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Meta-rules and exceptional circumstances considerations

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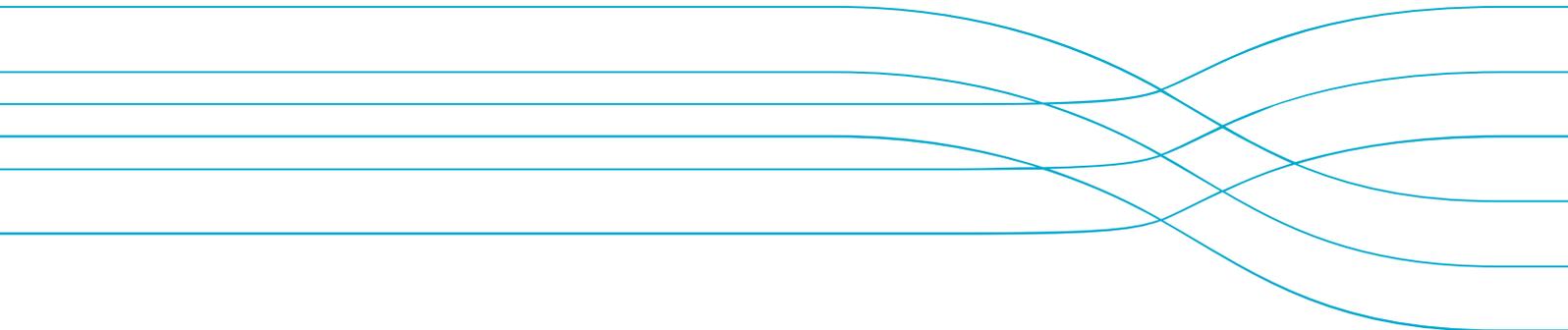
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Abstract

The meta-rules for the CCSBT Management Procedure (MP) include an annual review of the input monitoring series for the MP and fishery and stock indicators. The purpose of the review is to identify conditions and/or circumstances that may represent a substantial departure from which the MP was tested, termed "exceptional circumstances", and where appropriate recommend the required action. In 2017, the ESC will review MP implementation in the context of the TAC for 2018, recommended at the 2016 meeting of the ESC and adopted by the Commission.

Issues of potential concern in 2017 include: 1) changes in estimates of the population dynamics and productivity of the stock; 2) the unresolved shift in selectivity in the Indonesian fishery since 2013; and 3) potential for total catches (members and non-members) to be greater than the TAC (either annually or over the quota block).

The projections for rebuilding the stock, using the Bali Procedure MP and reference set of reconditioned operating models for the 2017 assessment of stock status, indicate that the interim rebuilding target may be reached earlier than expected. The population dynamics are different to the operating model conditions when the MP was tested. The change is positive, in that rebuilding may potentially occur earlier, and operating model changes do not impact directly on the MP or TAC advice and therefore no action on the 2018 TAC is required. The potential changes in population dynamics will impact on testing candidate MPs to replace the existing MP in 2019.

The second issue of change in selectivity in the Indonesian fishery is of continuing concern, but not for the operation of the MP and 2018 TAC advice; rather for the monitoring of the spawning stock, close-kin sample collection and the impact on OM conditioning and advice on stock status.

In terms of the third issue, progress has been made by the Extended Commission to account for all sources of mortality; however, uncertainties remain and limited information is available on quantities of additional mortality that will be accounted for by members in 2018, or the historical estimates for these sources. These data are required for reconditioning operating models and management strategy evaluation of candidate MPs in 2018.

1   Introduction

The meta-rules for the CCSBT Management Procedure (MP) include: a review of the input monitoring series for the MP and fishery and stock indicators (annual); periodic assessments of the status of the stock via reconditioned operating models (3 year intervals); and in depth review of the MP performance (6 years intervals). The aim of the meta-rules process is to determine whether there is evidence for exceptional circumstances and decide what, if any, action should be taken to deviate from the TAC recommended by the MP (Attachment 10 of the 2013 ESC report (Anon 2013)). In 2017, the ESC will review MP implementation in the context of the TAC set for 2018 recommended at the 2016 meeting of the ESC.

Issues of potential concern in 2017 include: 1) changes in estimates of the population dynamics and productivity of the stock; 2) the unresolved shift in selectivity in the Indonesian fishery since 2013; 3) potential for total catches (members and non-members) to be greater than the TAC (either annually or over the quota block). These issues will need to be considered by the ESC and principles and process for action agreed, if required.

These issues also need to be considered in terms of the data required and the potential impact on re-conditioning operating models and associated work on the development of a new MP. Additional exceptional circumstances may be identified at the ESC following review of stock and fisheries indicators.

2 Meta-rules and exceptional circumstances

As noted above, the meta-rules include a process for identifying exceptional circumstances. Exceptional circumstances are events, or observations, that are outside the range for which the CCSBT MP was tested and, therefore, indicate that application of the total allowable catch (TAC) generated by the management procedure (MP) may be highly risky, or highly inappropriate.

The exceptional circumstances process under the meta-rules involves the following three steps:

1.   Determining whether exceptional circumstances exist;

2.   A "process for action" that examines the severity (and implications) of the exceptional circumstances for the operation of the MP, and the types of actions that may be considered; and

3.   "Principles for action" that determine how recommendations from the management procedure might be altered, if at all, based on the most recent reconditioning of the OM.

The meta-rules process as adopted by CCSBT can be found at Attachment 10 of the 2013 ESC report (Anon 2013).

3 Exceptional circumstances in 2017 and potential severity for MP implementation

The following items may represent exceptional circumstances and will be reviewed by the ESC in 2017:

1) changes in estimates of the population dynamics and productivity of the stock,

2) the unresolved shift in selectivity in the Indonesian fishery since 2013,

3) continuing concern that total fishing mortality (from members and non-members) are greater than the TAC recommended by the MP.

In considering the potential for exceptional circumstances arising from these issues, we have examined whether: 1) the inputs to the MP are affected, 2) the population dynamics are potentially significantly different from those for which the MP was tested (as defined by the 2011 Reference and Robustness sets of OMs), 3) the fishery or fishing operations have changed substantially, 4) total removals are greater than the MP recommended TACs, and 5) if there are likely to be impacts on the performance of the SBT rebuilding plan as a result.

The events are considered individually, however, the implications of the combination of events for the performance of the MP and the ability of the ESC to provide robust advice on the status and trends of the stock should also be considered. Further exceptional circumstances may also be identified at the ESC as part of the 2017 assessment of stock status, and annual review of stock and fishery indicators.

3.1 Changes in population dynamics and productivity of the stock

The 2017 assessment of stock status is based on a revised reference set of reconditioned operating models, which include new and updated data and structural changes. Results are presented in Hillary et al. (2017a). Historical estimates of absolute biomass aged 10+ are substantially different from the 2011 operating model results used to test and tune the current MP, mainly as a result of inclusion of close-kin data in the 2014 stock assessment (Anon 2011; Anon 2014). The historical estimates of relative depletion are more consistent, and the estimates for the most recent years indicate an improvement in stock status. The projections of the 2017 reconditioned reference set of operating models indicate that the interim rebuilding target (70% probability of rebuilding to 20%B0 by 2035) may be reached much earlier than previously anticipated. The population dynamics are potentially significantly different from those used for MP testing in 2011.

Changes in the population dynamics are not unexpected because there have been a number of changes in the operating models since 2011. The substantial differences in the projections results are positive: rebuilding to the interim target under the Bali MP are predicted to occur earlier, or with higher probability. Sensitivity tests are used to explore the impacts of alternative scenarios

and interpretations of data on population dynamics and rebuilding of the stock. The stock status results are similar across the sensitivity tests, and the rebuilding for the sensitivity tests is slower or faster than the 2017 reference set depending on the scenario. All of the sensitivity test results indicate that the probability of reaching the interim rebuilding target are greater than that specified for the MP, i.e. a probability of 0.7. We note that changes to the operating models have no impact on operation of the MP or TAC calculations, as the MP parameters and inputs are fixed and remain unchanged, apart from each additional year of data added to the two input data series (i.e. CPUE and aerial survey indices).

To identify the factors influencing the optimistic projection results, we explore the operating model changes since 2011 and sensitivity test results (Table 1). The close-kin data were first included in the operating models in 2013 (Hillary et al., 2013), and have been substantially updated in 2017 with additional Parent-offspring Pair (POP) data and new Half-sibling Pair (HSP) data (Hillary et al., 2017b). In addition to inclusion of these data, the operating models have a new maturity ogive based on fecundity information with parameters for change in growth (Hillary et al, 2017b). These changes contributed to modification of the range of natural mortality values in 2014 (Anon 2014) and steepness values in 2017 (Anon 2017) that are included in the reference set, as the range of uncertainties that is considered changes with updated information on the population dynamics. Sensitivity tests that exclude the new POP and HSP data ("No POPs/HSPs" and "No HSPs") indicate only small changes in rebuilding trajectories relative to the reference set (probability of reaching rebuilding target is 0.79 for the "No POP/HSP" sensitivity test, and 0.88 for "No HSP" test, compared to 0.88 for the reference set). The stability in these rebuilding results is due to the structural changes (i.e. to maturity, natural mortality and steepness values used in the reference set) that were adopted when integrating these data.

The impact of the structural change to the range of steepness values (reference set: 0.6, 0.7, 0.8) in the reference set is evaluated by the sensitivity test which evenly weights runs with steepness equal to 0.6 and 0.7 and gives zero weight to the 0.8 steepness runs ("No h=0.8"). There is a relatively small reduction in the probability of rebuilding to 0.83 (from 0.88 in the reference set).

The possibility of future low recruitment is examined with the "Low Recr" test (similar to test used in 2011), which sets the first 5 years of recruitment in the projections to 50% of the predicted value. The impact of this test is to reduce the probability of recovery to 0.75, which is lower than the reference set but higher than the target. The MP responds appropriately and the population rebuilds above the current interim target level.

Updated CPUE and aerial survey data have shown positive trends in recent years which appear to contribute most to the faster rebuilding dynamics. CPUE has had an increasing trend since 2007. The upq2008 sensitivity test explores an increase in catchability from 2008 which affects the interpretation of the CPUE data, changing the probability of rebuilding by 2035 to 0.73 (which is still above the interim target) from the reference case of 0.88. The influence of recent high catch rates in area 7 on the CPUE is explored in the CPUE without area 7 ("CPUE w/o A7") sensitivity test results, which indicates change in the probability of rebuilding by 2035 to 0.83 (from reference set estimate of 0.88).

We note that the 2017 aerial survey estimate of juvenile relative abundance is within the range of values for which the MP was tested (Takahashi et al, 2017), however, recent very high values (2016 and 2014) have been outside the bounds or very close to it. These very high values and the

series of high estimates since 2012 appear to have a large effect on the rebuilding trajectories. Sensitivity tests that exclude the highest 2016 aerial survey data point ("No AS 2016") indicate that the rebuilding target will still be met but will be much slower (the probability of rebuilding by 2035 is 0.74 compared with reference set 0.88). The sensitivity test with high aerial survey coefficient of variation ("High Aerial CV") gives a similar lower probability of rebuilding by 2035 (0.72).

Table 1. A subset of the sensitivity tests and results from Hillary et al., 2017a (table 3), plus an additional test of potential rebuilding for the Low Recr robustness test (defined in 2011), where recruitment is 50% lower than predicted for the first n years (5 years in this case). Columns 1-6 are:
1. **"Run", the name of the sensitivity test, defined in Table 2 of Hillary et al 2017,**
2. **"Rel. TRO (2017)", summary statistics (median and 90th %-iles) for the Total Reproductive Output (TRO) in 2017 relative to TRO(0),**
3. **"Rel. B10+ (2017)", biomass of animals age 10+ in 2017 relative to 10(0),**
4. **"F-to-FMSY 2017", the ratio of current F (2017) to F at MSY,**
5. **"Rel. TRO (2035)", TRO in 2035 relative to TRO(0),**
6. **"P(B10+ > 0.2B10+(0)) @ 2035", the probability that biomass of animals age 10+ is greater than 20% of the unfished state in 2035 (the original tuning objective).**

Run	Rel. TRO (2017)	Rel. B10+ (2017)	F-to-FMSY (2017)	Rel. TRO (2035)	P(B10+ > 0.2B10+(0)) @ 2035
Reference	0.13 (0.11-0.17)	0.11 (0.09-0.13)	0.5 (0.38-0.66)	0.3 (0.21-0.46)	0.88
UAM1	0.13 (0.1-0.17)	0.11 (0.09-0.13)	0.57 (0.43-0.74)	0.28 (0.18-0.43)	0.80
High Aerial CV	0.12 (0.1-0.16)	0.11 (0.09-0.14)	0.58 (0.43-0.78)	0.26 (0.16-0.41)	0.72
No AS 2016	0.13 (0.1-0.16)	0.11 (0.09-0.14)	0.59 (0.44-0.78)	0.26 (0.17-0.40)	0.74
Upq2008	0.11 (0.1-0.15)	0.09 (0.08-0.12)	0.56 (0.42-0.75)	0.26 (0.17-0.42)	0.73
CPUE w/o A7	0.12 (0.1-0.15)	0.1 (0.08-0.12)	0.54 (0.4-0.71)	0.29 (0.19-0.44)	0.83
No HSPs	0.13 (0.11-0.17)	0.11 (0.09-0.13)	0.5 (0.38-0.66)	0.30 (0.21-0.47)	0.88
No POPs/HSPs	0.12 (0.1-0.15)	0.1 (0.08-0.11)	0.52 (0.4-0.67)	0.29 (0.19-0.45)	0.79
No h = 0.8	0.13 (0.1-0.16)	0.11 (0.09-0.13)	0.57 (0.44-0.67)	0.28 (0.20-0.43)	0.83
Low Recr	Same as reference	Same as reference	Same as reference	0.26 (0.17-0.38)	0.75

Source: Hillary et al. (2017a), Table 3.

The two data inputs to the current MP are the CPUE and Aerial Survey indices. The most recent updates for these two time series do not trigger exceptional circumstances review of MP data inputs as they are within the ranges tested (Takahashi et al, 2017). Both declined from the most recent high data estimates in 2016. These recent high aerial survey estimates (2014 and 2016) were examined in detail in 2016 (Anon 2016). The MP TAC advice was shown to be primarily driven by the CPUE data and recent positive trends in the CPUE time-series.

The changes to the rebuilding timeframe are substantial and may be considered exceptional circumstances. As the direction of the change is positive (i.e. more rapid rebuilding) and these changes do not impact the calculation of recommended TAC in the MP, we do not recommend any action to review the 2018 TAC (set in 2016). These potential changes in population dynamics will, however, impact the development of operating models for testing candidate MPs that will replace

the existing MP in 2019. Given this, and the relatively few observations of the cohorts that make up the high 2016 aerial survey observation, this issue (change in population dynamics) should be reviewed again as part of finalizing conditioning of operating models for MP testing in 2018.

3.2   Changes in the Indonesian fishery selectivity

Since 2013, unusually large numbers of small fish have been recorded in the Indonesian catch monitoring data from Benoa, Bali (see Farley et al., 2017). It has not been possible to determine whether these fish were caught on or off the spawning ground, and/or whether these data indicate a substantial shift in the selectivity of the Indonesian fishery. Attempts have been made to match the catch monitoring data with additional fishery data provided by Indonesia, but linking the records has proved difficult, and the issue remains unresolved.

The potential shift in selectivity does not affect the data inputs to the MP, but may indicate changes in the operation of the Indonesian fishery that were not included in the OMs used at the time of testing the MP. The advice from the 2015 ESC regarding this issue remains the same for the 2018 TAC recommendation: the potential change in selectivity is of concern but the immediate implications for the operation of the MP are insufficient on their own to constitute a basis for recommending modification to the MP TAC. The previously recommended action should be urgently pursued by the CCSBT and Indonesia so that the shift may be addressed in the next reconditioning of the operating models in 2018 for management strategy evaluation of candidate MPs.

3.3   Total fishing mortalities exceeding the TAC

The design and simulation testing of the current MP assumed that all removals from the stock were accounted for, i.e. the implementation of the TAC was exact. Additional unaccounted mortality by members and non-members has the potential to undermine the MP based rebuilding strategy of the Commission. In 2014, the ESC evaluated the impacts of potential un-accounted mortalities from a variety of sources on stock status and the rebuilding plan (Anon 2014). The results indicated that, for the scenarios examined, there was likely to be little impact on current stock status; but if the total mortalities were as large as those considered in the 'added-catch scenario' (Anon 2014), and they continued into the future, then the impacts on the performance of the MP rebuilding plan may be substantial. The ESC could only use simple scenarios (i.e. the level and trajectory of potential unaccounted mortality) in these scenario analyses because there is very limited data or information on the specifics of the potential member and non-member unaccounted mortalities.

In 2014, 2015 and 2016 the ESC has agreed that the scenarios considered for potential unaccounted mortalities, if they were in fact occurring, triggered exceptional circumstances. The ESC did not recommend urgent management action on the level of the TAC in any of these years, but has requested that the Commission provide more informative data on unaccounted mortalities.

Accounting for sources of additional mortalities by members has progressed, with the Extended Commission defining a common definition for member's "attributable catch". Members will account for all sources of mortality as defined by the Commission, within their TAC from 2018

onwards, and report on their attributable catches to the ESC and CC. If the catch quantities to be attributed to total catch by members do not account for their total fishing mortality, then the potential for impact on the rebuilding plan for SBT will remain. Limited information is available on quantities of additional mortality that will be accounted for by members in 2018, or the historical estimates for these sources.

Reported catches by members have been greater than the global TAC in recent years. In 2013 and 2014 member's reported catches were greater than the TAC (477t and 324t). In 2015 and 2016 (preliminary figures) the member reported catches did not exceed the TAC (CCSBT, 2017) (451t and 434t under TAC respectively). Papers have been presented over many years on uncertainties in members' catches (e.g. Anon, 2016), but the issues remain unresolved.

Attempts to quantify potential levels of non-cooperating non-member unaccounted mortality in the Pacific, Indian and Atlantic Oceans by indirect methods has also progressed (Edwards et al., 2016). There are substantial uncertainties and assumptions made in these analyses. As part of boarding and inspection activities in the Tasman Sea in 2016, catches of undeclared SBT were seized (103t) from a single vessel operating in the same area at the same time as three other vessels from the same company (NZ MPI, 2016)). The Commission has set aside 306t to account for non-cooperating non-member catches through a "direct approach" in each year in the 2018-2020 TAC block. For TAC recommendations for 2021 and beyond, an "MP approach" will be used (Anon 2016) to encapsulate the uncertainty in total fishing mortality in tuning of candidate MPs to replace the current Bali procedure.

The ESC 2016 noted that the added catch scenario was potentially still plausible given the available data, analysis and reports. The additional catch scenario has been updated as the "UAM1" sensitivity test in 2017. The current stock status estimates are unaffected for this sensitivity test. The rate of rebuilding is slower than the reference set of projections, with the probability of rebuilding to the interim target estimated as 0.8 (down from 0.88 for the reference set). The target rebuilding objective would still be met under the current population dynamics model. This differs from 2014, where it was noted that although the MP was able to respond to the additional catches being taken (Anon 2014), the MP could not respond quickly enough to rebuild to the target within the specified timeframe.

The combination of the UAM1 sensitivity test with another sensitivity test with less optimistic rebuilding results could result in probability of rebuilding below the target objective, so this potential exceptional circumstances still poses a threat to rebuilding of the stock. Since there is a positive trajectory for rebuilding the stock, there is no requirement for action on the recommended TAC for 2018 in relation to this potential exceptional circumstance.

4   Conclusions

Through the meta-rules process we have examined changes in the (most likely) population dynamics since the MP was adopted in 2011, the potential shift in selectivity in the Indonesian fishery, and the potential for fishing mortality to be greater than the TAC. The impacts of these issues have been considered in the context of the 2018 TAC (recommended in 2016).

The change in the estimates of the population dynamics in the reconditioned operating models does not affect running of the MP or the 2018 TAC recommendation, and the MP input data do not trigger exceptional circumstances.

The Indonesian selectivity change remains unresolved. Similarly, this does not directly impact on the running of the MP or TAC advice, but this issue will need to be addressed for reconditioning operating models in 2018 for management strategy evaluation of candidate MPs. As such it should remain a priority for CCSBT and Indonesia to resolve, particularly as this issue potentially impacts on the close-kin data collection into the future.

The potential for total catches to be greater than the TAC remains a concern. Action has been taken by the Commission and members will account for their attributable catches from 2018 onwards, and an allowance for non-cooperating non-member catches has been made in the 2018-2020 TAC block.

These potential exceptional circumstances have been considered in isolation from one another, and the ESC may wish to consider the risk that cumulative impacts could impose on performance of the MP and the ability of the ESC to provide robust advice on stock status.

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