Updated Specifications of the CCSBT Management Procedure

(from Attachment 10 of the Report of the Eighteenth Meeting of the Scientific Committee)

Introduction

From 2002 to 2011, the CCSBT conducted extensive work to develop a Management Procedure (MP) to guide its global TAC setting process for southern bluefin tuna. The final MP, known as the "Bali Procedure", was recommended by the CCSBT's Extended Scientific Committee (ESC) in July 2011. Management parameters of the Bali Procedure could be adjusted to set different time horizons for rebuilding, and to constrain the maximum TAC changes allowed every time the TAC is updated. Simulation tests results for a range of parameter options were presented to CCSBT's Extended Commission for its consideration.

The Extended Commission adopted the Bali Procedure together with the following associated management parameters as its MP at the CCSBT's eighteenth annual meeting in October 2011:

- The MP is to be tuned to a 70% probability[1] of rebuilding the stock to the interim rebuilding target reference point of 20% of the original spawning stock biomass by 2035;
- The minimum TAC change (increase or decrease) will be 100 tonnes;
- The maximum TAC change (increase or decrease) will be 3,000 tonnes;
- The TAC will be set for three-year periods, subject to paragraph 7 of CCSBT's Resolution on the Adoption of a Management Procedure[2]; and
- The national allocation of the TAC within each three-year period will be apportioned according to CCSBT's Resolution on the Allocation of the Global Total Allowable Catch[2].

The CCSBT used the MP to compute the TAC for 2012 to 2014 inclusive and decided that MP will be used to guide the setting of the global SBT TAC for 2012 and beyond[3]. For the second (2015-2017) and subsequent three-year TAC setting periods, there will be a one year lag between the TAC calculation by the MP and implementation of that TAC (i.e. the 2015-2017 TAC will be calculated in 2013).

Technical details of the MP, together with specifications of how the CPUE and Aerial Survey indices that are to be provided as input to the MP are to be calculated, and the Metarule process that the Extended Commission has adopted for dealing with exceptional circumstances in the SBT fishery, are provided in the following sections of this document.

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[1] Probabilities were computed across a weighted set of operating models defined as the "Reference Set", which represented the most important uncertainties in the model structure, parameters, and data. These included alternative values for natural mortality and steepness parameters (model weights proportional to their maximum posterior density), alternative CPUE series (given equal weights), and two different age ranges used to normalize selectivity for CPUE predictions (given pre-determined weights). Specifications about the reference set used for the final tuning of MPs are provided at paragraph 92 of Appendix 2 of the Report of the Sixteenth Meeting of the Scientific Committee.

[2] Report of the Eighteenth Annual Meeting of the Commission (10-13 October 2011, Bali, Indonesia).

[3] The TAC for 2012 and 2013 was set at the value computed using the MP in 2011. The Extended Commission decided that the TAC for 2014 will either be the value computed in 2011 or the value of the MP outcomes for 2015 – 2017 (whichever is the less), unless the Extended Commission decides otherwise based on the assessment of the Compliance Committee.

1. Background and Technical details of the Bali Procedure

Concept

The ESC experienced difficulty in choosing between the two preferred MPs that it had identified (MP1 and MP2) and it subsequently decided to recommend an alternative which was a combination of MP1 and MP2. There were features of each of MP1 and MP2 that appealed to the ESC, and an integrated combination of those features was considered to be a suitable approach for providing a single MP (the Bali Procedure) that is a genuine representation of all the work Member scientists had conducted.

Details

There were several key features that differed between MP1 and MP2:

- Empirical versus model based;
- CPUE target versus CPUE trend; and
- Use of historical aerial survey data

Empirical MPs have the virtue of being (usually) simpler to understand and compute, but their output recommendations can often be over-strongly influenced by noise in the data. Model-based MPs can "filter" the signal (and key parameters) from the noise in the MP data, but if that process is too complex or over-parameterised, it can sometimes behave strangely in the testing phase, as a result of non-convergence or hitting boundaries due to complex likelihood surfaces. The simple Biomass Random Effect Model (BREM) part of MP1 did not exhibit any of these properties: it always converged and without any apparently strange parameter estimates. Given that in both rounds of MP testing it demonstrated an ability to reduce variance in both catch and spawning stock biomass (SSB), this suggested that it would form a sensible base point for an MP.

CPUE

MPs that act (primarily) on trends in CPUE have the advantage of acting "locally", in that they do not depend on the absolute level of the abundance index, unlike target-based MPs where target mis-specification can be a problem. However, trend-based MPs can get "lost" by failing to recognise a spuriously positive trend at very low stock biomass levels and thus potentially fail to secure resource recovery. Both MP1 and MP2 are target and trend driven (in relation to CPUE), so a combination of the two should have a mix of both trend and target driven behaviour at their core.

Aerial survey

The historical aerial survey data points (1993-2000, 2005-2011) cover the years for which estimated recruitments were the lowest on record. As such, they represent levels of the aerial survey index to preferably stay above and ideally, never be below. In MP2 the tuning parameter was effectively a target level of the future aerial survey which was a multiple of the average historical level of the survey given real data. From paper CCSBTESC/1107/34 in Table 1 it was seen that the tuned level of this multiplier was always less than 1 and mostly between 0.6-0.8. This meant, in effect, that the target level of aerial survey was actually less than that observed in the historical data. This is perhaps not ideal, as it is not desirable for the recruitment level to decrease below the levels seen in the last two decades, so it was suggested that the average historical level of the aerial survey should form a kind of limit reference point, and that below this point any MP (including MP2) should act strongly to ensure that the stock is brought above this level as was done in MP1.

Form of the new HCR

To combine the features of both MP1 and MP2 two candidate TACs are calculated, based on the key aspects of each of MP1 and MP2, and the (arithmetic) mean of the two TACs are taken. The key MP variables are not the raw CPUE and aerial survey, but their "filtered" counterparts the adult (B_y) and juvenile (R_y) relative biomass, respectively, that come from the BREM estimation framework of MP1. The first candidate TAC is based upon the trend in adult relative biomass:

$$TAC^1_{y+1} = TAC_y \times \begin{cases} 1 - k_1 |\lambda|^\gamma & \lambda < 0 \\ 1 + k_2 \lambda & \lambda \geq 0 \end{cases} \quad (1)$$

where λ is the slope in the regression of $\ln B_y$ against year (from years $y-\tau_B+1$ to year y). The second TAC is defined as follows:

$$TAC^2_{y+1} = 0.5 \times \left(TAC_y + C^{t\arg}_y \Delta^R_y \right), \quad (2)$$

where

$$C^{t\arg}_y = \begin{cases} \delta \left[B_y / B^* \right]^{1-\varepsilon_b} & B_Y \geq B^* \\ \delta \left[B_y / B^* \right]^{1+\varepsilon_b} & B_y < B^* \end{cases} \quad (3)$$

where $\varepsilon_b \in [0,1]$ represents the degree to which the response to a biomass level above or below the target level B^* is asymmetric. The recruitment adjustment Δ^R_y is defined as follows:

$$\Delta^R_y = \begin{cases} \left[\overline{R} / \Phi \right]^{1-\varepsilon_r} & \overline{R} \geq \Phi \\ \left[\overline{R} / \Phi \right]^{1+\varepsilon_r} & \overline{R} < \Phi \end{cases} \quad (4)$$

and $\varepsilon_r \in [0,1]$ is the level of asymmetry in response to the current moving (arithmetic) average - and this has been changed to include up to year y - recruitment levels, $\overline{R}$:

$$\overline{R} = \frac{1}{\tau_R} \sum_{i=y-\tau_R+1}^{y} R_i \ , \quad (5)$$

of length τ_R relative to the average, Φ, calculated over the years for which the estimates are based on the most up to date observed data (1993-2000 and 2005-2011). Most of the fixed parameters of this MP are kept at their respective levels as used in MP1 and MP2 with the single tuning parameter δ. However, the parameter k_2 is reduced to a value of 3 to reduce reactivity to positive CPUE trends, but to ensure tuning is possible for the most difficult tuning settings requested by the Extended Commission, the parameter ε_b is reduced from 0.5 to 0.25. Table 1 details the fixed parameter values in the combined Bali Procedure and their values in the individual procedures. Finally, the Bali Procedure TAC is defined as:

$$TAC_{y+1} = 0.5 \times \left(TAC_{y+1}^{1} + TAC_{y+1}^{2} \right) \qquad (6)$$

Table 1: Fixed values and tuning parameter for the combined Bali Procedure and their respective values for the two original MPs.

Parameter	Bali Procedure	MP1/MP2
Δ	Tuned	Tuned (MP1)
k_1	1.5	1.5 (MP2)
k_2	3	5 (MP2)
Γ	1	1 (MP2)
τ_B	7	7 (MP2)
B^*	1.2	1.2 (MP1)
ε_b	0.25	0.5 (MP1)
ε_r	0.75	0.75 (MP1)
τ_R	5	5 (MP1)

2. Specification of Standardised CPUE for the MP

Data to be used

The CPUE dataset to be used in the MP is based on the longline catch and effort data of Japanese, Australian (Real-Time Monitoring Program in the 1990s) and New Zealand (NZ) charter vessels at the shot-by shot resolution. Southern bluefin tuna (SBT) aged 4 years or older are used in the CPUE dataset. In the most recent year of the dataset, CPUE (number of SBT individuals per 1000 hooks) is calculated from Japanese data available at the time which are mainly from RTMP and New Zealand data. From this dataset, a set of core vessels are selected which meet certain conditions. These conditions are: CCSBT statistical areas (Area) 4-9, Month 4-9, x (top rank of SBT catch in a year) = 52, and y (number of years in the top ranks) = 3.

The dataset each year is further adjusted by:

- Deleting records from operations south of 50^0S;
- Combining operations from Area 5 and Area 6 into one area (Area 56); and
- Deleting operations with extremely high CPUE values (>120).

The shot-by-shot data are then aggregated into 5x5 degree cells by month before standardization. Aggregated data cells with little effort (<10,000 hooks) are deleted.

CPUE standardization

Unweighted CPUE

The aggregated CPUE dataset is standardized using the following Generalised Linear Model (GLM)[4]:

$$\log(CPUE+const) = Intercept + Year + Month + Area + Lat5 + BET\_CPUE + YFT\_CPUE + (Month*Area) + (Year*Lat5) + (Year*Area) + Error \quad (1)$$

where

Area	is the CCSBT statistical area
Lat5	is the latitude in 5 degree
BET_CPUE	is the bigeye tuna CPUE
YFT_CPUE	is the yellowfin tuna CPUE
const	is the constant as 0.2 derived as 10% of the mean nominal CPUE in Nishida and Tsuji (1998)

Area weights

To obtain the area weighted CPUE indices described below, the area of SBT distribution was calculated based on a 1x1 degree square resolution. The area was calculated in the form of an area index such that an area size of 1x1 degree square along the equator was defined as 1, and the area size for other 1x1 degree squares of different latitudes was determined as the proportion of the square area along the equator. The area index for the Constant Square (CS)[5] was simply a union of fished 1x1 degree squares through all years (1969-present) and was calculated for each

[4] Currently, there is no specification of the procedure to be followed for the GLMs here and below that have fixed interaction effects if in a future year one of the associated cells is empty of data.

[5] For explanation of Constant Square and Variable Square CPUE interpretations, see Anonymous (2001b).

quarter, month, statistical area, and latitude (5 degree) combination. The area index for the Variable Square (VS) was the sum of fished 1x1 degree square areas and was calculated for each year, quarter, month, statistical area, and latitude combination. For VS, a square counts as fished only for the month in which fishing occurred. More details of the area index calculation are described in Nishida (1996).

Area weighted CPUE
With the estimated parameters obtained from the CPUE standardization above (1), the Constant Square (CS) and Variable Square (VS) CPUE abundance indices are computed by the following equations:

$$CS_{4+,y}=\sum_m \sum_a \sum_l (AI_{CS})_{(yy\text{-}present)}[\exp(Intercept + Year + Month + Area + Lat5 + BET\_CPUE + YFT\_CPUE + (Month*Area) + (Year*Lat5) + (Year*Area) + \sigma^2/2) - 0.2] \quad (2)$$

$$VS_{4+,y}=\sum_m \sum_a \sum_l (AI_{VS})_{ymal}[\exp(Intercept + Year + Month + Area + Lat5 + BET\_CPUE + YFT\_CPUE + (Month*Area) + (Year*Lat5) + (Year*Area) + \sigma^2/2) - 0.2] \quad (3)$$

where

$CS_{4+,y}$	is the CS abundance index for age 4+ and *y*-th year,
$VS_{4+,y}$	is the VS abundance index for age 4+ and *y*-th year,
$(AI_{CS})_{(yy\text{-}present)}$	is the area index of the CS model for the period *yy*-present (*yy*=1969 or 1986 depending on the period of standardization,
$(AI_{VS})_{ymal}$	is the area index of the VS model for *y*-th year, *m*-th month, *a*-th SBT statistical area, and *l*-th latitude,
σ	is the mean square error in the GLM analyses.

The w0.5 and w0.8 (B-ratio and geostat proxies) CPUE abundance indices are then calculated using the following equation (Anonymous 2001a):

$$I_{y,a} = wCS_{y,a} + (1-w)VS_{y,a} \qquad \text{where } w = 0.5 \text{ or } 0.8 \quad (4)$$

The final CPUE input series is the arithmetic average of the w0.5 and w0.8 series.

Data calibration
The estimated CPUE value in the most recent year, which is mainly derived from RTMP data, is corrected using the average of the “Logbook based CPUE / RTMP based CPUE” ratio for the most recent three years of logbook data.

The area weighted CPUE series between 1986 and the most recent year are then calibrated to the historical CPUE series between 1969 and 2008 using the following GLM (equation 5), described in Nishida and Tsuji (1998) for 5x5 degree cells by month data for all vessels (i.e. both core and other vessels) in Areas 4-9 and Months 4-9:

$$\log(CPUE+const) = Intercept + Year + Quarter + Month + Area + Lat5 + (Quarter*Area) + (Year*Quarter) + (Year*Area) + Error \quad (5)$$

where

const is 10% of the mean nominal CPUE.

CPUE series for monitoring

Two additional CPUE series will be used for monitoring purposes of the status of the stock and MP implementation. These include:

(1) Same procedure as specified above, but at the shot-by-shot level rather than the aggregated 5x5 level.

(2) Same procedure as specified above, but using the simpler GLM given by:

$$log(CPUE+0.2) = Intercept + Year + Month + Area + Lat5 + (Month*Area) + Error \quad (6)$$

Historical CPUE Series used as input to the Management Procedure

The CPUE series used in the MP is the average of the base CPUE series (w0.5 and w0.8) and is adjusted in the years 1989 -2005 for the case 1 LL over-catch. The overcatch correction is based on the same assumptions used in the base-case operating model used for MP testing, namely: (i) that 25% of the unreported catch was attributed to the LL1 reported effort and (ii) that the LL overcatch was distributed amongst LL1 subfleets, areas and months in proportion to the nominal catch, except for the Australian joint venture and New Zealand charter fleets (called Option A in Attachment 4 of OMMP 2009 meeting report). In 2009, the extent of LL1 overcatch corresponding to the Case 1 market estimates provided by Lou and Hidaka for 1985-2005 (with unreported catch in 2005 set equal to unreported catch in 2004) were re-estimated using a new equation for the lag from catch to market (documented in Attachment 4 of the OMMP2009 meeting report).

The resulting catch and CPUE multipliers are provided in Table 2. The CPUE multipliers are not exactly 0.25 because a small proportion of the CPUE catch (from the Australian joint venture and New Zealand charter fleets) is not affected by the overcatch. The historical CPUE series to be used as input of the MP is calculated using the following equation:

CPUE = (w0.5 + w0.8)/2 * (1+(Catch_multiplier-1)*CPUE_multiplier)

Table 2. Year, CPUE multipliers and Catch multipliers for the Case 1 LL CPUE adjustment.

	CPUE multiplier	Catch multiplier
Year	S=0.25-A	Case 1
1983	0.25	1
1984	0.25	1
1985	0.25	1
1986	0.25	1
1987	0.25	1
1988	0.25	1
1989	0.244	1.28

1990	0.249	1.8
1991	0.25	1.53
1992	0.275	1.24
1993	0.273	1.62
1994	0.266	2.66
1995	0.247	2.14
1996	0.25	2.2
1997	0.246	2.6
1998	0.247	1.82
1999	0.248	1.77
2000	0.247	2.13
2001	0.248	2.16
2002	0.249	2.13
2003	0.249	1.92
2004	0.248	1.75
2005	0.249	1.69
2006	0	1

Reference

Anonymous. 2001a. Report of the Fifth Meeting of the Commission for the Conservation of Southern Bluefin Tuna, Scientific Committee. 19-14 March 2001, Tokyo, Japan.

Anonymous. 2001b. Report of the SC to CCSBT on the Scientific Research Program. Attachment D in Report of the Fifth Meeting of the Commission for the Conservation of Southern Bluefin Tuna, Scientific Committee. 19-14 March 2001, Tokyo, Japan.

Nishida, T. 1996. Estimation of abundance indices for southern bluefin tuna (Thunnus maccoyii) based on the coarse scale Japanese longline fisheries data. Paper submitted to the Commission for the Conservation of Southern Bluefin Tuna, Scientific Meeting. CCSBT/SC/96/12. 26 pp.

Nishida, T. and S. Tsuji. 1998. Estimation of abundance indices of southern bluefin tuna (*Thunnus maccoyii*) based on the coarse scale Japanese longline fisheries data (1969-97). Paper submitted to the Commission for the Conservation of Southern Bluefin Tuna, Scientific Meeting. CCSBT/SC/9807/13.27 pp.

Parma, A. (2009). Catch and CPUE scenarios. Attachment 4, Report of the CCSBT Operating Model and Management Procedure Technical Meeting, 13 - 17 July 2009, Seattle, USA.

3. Data and Model Specifications for the Aerial Survey Index used in the MP

Data

The scientific aerial survey data are estimates of the biomass of SBT patches in the Great Australian Bight (GAB) as observed by experienced spotters. The aerial survey is conducted in January through March of each year, and consists of an aircraft flying along 15 north-south transect lines running from the coast to continental shelf (from 128E to 134E degrees longitude). Trained tuna spotters (historically, one dedicated spotter and one spotter-pilot) search for surface schools of SBT. When a school or group of schools is spotted (termed 'a sighting'), the plane flies out to the sighting and each spotter independently estimates the biomass of each school. The plane then returns to the transect line to continue the survey. The survey data consists of distance flown, location of sightings, biomass estimates of each school in a sighting, and environmental observations that might affect the number and size of sightings, such as sea surface temperature (SST), swell, haze, wind speed, and sea shadow. The aim is to complete four to six replicates of the survey region, but this is not always possible because planes can only fly when minimal environmental conditions are met.

From 2011 there were no spotter-pilots in the survey, only dedicated spotters and a non-spotting pilot. Calibration experiments were carried out in 2008 and 2009 to assess the impact of this change on the standardised index (Eveson et al. 2008, 2009). Based on data from these calibration experiments, a method for accounting for the fact that a plane with one spotter makes fewer sightings than a plane with two spotters was developed and subsequently refined (Eveson et al. 2011). Unless further data comes available regarding the one spotter calibration issue, the approach detailed in Eveson et al. (2011) will be used in the aerial survey standardisation.

Standardisation model

The raw survey data are standardised in two stages, in terms of biomass-per-sighting (BpS) and sightings-per-mile (SpM), and then combined together to produce a single standardised abundance index with accompanying CV-by-year (see Eveson et al.(2011) for the details of this combination process). Since environmental conditions affect what proportion of tuna are available at the surface to be seen, as well as how visible those tuna are, and since different observers can vary both in their estimation of school size and in their ability to see tuna patches, the models include 'corrections' for environmental and observer effects in order to produce standardized indices that can be meaningfully compared across years. The coefficients of the GLM model used are updated each year by making use of the data from the most recent survey.

Biomass-per-sighting (BpS) model

For the biomass-per-sighting (BpS) standardisation, the spatio-temporal and environmental covariates which are most statistically appropriate have been explored, and the following model determined:

$$\log(BpS) \sim Year*Month*Area + SST + WindSpeed \qquad (1)$$

The model is fitted using a GLMM with a log link and a Gamma error structure. The Year, Month and Area effects are treated as factors, with the term Year*Month*Area covering all 1-, 2- and 3-way interactions. The main (1-way) effects are treated as fixed effects, and the 2- and 3-way interactions are treated as random effects to deal with sometimes sparse data coverage.

Given the changing nature of the environmental information in each year, and the shortness of the time series, the environmental covariates determined as most appropriate can change with time. Thus, there may be minor variations in the model structure (the same applies to the SpM model); however, the standardisation routine will always use the same set of covariates for all years in the analysis (i.e., each year, the BpS and SpM models are fit to the data from all survey years to produce a time-series of relative abundance indices). This is in line with the primary goal of the derivation of an unbiased index of the juvenile biomass in the GAB as assumed in the operating model and for the MP testing.

Sightings-per-mile (SpM) model
For the sightings-per-mile (SpM) model, as with the biomass-per-sighting model the spatio-temporal and environmental covariates which are most statistically appropriate have been explored, and the following model determined[6]:

$$\log(N\_sightings) \sim \text{offset}(\log(Distance)) + Year*Month*Area + \log(ObsEffect) + SST + WindSpeed + Swell + Haze + MoonPhase \qquad (2)$$

The SpM model is fitted using a GLMM with the number of sightings (N_sightings) as the response variable, as opposed to the sightings rate. The model can then be fitted assuming an overdispersed Poisson error structure[7] with a log link and including the distance flown (Distance) as an offset term to the model (i.e. as a linear predictor with a known coefficient of one), given SpM = N_sightings/Distance. As with the BpS model, the main spatio-temporal effects (Year, Month and Area) are fitted as fixed effects, and the 2- and 3-way spatio-temporal effects are fitted as random effects.

Generating the standardised index
The specific details of the combination of the two standardised indices into one index can be found in Eveson et al. (2011). Combining the index to obtain a mean index is straightforward, with a weighted average of the biomass in each stratum being summed to obtain the total index. The calculations to obtain the CV-by-year for the index are more complex, involving the delta method, given the lack of independence of both the SpM and BpS estimates across strata.

Issue of inter-annual scale changes
Unlike CPUE, the overall scale of the standardised aerial survey can change from year to year, and sometimes substantially. This is because it is a weighted sum of the abundance in the various survey strata not some kind of weighted average. In an OM context there is no issue as the estimation of the catchability coefficient takes care of the any scale changes. This scale change

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[6] These were the environmental covariates used in the 2011 analysis. Note that, as for the BpS model, the covariates included in the SpM model and the functional nature of their inclusion (linear/polynomial) can change over time as new data are recorded and future analyses are undertaken.
[7] Note that the standard Poisson distribution has a very strict variance structure in which the variance is equal to the mean, and it would almost certainly underestimate the amount of variance in the sightings data, hence the use of an overdispersed Poisson distribution to describe the error structure.

does have to be taken into account when either running the MP or when attempting to ascertain whether the new aerial survey data point is inside or outside of the bounds of what we have tested for in the MP evaluation work. This can very easily be dealt with using robust but simple statistical bootstrap techniques and, when required, this process and any required scale changes in the MP will be detailed.

Reference

Eveson, P., Bravington, M. and Farley, J. 2008. The aerial survey index of abundance: updated analysis methods and results. CCSBT-ESC/0809/24.

Eveson, P., Farley, J., and Bravington, M. 2009. The aerial survey index of abundance: updated analysis methods and results. CCSBT-ESC/0909/12.

Eveson, P., Farley, J., and Bravington, M. 2010. The aerial survey index of abundance: updated analysis methods and results for the 2009/10 fishing season. CCSBT-ESC/1009/14.

Eveson, P., Farley, J., and Bravington, M. 2011. The aerial survey index of abundance: updated analysis methods and results for the 2010/11 fishing season. CCSBT-ESC/1107/15.

4. Metarule Process

Preamble

Metarules can be thought of as "rules" which prespecify what should happen in unlikely, exceptional circumstances when application of the total allowable catch (TAC) generated by the management procedure (MP) is considered to be highly risky or highly inappropriate. Metarules are not a mechanism for making small adjustments, or 'tinkering' with the TAC from the MP. It is difficult to provide firm definitions of, and be sure of including all possible, exceptional circumstances. Instead, a process for determining whether exceptional circumstances exist is described below. The need for invoking a metarule should only be evaluated at the ESC based on information presented and reviewed at the ESC.

All examples given in this document are meant to be illustrative, and NOT meant as complete or exhaustive lists.

Process to determine whether exceptional circumstances exist

Every year the ESC will:

- Review stock and fishery indicators, and any other relevant data or information on the stock and fishery; and
- On the basis of this, determine whether there is evidence for exceptional circumstances.

Examples of what might constitute an exceptional circumstance include, but are not limited to:

- Recruitment, or a series of recruitment values outside the range[8] for which the MP was tested;
- A scientific aerial survey or CPUE result outside the range[8] for which the MP was tested;
- Substantial improvements in knowledge, or new knowledge, concerning the dynamics of the population which would have an appreciable effect on the operating models used to test the existing MP; and
- Missing input data for the MP, resulting in an inability to calculate a TAC from the MP.

Every three years (not coinciding with years when a new TAC is calculated from the MP) the ESC will:

- Conduct an in depth stock assessment; and
- On the basis of the assessment, indicators and any other relevant information, determine whether there is evidence for exceptional circumstances (an example of exceptional circumstances would be if the stock assessment was substantially outside the range of simulated stock trajectories considered in MP evaluations, calculated under the reference set of operating models).

Every six years (not coinciding with years when a new TAC is calculated from the MP) the ESC will:

- Review the performance of the MP; and
- On the basis of the review determine whether the MP is on track or a new MP is required.

[8] The "range" refers to 95% probability intervals for projections for the index in question made using the reference set of the operating models during the testing of the MP.

If the ESC concludes that there is no or insufficient evidence for exceptional circumstances, the ESC will:

- Report to the Extended Commission that exceptional circumstances do not exist.

If the ESC has agreed that exceptional circumstances exist, the ESC will:

- Determine the severity of the exceptional circumstances; and
- Follow the "Process for Action".

Process for Action

Having determined that there is evidence of exceptional circumstances, the ESC will in the same year:

- Consider the severity of the exceptional circumstances (for example, how severely "out of bounds" is the CPUE or recruitment);
- Follow the Principles for Action (see below);
- Formulate advice on the action required (for example, there may be occasions, if there appears to be 'exceptional circumstances', but the severity is deemed to be low, when the advice is not for an immediate change in TAC, but rather a trigger for a review of the MP or collection of ancillary data to be reviewed at the next ESC); and
- Report to the Extended Commission that exceptional circumstances exist and provide advice on the action to take.

The Extended Commission will:

- Consider the advice from the ESC; and
- Decide on the action to take.

Principles for Action

If the risk is to the stock, principles may be:

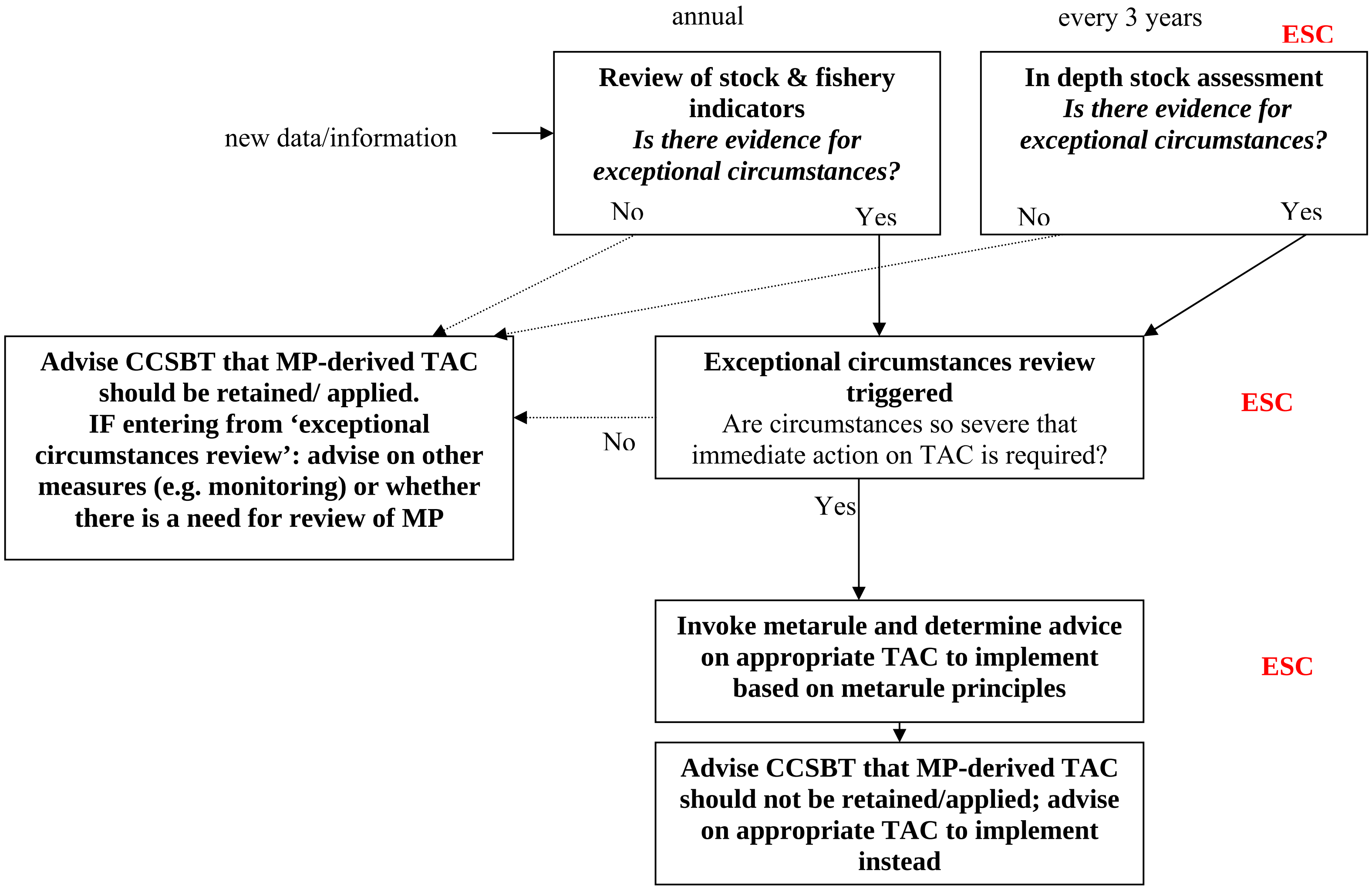
a) The MP-derived TAC should be an upper bound;
b) Action should be at least an x% change to the TAC, depending on severity.

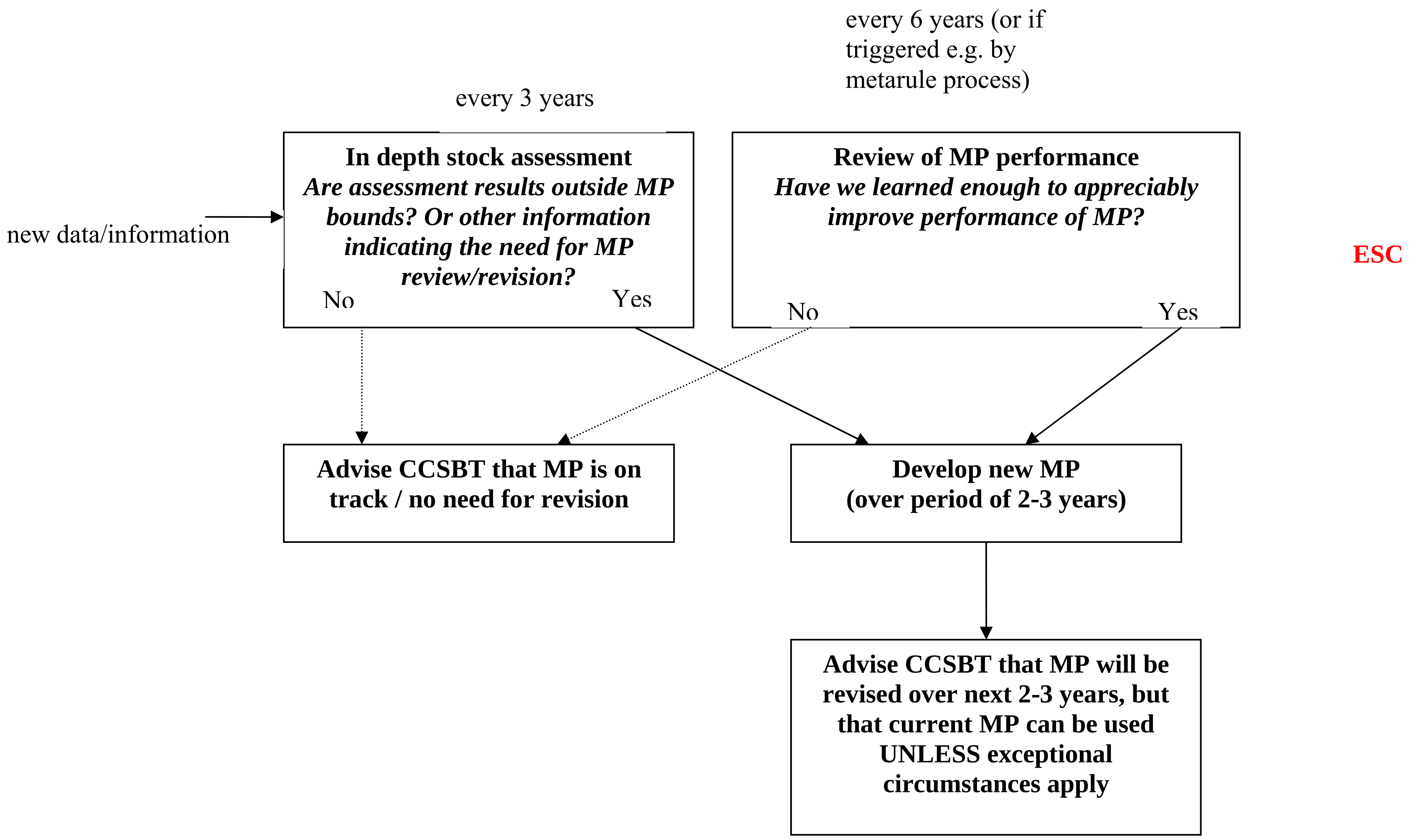
If the risk is to the fishery, principles may be:

a) The MP-derived TAC could be a minimum;
b) Action should be at least an x% change to the TAC, depending on severity.

An urgent updated assessment and review of indicators will take place, with projections from that assessment providing the basis to select the value of the x% referred to above.

Figure 1: Flowchart for Metarules process




every 3 years
every 6 years (or if triggered e.g. by metarule process)
new data/information
In depth stock assessment
Are assessment results outside MP bounds? Or other information indicating the need for MP review/revision?
No
Yes
Review of MP performance
Have we learned enough to appreciably improve performance of MP?
No
Yes
ESC
Advise CCSBT that MP is on track / no need for revision
Develop new MP (over period of 2-3 years)
Advise CCSBT that MP will be revised over next 2-3 years, but that current MP can be used UNLESS exceptional circumstances apply