SOME INITIAL CONSIDERATIONS FOR THE REVIEW OF THE BALI MANAGEMENT PROCEDURE IN 2017

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Abstract : Some initial considerations for a review of the current management procedure (MP; "Bali procedure") scheduled in 2017 are presented. This review must include consideration of the indices required, the stock level attained by that time, and trends in regard to meeting the rebuilding target. Furthermore, the future availability of the indices required for any proposed procedure is very important to consider, including as regards the continuing use of the current MP. Several alternatives to the current MP are considered in terms of data quality, the cost of alternative indices, the future availability of data, the development cost and the time required.

要旨 : 2017 年に予定されている現行の管理方式（MP；"バリ方式"）の見直しに向けた初期的な検討を提示している。この見直しは、必要な指数の検討、及び資源再建目標に合致することに関してその年までに達成されるべき資源水準と動向の検討を含まなければならない。また、現行の MP の継続利用の点も含めて、いかなる提案された管理方式にも必要な指数の将来の入手可能性を検討することも大変重要である。現行の MP に対するいくつかの代替案を、データの品質、代替の指数にかかる費用、データの将来の入手可能性、及び開発に必要な費用と期間に関して検討している。

1. Introduction

Since 2011 the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) has set the global total allowable catch (TAC) of southern bluefin tuna (SBT; *Thunnus maccoyii*) based on a recommended value as calculated by a management procedure (an MP, which is called the "Bali procedure"). Along with this MP, the CCSBT prescribes "metarules" that pre-specify what should be done in Exceptional Circumstances (situations that deviate from the ones for which the MP was tested) when application of a TAC calculated from the MP would become highly risky or inappropriate (CCSBT 2012[1]). As a part of the "metarule" process, every six years the Extended Scientific Committee (ESC) (1) reviews the performance of the MP; and (2) on the basis of this, determines whether the MP is on track as expected or a new MP is required. The first thorough review of the Bali management procedure is due for the ESC meeting in 2017. In this document, we present some initial considerations on regarding this review of the Bali procedure.

The cancellation of the 2015 aerial survey (AS), taken together with the reduction in the

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[1] The technical specifications of the MP were updated in 2013 (available from http://www.ccsbt.org/userfiles/file/docs_english/general/MP_Specifications.pdf)

scale of this survey for 2016 and potentially beyond due to budgetary issues, raises considerable concern about the continuing use of the Bali procedure because the recruitment index from the AS is one of the two essential inputs to the procedure to compute a TAC value. The Strategy and Fisheries Management Working Group (SFMWG) requested that the ESC provide advice to the Extended Commission (EC) in 2015 on any preliminary consideration of alternatives to the current MP (CCSBT 2015b). Below we also provide some discussion on several alternatives to the Bali procedure.

2. Requirements for a thorough review of the Bali management procedure

Some of checks and considerations that are required for a thorough review of the current MP in 2017 have been undertaken annually, as well as every three years as a part of the metarule process. We discuss below some aspects of items that are required for a comprehensive review of the performance of the Bali MP, including those items that have been checked annually and in every-three-year reviews.

2. 1. Check whether observed indices and stock status are on the track expected

1) Required indices for the Bali procedure

In regard to the two inputs to the MP, the Japanese longline core vessel CPUE and the aerial survey (AS) indices, a check is needed as to whether observed trend of each index has been well within a predicted range by operating model (OM) projections. Actually, this has been done every year since the MP implementation in 2011 as a part of metarule process (Kurota et al. 2012, Sakai et al. 2013, Sakai and Takahashi 2014, Takahashi et al. 2015). So, for this component of the MP review, simply noting the accumulated results of past and current annual checks would suffice. If we look at results of check done in recent years, they show that the AS index tends to be outside the range predicted by the reference case of the OM and seems to be more variable than we initially thought (Sakai et al. 2013, Sakai and Takahashi 2014)

This check can also be considered as a review of the performance of indices required for the current MP along with validity of OM projections. Although this review of the two indices does not relate directly to performance of the MP, it does indirectly because to some extent these indices may reflect the stock dynamics of SBT resulting from management under the MP.

An examination of both the variability of the indices (has this continued within the range assumed when the MP was tested), and if not robustness of the MP to higher variability, is also important. This enables us to consider whether the continued use of an MP that utilizes such indices is appropriate.

2) Stock level and trend

Without doubt, the highest priority for the CCSBT is to achieve the interim management objective[2]. The performance of the current MP must be evaluated by examining whether the level and trend of SBT stock fall within predicted ranges under OM projections, and whether they are approaching the rebuilding target. This examination should be based on results from a full stock assessment, which since 2011 has been conducted every three years as a part of metarule process[3]. The next full stock assessment for SBT is scheduled for 2017 when the MP review is also planned, and the same type (though more comprehensive) examination of assessment results should be conducted focusing on review/evaluation of the MP. The performance of the MP can be evaluated according to the extent of deviation of the expected stock level and trend under earlier MP trials from those estimated in full assessment.

2. 2.　Consider future availability of the inputs required for the Bali procedure

In addition to reviewing the performance of the MP, the future availability of the inputs required for this MP (the core vessel CPUE and AS indices) should be considered when assessing the merits of the continuing use of this MP.

1) Core vessel longline CPUE index

Given TAC increases in the recent past and the current commercial situation in the SBT market, it is hard to imagine that the SBT-targeting Japanese longline fishery including the "core vessels" will fade away in near future. Thus it seems reasonable to assume that the core vessel CPUE index will continue to be available unless there is no substantial spatial/temporal change in fishing operation. Most of costs needed for the CPUE index are for the storing/processing of catch and effort data. A routine system for data storing/processing had been already developed. Data storing/processing has been well funded on a regular basis and will be funded in future as well.

　　However, the fishery-dependent CPUE index may be affected by changes in fleet dynamics of the longline fishery, and consequently may fail in the future to reflect stock trends adequately. Thus, this CPUE index should continue to be monitored by the CPUE

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[2] The CCSBT interim management objective is to rebuild the stock to a reference point of 20% of the pre-exploitation spawning stock biomass by 2035 with a 70% probability

[3] In the most recent past assessment in 2014, the ESC concluded that "the ESC also notes that continuing to follow the MP as proposed does lead to continued rebuilding in the short term even if the circumstances of the hypothesised additional unaccounted mortality are true. Hence, the ESC advises the EC to continue to follow the MP as formulated but, as a matter of urgency, to take steps to quantify all sources of unaccounted SBT mortality. If substantial levels of unaccounted mortality are confirmed, then there will be a need to retune the MP to achieve the EC's stated rebuilding objective" (CCSBT 2014a)

modeling group of the ESC as in the recent past.

2) AS index

As mentioned in the Introduction, the cancellation of the 2015 AS and reduction in the scale of the AS survey for 2016 casts a shadow over future funding for the AS and hence over the continuing use of the current MP. The ESC has been asked by the SFMWG to provide advice to the EC in 2015 on the costs[4] and benefits of continuing with the current MP, including on conducting the AS from 2017 to 2019 (CCSBT 2015b). These aspects will be analyzed and discussed at the 2015 ESC meeting, but the ESC should also ask the EC about the possibility/availability of funding the AS beyond 2019. Such information is necessary to enable the MP review in 2017 to consider future availability of the AS index, i.e. to consider the continued use of the current MP.

Issues pertaining to the AS index is not only financial, as, there could also be logistical problems to continue the survey. For instance, it is possible that the availability of experienced spotters will fall as these spotters become older. As regards what possible logistical problems might arise for the AS, this is difficult to judge for those who have not been closely involved in the AS; it would therefore be helpful for future discussions if Australian scientists could give advice on such possible logistical issues.

3. Potential alternatives to the Bali procedure

The SFMWG requested that the ESC provide advice to the EC in 2015 on any preliminary consideration of alternatives to the current MP (CCSBT 2015b). At the same time, the SFMWG requested further that the ESC initiate an assessment and provide advice on the relative merits of such alternatives to the current MP for reporting back to the 2016 EC meeting. We present here some preliminary consideration of such alternatives focusing on which stock indicator(s) is to be used in an MP. It should be emphasized that consideration not only for algorithm of MP but also for unfailing future availability of input data for MP is essential.

There are several candidates for such alternative to the Bali procedure. Some of them have been already mentioned briefly in CCSBT (2015b). Types of possible candidates include:

1) MP with only Japanese longline (LL) CPUE
2) MP with Japanese LL CPUE and other LL CPUE(s)
3) MP with the trolling index and Japanese LL CPUE

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[4] Costs of the AS are estimated as about AUD $830,000 for a full-scale survey and AUD $560,000-$680,000 for a reduced survey (see CCSBT 2015a for details).

4) MP with the SAPUE index and Japanese LL CPUE

5) MP with gene tagging (and/or close-kin) information and Japanese LL CPUE

6) Any MP combining 2, 3, 4 and 5 above

7) No MP (TAC based on constant catch or F projections)

We summarize initial thoughts on these alternatives in the sections below and in Table 1. For comparison, the current MP with the AS index (full-scaled or reduced) and Japanese LL CPUE is also included in the table as a potential candidate.

1) MP only using Japanese longline (LL) CPUE

This type of MP is one that utilizes the Japanese LL (core vessels) CPUE index only to calculate a TAC value. This MP can use the CPUE index for lower age class(es) (e.g. age 4) as a recruitment index together with the customary CPUE index for ages 4+, although an MP using only the CPUE index for ages 4+ is also possible to develop. The "Butterworth-Mori" management procedure that was agreed by the CCSBT in 2005 is an example of this type (see Attachment 6 in CCSBT 2005), but would need retuning if reconsidered at this time.

With a new MP which uses the CPUE for ages 4+ only, or uses the CPUE for a lower age class(es) as a recruitment index, there would be a risk that that MP might not be able to react to a recruitment failure in a timely manner for stock conservation due to the time lag before a signal of this failure would become detectable in the CPUE series. To reduce this risk, the MP might be reinforced by an annual review of other various fisheries-dependent and fisheries-independent indicators in the metarule process for examining whether or not recruitment failure has occurred and hence the TAC should be set lower than the MP output indicates.

The CPUE index used for the current MP is based on Japanese LL catch and effort data (for "core vessels"). The quality of these data is considered good in terms of data collection, and they have been accepted because they are collected through the well-systematized Real Time Monitoring Program (RTMP). The RTMP was developed to provide a regular routine for data collection. Data storing/processing have been and there is no reason to suspect that they will continue to be well funded. Therefore, as long as the fishery continues to exist, it seems safe to assume that there will not be any problem regarding the future availability of the CPUE index.

Scientists in the CCSBT are familiar with both this CPUE index and the MP that uses it. Taking account of this, development of such an alternative MP should be possible by 2019, by when the next TAC decision after that in 2016 if to be made. Almost the whole current OM framework can be used to test an alternative of this type because this MP needs the LL CPUE

only, and this is fitted and then projected in the current OM. If, for example, the Butterworth-Mori MP is reconsidered and re-tuned for the new alternative, then that would make the development easier.

2) MP with Japanese LL CPUE and other LL CPUE(s)

This type of MP utilizes other LL CPUE indices along with the Japanese LL CPUE. Possible candidates for such an index would be ones based on: i) the Korean LL CPUE and ii) the Taiwanese LL CPUE. In particular, the Taiwanese CPUE might be used as a recruitment index in this type of MP given the generally small SBT size classes the Taiwanese LL fleet catch. Standardized indices based on the Korean and Taiwanese LL CPUE data have been under development.

The quality of the Korean and Taiwanese data is considered good in terms of data collection, but further detailed reviews may be necessary. Because these are fisheries data, it is reasonable to assume that regular routines for data collection are well developed and that data storing/processing are well funded. Therefore, as long as these fishery continue, there should be no problem regarding the future availability of such CPUE indices.

The Japanese LL CPUE index is the only one for which an MP has been developed to date; with Korean or Taiwanese CPUE not used in this way as yet. Thus, adequate time is necessary for developing such an alternative MP, including time for constructing a standardized CPUE index/indices for the further catch-effort data introduced. The current OM would need to be modified to be able to generate data with the properties of those indices to be able to test alternative MPs of this type.

3) MP with the trolling index and Japanese LL CPUE

Along with Japanese LL CPUE index for ages 4+, this type of MP utilizes the trolling survey index of recruitment when calculating a TAC recommendation. The trolling survey index, "grid-type trolling index (GTI)" in particular, shows good agreement in terms of trend with other recruitment indicators (Takahashi et al. 2015).

The trolling index is fisheries-independent and based on data obtained from a trolling survey. Thus, the quality of these data is considered to be fairly good. The cost of the trolling survey is about AUD $100,000 which is much less than the cost of the AS. The troll survey and associated data processing have been well funded in the past. Therefore, as long as there are no logistical problems, the trolling index seems very likely to continue to be available in future. The trolling survey was not conducted in 2015 to use time effectively for analyzing other data.

The trolling index has already been included in the OM conditioning as one of robustness

tests, but has not been considered as input data for MP for projections. Hence the OM would need to be modified to generate simulated series for this index in projections. Probably this index will manifest greater variability than the AS, thus necessitating a somewhat more conservative MP than the Bali procedure.

4) MP with the SAPUE index and Japanese LL CPUE

Along with Japanese LL CPUE index for ages 4+, this type of MP utilizes the SAPUE index as an index of recruitment to calculate a TAC recommendation. Although the SAPUE index shows good agreement in terms of trends in the abundance of ages 2-4 age with the AS index, there have been recommendations not to use the SAPUE index in place of the AS index because the SAPUE index can be biased to different extents from year to year as it is based on commercial spotting data (Basson and Farley 2014). Nevertheless, we consider that it would still be worth considering an MP which includes use of the SAPUE index in the ESC, provided robustness tests that allow for bias in this index as a measure of recruitment.

Although the SAPUE index is fisheries-dependent and is based on commercial spotting data, given its agreement with the AS index, the quality of these data might be considered acceptable. The cost of the spotting survey is already covered by industry. Therefore, the future availability of the SAPUE index would depend upon the industry, but since they have found these surveys to be beneficial for them in the past, the industry would seem likely to continue them in all future years. Nevertheless, it would be necessary to consider whether or not there would be any logistical problems in continuing this survey.

The SAPUE index is not included in the current OM framework. Hence, the OM would needs to be modified both for conditioning and for generating SAPUE data for projections.

5) MP with gene tagging (and/or close-kin) information and Japanese LL CPUE

In addition to the Japanese LL CPUE index for ages 4+, this MP includes information on recruitment obtained from the gene-tagging project (Preece et al. 2015). For this type of MP, close-kin (CK) data can also be utilized, but here our consideration focuses on gene tagging data as recruitment information. Although the provision of information on recruitment from this gene tagging project is promising, the project is very new in the CCSBT having been launched only recently. Hence, several years will need to pass before these data will come on track for practical application.

In theory, recruitment information from this project is not subject to many of the problems associated with conventional tagging studies (such as the difficulties of estimating tag reporting rates). Thus, the quality of these data is considered likely to be fairly good. The cost of the gene tagging is estimated at about AUD $700,000 to AUD $900,000 for the pilot

study, which is similar to the cost of the AS (the running cost of the gene tagging is estimated as about AUD $590,000). The gene tagging project is planned to be funded within the CCSBT framework. The future availability of recruitment information from the gene tagging would thus depend upon both the continuation of this funding and the success of the pilot study.

The OM needs to be modified to include information from gene tagging for conditioning and generating such data in projections. Inclusion of gene tagging data

6) Any combination MP of 2, 3, 4, and 5 above

This type of MP would involve any combination of 2, 3, 4 and 5, so the points discussed above would also apply here.

7) No MP (TAC based on constant catch projections)

This is what the approach the ESC used to provide TAC recommendations before the Bali procedure was adopted. Would it be wise to return to this approach with its associated problems, which provide the original motivation to move to an MP in the first place? This approach involves is much riskier because of uncertainties about stock dynamics than the current MP approach.

Table 1. Summary of preliminary consideration of the alternatives to the Bali procedure.

Type of alternative MP	Data quality for index	Cost for index	Future availability of index	Development cost[a] & time	Other notes
0) MP with AS index & Jpn LL CPUE (for comparison with alternatives below)	i) fairly good for AS (but recent variability is a concern) ii) good and acceptable (because of RTMP data)	i) for AS, funded (AUD $830,000 for full-scaled and AUD $560,000-$680,000 for reduced) by CCSBT(budget issues apparent) ii) for Jpn LL, well funded by Japan	i) for AS, uncertain ii) for Jpn LL, no problem	already developed	
1) MP only with Jpn LL CPUE	good and acceptable (because of RTMP data)	well funded by Japan	no problem	i) technical and ESC meetings/year ii) 2 years? (by 2019 possible)	a) Previously-agreed Butterworth-Mori MP is available, but would need retuning b) CPUE for lower age(s) as recruitment index c) the current OM framework can be used to test such MPs
2) MP with Jpn LL & other LL CPUE	i) good for Korean and Taiwanese LL, but may need further reviews ii) see above for Jpn LL	well funded by Japan, Korea, and Taiwan	no problem	i) technical and ESC meetings/year, may need CPUE WS to examine Korea and Taiwanese CPUE? ii) 2-3 years? (by 2019 impossible?)	a) Jpn CPUE for lower age(s) or Taiwanese CPUE as a recruitment index b) OM needs to be modified to include Korean or Taiwanese CPUE
3) MP with Trolling index & Jpn LL CPUE	i) fairly good for trolling (because of fisheries-independence) ii) see above for Jpn LL	i) well funded (AUD $100,000) in past by Japan, may be OK in future for trolling ii) see above for Jpn LL	i) may be OK depending on funding for trolling ii) see above Jpn LL	i) technical and ESC meetings/year ii) 2 years? (by 2019 possible?)	a) OM projection needs to be modified to generate simulated series for trolling index b) Likely higher variance could necessitate a more conservative MP
4) MP with SAPUE & Jpn LL CPUE	i) acceptable for SAPUE (because of agreement with the AS) ii) see above for Jpn LL	i) Australian industry pays for SAPUE survey ii) see above for Jpn LL	i) depending on Australian industry for SAPUE ii) see above Jpn LL	i) technical and ESC meetings/year ii) 2 years? (by 2019 possible?)	a) OM needs to be modified to include SAPUE b) Obtaining adequate performance under robustness tests allowing for possible bias in the index would necessitate a more conservative MP
5) MP with gene tag (and/or CK) info & Jpn LL CPUE	i) fairly good for gene tagging (because of fisheries-independence) ii) see above for Jpn LL	i) there are plans for funding by CCSBT for gene tagging ($700,000 to AUD $900,000 for the pilot study, AUD $590,000 for running costs) (also there are plans for CK) ii) see above for Jpn LL	i) depending on funding and success of the pilot study for gene tagging (also available funding for CK) ii) see above Jpn LL	i) technical and ESC meetings/year ii) at least 5 years? due to gene tagging (by 2019 definitely impossible)	a) OM needs to be modified to include information from gene tagging

6) Any combination MP of 2, 3, 4, & 5 above	see above	see above	see above	see above	see above
7) No MP (TAC based on constant catch or F projections)	same as data for OM	-	-	-	a) This approach is far riskier to uncertainty of stock dynamics than the current MP approach, so that TACs would need to be set at lower levels than possible under an MP to reduce this risk

Notes a: For example of meeting costs required in 2014, AUD $49,881 for the Operating Model/Management Procedure Technical Meeting (4 days) and AUD $175,327 for the ESC Meeting

(6 days) (CCSBT 2014b)。

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