## Estimating unaccounted catch mortality in southern bluefin tuna fisheries

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#### 1. Summary

The ESC is planning to update the stock assessment for southern bluefin in 2014. The ESC agreed at the last meeting on the catch input data to be used in the Operating Model and also agreed to a number of sensitivity runs. One of these runs is to include all sources of unaccounted mortality not previously included in the stock assessment.

There are many sources of unaccounted mortality in the SBT fisheries but it is difficult to quantify many of these. The proposed approach is for the ESC to agree on the best estimate of mortality estimate from each identified source at the next meeting. This paper outlines the possible sources of unaccounted morality and identifies some of the data required to estimate these mortalities. At the OMMP meeting these unaccounted mortalities will be discussed and recommendations made to the ESC on the inputs to the sensitivity analysis for unaccounted mortality.

### 2. Introduction

The ESC is planning to update the stock assessment for southern bluefin in 2014. To progress the development of the new assessment, the ESC held a technical discussion on the data inputs and assumptions to be used in the Operating Model at their last meeting. Attachment 8 of the Report of the Eighteenth Meeting of the Scientific Committee outlines the results of this technical working group discussion (attached as Appendix 1). The ESC agreed on the catch input data to be used in the Operating Model and also agreed to a number of sensitivity runs. One of these sensitivity runs is where all unreported catch mortalities are included.

At the 20th meeting of the Extended Commission in Adelaide this issue was discussed and the following request was made of the ESC (paras 67 and 68 of Commission report):

67. In addition, the EC requested the ESC to conduct sensitivity analysis around all sources of unaccounted catch mortality as part of the ESC's planned 2014 stock assessment and to incorporate this information in its advice on the existence of exceptional circumstances and approach to follow as defined in the Management Procedure in accordance with the metarule process. The EC also asked the ESC to provide preliminary advice to CCSBT 21 on the impact of any unaccounted catch mortalities on the stock assessment projections and the possible Management Procedure recommendation beyond the 2015-17 quota block.

68. The sources of mortality should include:

- Unreported or uncertainty in retained catch by Members, for example:
  - o surface fisheries,
  - o artisanal catch,
  - o non-compliance with existing measures (e.g. catch over-run);
- Mortality from releases and/or discards;
- Recreational fisheries;

• Catches by non-Members;

• Research Mortality Allowance; and

• Any other sources of mortality that the ESC is able to provide advice on

(including depredation).

New Zealand agreed at the ESC and the Commission meetings to collate all the known information on unaccounted mortality of SBT catches. The purpose of this report is to outline the approach to be taken by the ESC to estimate unaccounted mortality from all the sources listed above and how these will be included in a sensitivity analysis of the Operating Model.

## 3. Methods

There are three decisions required for each source of unaccounted mortality added to the model:

- (i) the total volume of mortality in tonnes;
- (ii) the time period over which the mortality applies; and
- (iii) the likely size structure of this catch.

The size information is important to ensure that catches in the assessment model are removed from the appropriate section of the population. After discussions with the leader of the stock assessment team it was agreed that the sensitivity analysis for 2014 would be limited to adjustments to the catch volumes assumed for each fleet component. The reason is that this would not require any complicated coding to be written and tested before the models could be run. Although this reduces the flexibility for allowing for unaccounted mortality in the assessment this year, it should still provide enough information to respond to the request from the Commission.

In the current stock assessment catches are input to the Operating Model as one of five fleet components, which are assumed to have separate distinct length frequency distributions (based on the assumed or estimated selectivity patterns):

- LL1 (includes Japanese longline)
- LL2
- LL3
- LL4 (Indonesian spawning fishery)
- Australian surface fishery

The combined size frequencies over the last 5 years for each of these fleet components are presented in Figures 1 and 2. Some of the modes in the distributions are similar but overall they have quite different size distributions.

Each unaccounted source of mortality will be matched to the size distribution which most closely matches it and added to the catch volume input for the respective fleet in each year. For example the Australian recreational catch appears to be mainly small fish, therefore these catches should probably be added to the surface fishery (juveniles) to reflect the correct size distribution of the catch.

Another consideration is the years over which to correct the catches for unaccounted mortality. It is proposed to add these additional mortalities from 2000 onward but this period needs to be agreed by the ESC.

## 4. **Results**

## 4.1 Unreported or uncertainty in retained catch by Members

## (a) Surface fisheries

The current assessment of SBT includes an assumption (correction) for overcatch by the Australian surface fishery. The ESC has included 20% overrun to the catches reported for each year from 2000 (ramping up from 1% overrun in 1992 to 20% in 2000). This correction has been accepted and included in the OM. However, there are better estimates available for the total catch of the Australian surface fishery from 2007-09 based on mixture distribution analysis of length frequency data, and these estimates may be more appropriate to use (CCSBT-ESC/1208/30). These estimates should be considered an improvement on the *ad hoc* approach currently used and the average of these estimates could be used to replace the 20% assumption.

## (b) Artisanal catch

At the 20<sup>th</sup> Commission meeting Indonesia requested an allowance of 300 t per year to cover the expected catch from vessels less than 30GT not authorised to land SBT (CC/1310/18). Information supplied to the Secretariat shows an increasing overcatch of their allocation in recent years. Table 1 shows that for the four year period 2010 - 2013 inclusive, Indonesia has exceeded its catch allocation by a combined total of 684t. In addition, records from the GTA trade statistics (exports of fresh and frozen SBT) indicate there are exports to seven countries which do not have CDS forms (most of these countries are NCNMs).

"For Indonesia, the exported quantities recorded on the GTA database are consistently quite low, and many times below the exported quantities of SBT recorded on the CDS database. Therefore, the GTA database does not appear to provide a realistic indication of Indonesian exports of SBT." (Secretariat's paper CCSBT-CC/1310/15)

How much of the artisanal catch is currently included in the reported catches is unknown. There is reference to SBT being transferred to CCSBT authorised vessels that fill out the CDS forms. However, what catch is not being reported on CDS forms is not known, and the Secretariat is following this up with Indonesia. The Phase I and II QARs may provide more information later this year concerning catch reporting in the Indonesian fishery (2014 reports are due by 31 August 2014).

(c) Non-compliance with existing measures

No new information

4.2 Mortality from releases and/or discards

Members have reported discards each year from the SBT fishery in their national reports. In most cases these represent live releases. In recent years the number of releases has increased a lot as the abundance of smaller SBT has increased.

The RTMP data showed that Japanese longline vessels released and discarded 10101 SBT in 2012 calendar year (CCSBT-ESC/1309/33). According to the visual size measurement by the fishermen, 78% of them were <20 kg (corresponding to ages  $\leq$ 4 years).

CCSBT-ESC/1309/34 described the estimation of post-release survival of southern bluefin tuna (SBT) released from Japanese longline vessels using pop up archival tags (PSAT). Based on a small sample size these data showed that a post-release survival rate was roughly 91%.

These values will be used to estimate the unaccounted mortality resulting from live releases/discards. Where no discards are reported, an allowance could be made based on the reports from Observers in the same fishery/area

## 4.3 Recreational fisheries

Several member and CNMs have potential recreational fisheries on SBT.

### (a) Australia

Recreational catches in Australian surveys have historically provided fairly low estimates of annual harvest by this sector (Table 2). However, there are two recent reports available on recreational harvest of SBT in the Australian states of Victoria (Green *et al.* 2012) and Tasmania (Tarcey *et al.* 2013), which indicate that the recreational fishery has increased. This may be due to increased abundance of fish and/or increased access to the fish through better communication and larger recreational vessels.

In Victoria it was estimated from a survey in 2011 that 19,700 fish (240 tonnes) were taken and another 6900 caught and released. The size distribution was dominated by fish less than 90 cm with size decreasing throughout the fishing season from March to July. The average size of SBT taken in this fishery in 2011 was 12 kg.

In Tasmania the survey estimated 60t of catch from ramp surveys plus another 16t in the charter boat fishery. Depredation by seals accounted for another 25t in this survey. Releases by fishers were 24% of total catches of SBT. The size distribution showed a similar decrease throughout the season from March to July, average weight of the catch was 16.6 kg.

Tagged releases of SBT by recreational fishers increased from 2005 to 2011 (Figure 3). This sudden increase in tag releases may reflect the catch and effort that has been attracted to the SBT recreational fishery. Most of these tag release are from the state of South Australia. The small size of fish taken in the recreational fishery suggests catch will vary with the abundance of young SBT.

#### (b) South Africa

A bag limit of 10 fish per day and a minimum legal size limit of 6.4 kg are in place. However, there are no reports of recreational harvest available.

#### (c) New Zealand

A small recreational catch of a few fish per year has been reported in the New Zealand country reports to ESC and CC.

#### 4.4 Catches by non-Members

At the Commission meeting members were informed by the Chair they there were catches of CCSBT being taken by non-members in the South Pacific. It is apparent that there is an increasing catch being taken as the non-member vessels fish further south in recent years, possibly from intended targeting of SBT. Unreported catches may also be taken from other areas.

Reports by non-members to other RFMOs were studied to determine the area and season of fishing by these longline vessels plus the total effort expended. However, no catches were reported of SBT in these reports to WCPFC. Unless the overlap of fishing with the SBT fishery in the same area/season can be determined, no estimate of likely catch of SBT by non-members is possible.

No new information obtained.

## 4.5 Research mortality allowance

These are only minor sources of mortality from the research allowances and these are already included in the catch figures.

## 4.6 Any other sources of mortality

No other information obtained.

## 5. Future work

To fully quantify all mortality on SBT the fisheries of member countries will need more extensive monitoring by Observers to record discards and live releases. The following studies should also provide more information in the future when completed:

- QAR reports from CCSBT members due 2014 and 2015
- Australian recreational survey results available 2015
- Results of experiments on survival of released SBT (IMAS Australia)

## 6. References

Anon (2013): Proposal to Re-Asses Indonesia's Annual Catch Quota. CCSBT-CC/1310/18

- Green, C., Brown P., Giri K., Bell J. and S. Conron (2012) Quantifying the recreational catch of southern bluefin tuna off the Victorian coast. *Recreational Fishing Grants Program Research Report. Department of Primary Industries, Victoria*
- Itoh T., Y. Akatsuka, T. Kawashima and M. Mishima (2102): Analyses on age composition, growth and catch amount of southern bluefin tuna used for farming in 2007-2010. *CCSBT*-*ESC/1208/30*
- Sakai O. and T. Itoh (2013): Releases and discards of Southern Bluefin Tuna from the Japanese longline vessels in 2012. *CCSBT-ESC/1309/33*
- Sakai O. and T. Itoh (2013): Post-releases survival of Southern Bluefin Tuna released from longline vessels. *CCSBT-ESC/1309/34*
- Tracey, S.R., J.M. Lyle, G. Ewing, K.Hartmann and A. Mapleston (2013): Offshore recreational fishing in Tasmania 2011/12. *Institute for Marine and Antarctic Studies Report*

Year	Allocation (t)	Catch Weight of Recorded in the CDS (t)	Reported Total Annual Catch Weight (t)	Tonnage by which the Total reported Catch Exceeded the Allocation (t)	Percentage of Reported Annual Catch Weight Recorded in the CDS
2013	709	604.02	992.52	283.52	60.86%
2012	685	825.44	909.76	224.76	90.73%
2011	1202	731.73	842.40	175.0	86.86%
2010	1302	613.37	635.50 <sup>1</sup>	175.9	96.52%
Totals	2,696	2,774.56	3,380.18	684.18	

# Table 1: Indonesian catch of SBT reported to CCSBT 2010 to 2013

<sup>1</sup> 2010 Reported Annual Catch Weight: Includes 13.6t of specifically noted as artisanal catch and not recorded by the CDS.

Table 2: Estimates of Australia-wide recreational catch of SBT (Hobsdawn et al. 2007)

Calendar year	Recreational catch (tonnes)
1994	16
1998	38
1999	3
2000	10
2001	60
2002	85







Figure 1 (contd): Combined 2008-12 length frequency of fleet components in the SBT fishery



Figure 2: Length frequency of SBT purse seine catch in Australia 2008-09 to 2012-13 from tow cage monitoring database (Reference: CCSBT-ESC/1309/SBT Fisheries – Australia)



Figure 3: Tag releases of SBT by Australian recreational fishers.

## Appendix 1

# Summary of Technical Working Group Discussions (Attachment 8 of Report of the Eighteenth Meeting of the Scientific Committee)

The technical working group discussed the OM issues with the aim of preparing for the 2014 stock assessment. The following items discussed and the decisions made are noted.

#### OM issues:

1) Assumptions about adult natural mortality in connection to effects on Indonesian selectivity and the size of the plus group.

Decisions:

- Range of M10 values to include in grid (previously six values examined: 0.03 0.04 0.05 0.075 0.1 0.125) *Drop 0.03 and 0.04 for the base* 

- Age at which M starts to increase (currently 25) Keep at 25, already a quite complex natural-mortality at age set of options, no support for alternatives (cross-reference 2009 findings and how we arrived at senescence as a plausible scenario)

- Age at which Indonesian selectivity becomes constant (currently 25) Conduct a sensitivity in which the age of Indonesian selectivity becomes constant at age 20, and for this grid of M10 values along a reasonable range that is sampled and is numerical stable.

2) Close-kin assumptions

- Sensitivity analyses conducted in Portland indicate the results were not too sensitive to alternative assumptions about maturity ogives.

3) Sample sizes and likelihood weightings Decisions needed:
Keep same "pragmatic" approach for LL/Age sample sizes? *Yes*

- Keep CV=0.18 for aerial survey? *Yes* 

- Recalculate tag overdispersion parameter? Yes but preferably recalculate with updated OM data

- Endorse Portland decision about uniform weights on steepness? *Yes* 

- CK overdispersion Recompute the parameter given updated OM data

4) Input data

- Close kin data Yes; likely unchanged from 2013

- Catch (currently using Case 1 overcatch scenario) Evaluate as a sensitivity and include all sources of unreported catch mortalities, see table and discussion below.

- CPUE (alternative series, effect of overcatch on CPUE) Candidate series including Taiwan, Korea that are under development but premature to include in OM at this time - Tagging

Only 1990s tagging, 2000s tagging data not to be included until cohort/mixing issues can be resolved through an appropriate spatial model

- Aerial survey *Include updated values* 

- Indonesian size/age composition

Evaluate the source of the smaller fish seen in the 2013 size composition, age the otolith collection and apply to the size data (after evaluating and correcting if needed). Use age-length keys only from the years in which they werecollected.

5) Candidate sensitivity runs and possible addition of grid axes. *See table 1 below.* 

"Assessment"		
Run	Description	from 2009
Added catch	Unaccounted catch mortality (see below)	New
SV_OverC	Continue 20% overcatch from Australian fishery if the	
	stereo video (SV) system is not implemented	New
IS20	Indonesian selectivity flat from age 20+ and using an	
	appropriate range of M10 values	New
Upq2008	CPUE q increased (permanent from 2008 35% increase)	
	BUT re-evaluate the extent of increase apparent in nominal	
	CPUE by age, to be done prior to the 2014 technical meeting	From 2011
Omega=0.75	A power function for the relationship between biomass and	
	CPUE with power $= 0.75$	From 2009
Tag F / Mixing	Increases the fishing mortality of tagged SBT by 50%	
	relative to the F applied to the whole population. Account	
	for incomplete mixing of the tagged fish.	From 2009
CPUE S=0	Overcatch had no impact on CPUE From 2009	
CPUE S=0.50	50% of LL1 overcatch associated with reported effort	From 2009
Include Troll	Includes the piston-line troll survey index	From 2009

Table 1. Sensitivity runs to be conducted for assessment purposes

#### Notes on unaccounted catch mortality

These include 1) catches by non-members, 2) released/discarded fish, 3) recreational fisheries catch, and 4) mortality from other sources.

It was noted that all sources of mortality are to be reported by Members and Cooperating Non-Members (including the sources highlighted here). Such reporting is to cover the historical period as well as for future reporting but may have periods of missing data.

Each of these sources should include the most appropriate category of existing fishery to which they should be added. Allocating to specific fisheries may be difficult, especially in areas where different size ranges are caught. The New Zealand delegation agreed to make an initial cut at this. It was noted that the approach should be sourced from the data exchange with scientifically defensible estimates.

The approach of incorporating this sensitivity in the model is less straightforward and some modeling work will be required. Ana agreed to review the code but the work will need to be prioritized and sourced accordingly.