted from the TAC and accounted for in total catch in the operating models.

Methods for estimating catches by non-members through analysis of non-member effort and member catch rates, were proposed by the 2014 ESC. In 2015, 2 methods were used to attempt to quantify potential non-member catches in the Pacific and Indian Oceans (Chambers and Hoyle 2015; Hoyle and Chambers, 2015). The methods are based on using the catch rates of SBT from CCSBT members in similar areas, and applying these catch rates to the effort from non-members in the same regions. The mean total catch by non-members was estimated to be 120 to 580 t for 2011-13 using the two different approaches (Anon 2015).

These approaches have been revised and extended for the 2016 ESC (Edwards et al, 2016). The updated analysis includes the Atlantic Ocean using non-member effort data from ICCAT. Two different methods were applied and catch-rates from Japanese Longline and Taiwanese fisheries were used to provide results. Estimates from the two methods are now similar. There are substantial difference, however, depending on whether the Japanese or Taiwanese CPUE data are used to scale the non-member effort. The methods use some aspects of the historical catch data, which is highly uncertain given the historical over-catches.

The CCSBT has also funded a project investigating the presence of SBT in the markets in China. The results from this study were not available at the time of writing.

Specifying the historical and future catch estimates for the non-member fishing mortalities and the uncertain components of the member’s attributable catch will need to occur in time for the reconditioning of the SBT OMs in 2016-2017 so that these data can be used for updated stock status advice and in testing of a new MP in 2017. Catches taken, or assumed taken, would be

incorporated in the regular CCSBT data exchange for updates of total catches reports and in data files for future updates of the OMs.

The EC has taken actions to account for the impact of non-member catches on the performance of the MP, with the approaches reviewed here, and in refining the definition of attributable catch. Un-resolved potential sources of additional fishing mortality remain an issue for full accounting of total fishing mortalities and their impact on the rebuilding performance of the SBT management procedure.

4 Conclusions

We recommend that the MP approach be adopted for accounting for the impact of non-member catches, and more broadly, for all sources of fishing mortality in future TAC advice. This approach is recommended because the ESC will initiate development of new candidate MPs in the coming 12 months, and technical methods for incorporating all sources of additional fishing mortality can be included and fully tested using updated and reconditioned operating models (i.e. via the MP approach). If sufficient levels of additional fishing mortality are incorporated into the operating models used in the evaluation of the new candidate MPs, the TAC advice from the selected MP will be robust to those levels of fishing mortality and uncertainties in them. Importantly, the safe guards provided by the meta-rules and over-arching MP framework will apply because the OMs will have a consistent accounting of additional catches in the both the conditioning and projections components. The MP approach will ensure best-practice science-based management of the fishery for which the CCSBT has been recognised as an international leader.

The data available to inform the catch estimates (for either approach) remains very limited and continues to constrain the level of specificity of the scenarios. The additional catch scenarios will need to encompass any unaccounted mortalities and uncertainties in catches that are not encompassed in the members “attributable catches”. Further advice from the Commission and Compliance Committee is a priority for 2016 to inform the updating of historical and future scenarios for reconditioning of operating models planned in 2017.

References

Anon. 2015. Report of the Extended Commission of the Twenty Second Annual Meeting of the Commission, 12-15 October 2015, Yeosu, South Korea.

Anon. 2014a. Report of the Nineteenth Meeting of the Scientific Committee, 6 September, 2014, Auckland, New Zealand.

Anon. 2014b. Report of the Extended Commission of the Twenty First Annual Meeting of the Commission, 13-16 October 2014, Auckland, New Zealand.

Anon. 2015. Report of the Twentieth Meeting of the Scientific Committee, 5 September 2015, Incheon, South Korea.

Chambers and Hoyle 2015 Chambers M, Hoyle S. 2015. Estimates of non-member catch of SBT in the Indian and Pacific Oceans. CCSBT-ESC/1509/10.

Edwards et al, 2016 Edwards C, Williams A, Hoyle S. 2016. Estimates of Southern Bluefin Tuna Catch by CCSBT Non-Member states. CCSBT-ESC/1609/BGD-02.

Hoyle and Chambers Hoyle S, Chambers M. 2015. Estimating Southern Bluefin Tuna Catches by Non-Members of CCSBT. CCSBT-ESC/1509/21.

Kolody DS, Preece AL, Davies CR, Hartog JR, Dowling NA. 2010. Integrated evaluation of management strategies for tropical multi-species long-line fisheries. Final report to the Fisheries Research and Development Corporation. CSIRO Marine and Atmospheric Research, Hobart.

Preece A, Davies C, Hillary R. 2014. Implications of unaccounted mortalities on stock status and projected rebuilding using the management procedure. CCSBT-ESC/1409/20.

Appendix 1 – Unaccounted mortalities considered in 2014

Attachment 5 of the 2014 ESC report:

"*This Attachment summarizes (1) the possible sources of unaccounted mortality, (2) what data currently exist that could be used to estimate unaccounted catch, (3) what data could be collected that would improve understanding of unaccounted catch, and (4) what analytic procedures could be used to calculate unaccounted catch*." (Anon 2014)

Attachment 5

Unaccounted mortality

The possibility of unaccounted for mortality raises important issues for the rebuilding of the stock and the success of the management procedure. The current MP was tuned assuming that future catches equaled the amount indicated by the procedure. In addition a series of robustness trials have been run to show performance for some other possible levels of historic and future unaccounted mortality, as well as anomalies in inputs to the MP. Unfortunately, estimates of unaccounted for mortality are either incomplete, unreliable or disputed, or they do not exist. This Attachment summarizes (1) the possible sources of unaccounted mortality, (2) what data currently exist that could be used to estimate unaccounted catch, (3) what data could be collected that would improve understanding of unaccounted catch, and (4) what analytic procedures could be used to calculate unaccounted catch.

The following potential types of unaccounted for catch have been identified

Source of unaccounted catch	
Unreported or uncertainty in retained catch by Members	• Small Fish Surface fishery • Artisanal catch • Large fish: members exceeding catch allowance
Mortality from releases and/or discards	Small fish Discarded catch Large fish: discarded catch
Recreational fisheries	All sizes: recreational catch
Catches by non-Members	Large fish: Non-member catch
Research Mortality Allowance	No additional -already included
Other sources of mortality	Possible depredation

Small fish: Surface fishery

Existing data and analysis

Data are needed on the number, size, age and weight at transfer into grow-out cages.

Number at transfer is measured by counting fish as they are transferred from tow cages to rearing cages. Observers record mortality during the towing process.

Size and weight at the time of introduction into rearing cages is measured by the 40 (prior to 2013) or 100 (since 2013) fish samples, adding to a total sample of about 3,000 SBT per season. SBT under 10kg are not included in the samples. Australia applies the mean weight in the samples to the number of fish captured (number transferred from the towing cage plus number of fish that die during catching, towing and transfers) to estimate the total weight of fish captured. The exclusion of fish less than 10kg from the estimate of mean weight tends to positively bias the estimate of catch weight.

Japan has used mixed normal modal analysis to estimate the age composition of farmed fish sold into Japan using length frequency data of imports. The source of the length frequency data is considered confidential by Japan. The estimated age composition of imports is used to impute the weight of catch using information on length at age of wild fish and a weight-length function. Such estimates of catch have been challenged by some members because of concerns about the source and representativeness of length frequency data and other assumptions. This approach could be improved by using CDS data (length and weight at time of harvest), which are held by CCSBT but are, at present, not available to members. There are modes in length representing ages in the 40/100 fish sampling data and length frequency data of imports reported by Japan, in some years. If these modes are identified in the CDS data, modal analysis could be used to estimate catch and possible bias in catch reports resulting from the 40/100 fish samples.

Other data that exists and would need to be taken into account to assess results.

(1) Data on when fish are put into farms and how long fish are held in the farms
(2) Growth rate data from fish in farms compared to wild fish (other studies not CCSBT)
(3) Growth rates of tagged fish from SRP that are subsequently harvested in farms
(4) Feed conversion ratios for the farms
(5) Differences in growth rates of each age group
(6) Current wild growth rates

New data sources and analysis

Uncertainty in the surface fishery catch may be reduced by the use of a stereo video system to address estimates of Australian catch by the surface fishery. Australia has demonstrated the potential utility of this method which it had planned to use to replace 100 fish samples. However, the method has not been made operational to date.

Experimental trials comparing stereo video to the 100 fish sample could be used to investigate the accuracy of 100 fish sample.

Another approach would be to take a 100 fish sample just prior to harvesting all the fish in pens. The estimated weight from the 100 sample could be compared to the calculated weight of harvested fish using their length frequency and a weight-length relationship or the sum of the weight of harvested fish.

Process aspects

The ESC encourages all countries to make their CDS data available to facilitate and improve analyses.

Small Fish: Release and discard mortality:

Japan reports releases during its RTMP programme. At present there are observer estimates of the number of small fish released or discarded from some other fleets. These numbers could be evaluated under a range of estimated/assumed release mortality to estimate the mortality from release and discard.

Japan put forward a methodology and an associated estimate of 9% for release mortality. Other members noted that some studies of other tuna species suggest that this may be an underestimate. Some suggested that bounds on release mortality be 9% to 100%, given uncertainly on mortality rates. The same approach could be applied to other fleets.

Small and Large fish Catch by non members

At the meeting of the Operating Model and Management Procedure Working Group (OMMP5) in Seattle in July the working group discussed the request from the Extended Commission and noted that the working group did not have the information required to estimate all unaccounted mortalities. The working group summarised the methods and sources of information required to better inform unaccounted mortality scenarios (Attachment 5, OMMP5 report), and encouraged the ESC, Compliance Committee and Extended Commission to work towards filling the gaps in the information base.

The working group proposed that scenarios could be developed by applying SBT bycatch rates in longline fleets to the effort by non-Members in the same areas and months. The meeting agreed that Members should evaluate the SBT by-catch rate of their own longline fleets which target other species to inform this analysis (CCSBT 2014). These approaches are documented in WP 13. It is noted that these methods will not provide any estimates of IUU catch, where there is no effort reported to the relevant RFMOs.

The ESC requests that the Compliance Committee consider approaches to monitor and review markets in order to provide further information that may inform the ESC considerations.

Reported catch exceeding current allowances

Over the last few years members reported catch has been very close to the catch allocations.

Indonesia has reported that their catch exceeded their allowance for a total of 1074 t. over the four years 2010 to 2013.

Unreported catch by members

Member countries report effort to CCSBT for all targeted SBT fishing. Although, there is some additional fishing effort by some member countries in areas where SBT are known to occur, such bycatches are expected to be included in the SBT catches reported.

Australia presented a paper (ESC/1409/12) suggesting there may be discrepancies in the market data and there may be unreported catch. This is based on the assumptions in the Japan Market Review, agreed by the CCSBT, on fish reported to be domestic, imported wild caught from foreign fleets and farmed. Japan suggested that these imbalances are due to the difference between fish that go through the auction and those that are traded only on paper. Actually resolving this issue is beyond the scope of the ESC, but it is a very important issue for the reliability of the stock assessment and performance of the OMP. A high proportion of the ESC work is dependent on reliable data on actual removals.

New data sources and analysis

Other data and analyses exist that would assist in resolving this uncertainty. Given the scientific technical expertise of the ESC, further consideration of market monitoring is more appropriately considered by the Compliance Committee. The ESC requests the EC and CC consider reviews and analyses that will clarify key assumptions of market monitoring. This should include consideration of:

a) a review of the data from Japan's monthly monitoring at Tsukiji since 2008 to verify the assumptions regarding number, weight and source of fish;
b) monthly data on the number, weight and source country of frozen SBT auctioned and not auctioned at Tsukiji; and
c) undertaking independent market reviews at significant markets.

The ESC encourages all countries to make their CDS data and information on market monitoring available to facilitate and improve analyses.

The ESC requests the Compliance Committee provide the results of these to the ESC for consideration in future assessments of stock status, projects and reviews of the performance of the MP.

Recreational fishing

Australia makes some estimates of their recreational catch but is currently in the final year of a project to develop a better methodology.

Other Sources

Marine mammal depredation was raised as a possible other source of unaccounted catch. This could be considered a source of background natural mortality, but if the rate of depredation has been rising (for instance due to increasing marine mammal populations and learning by these animals) then it is a potential concern.

CONTACT US

t 1300 363 400
+61 3 9545 2176
e csiroenquiries@csiro.au
w www.csiro.au

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FOR FURTHER INFORMATION

Oceans and Atmosphere
Ann Preece
t +61 3 6232 5222
e ann.preece@csiro.au
w www.csiro.au

Oceans and Atmosphere
Campbell Davies
t +61 3 6332 5222
e campbell.davies@csiro.au
w www.csiro.au

Oceans and Atmosphere
Rich Hillary
t +61 3 6232 5222
e rich.hillary@csiro.au
w www.csiro.au