Draft fisheries management plan for southern bluefin tuna

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Purpose

The terms of reference for the Strategy and Fisheries Management Working Group outline that one of the tasks of the group is to develop a draft **Fisheries Management Plan** for southern bluefin tuna, comprising management objectives for the southern bluefin tuna stock and ecologically related species consistent with modern standards of international fisheries management. This document provides some ideas on components of a fisheries management plan, with a particular focus on a rebuild strategy. The terms of reference for the SFMWG outline that a key component of the fisheries management plan will be a **rebuild strategy** that is consistent with the UN Fish Stocks Agreement and the precautionary approach.

Introduction

This document puts forward some suggested elements of a rebuild strategy that would form a central component of a broader fisheries management plan for SBT. This document does not consider other aspects of a fisheries management plan such as other technical measures for managing the stock, or management of ecologically related species. These components may be incorporated into the broader strategic plan for SBT, of which a fisheries management plan would be one component.

Given the current status of the SBT stock, the focus at this stage needs to be on rebuilding the fishery to a level that poses less risk of recruitment failure and will ultimately provide higher long term yields. However, it is also useful to at least consider some of the additional elements of a broader management strategy (termed here a fisheries management plan). In effect, a rebuild strategy is a component of an overall fisheries management plan. Considering the overall plan at this stage ensures longer term goals for the fishery can be incorporated into the MP as appropriate. This document does not provide a comprehensive review of the extensive literature on harvest strategies, but provides a starting point for further discussion.

Components of a rebuild strategy agreed to date include:

- **Target:** SSB_{MSY}
- **Interim target reference point:** 20% of SSB_0
- **Management actions:** Management Procedure (MP) to set TAC[1]

Agenda Item 3 of the April 2010 meeting of the SFMWG outlines that the 2010 meeting will be required to further develop the rebuilding strategy, including:

- Consideration of appropriate **timeframes** for reaching 20% SSB_0 and other performance targets

[1] Report of the First Meeting of the Strategy and Fisheries Management Working Group, April 2009.

Core elements of a rebuild strategy (Part One) and fisheries management plan (Part Two)

The concept of Maximum Sustainable Yield (MSY) was derived in the 1930s. MSY is a biological reference point that relates to both a target biomass level (B_{MSY}) and a target fishing mortality rate (F_{MSY}). The MSY concept was embodied in international law in 1982 in the United Nations Convention on the Law of the Sea. Subsequently, it has been adopted in national fisheries legislation in many jurisdictions.

MSY provides a balance or compromise between the competing interests of sustainability and utilisation. It does, however, have some noted limitations. First, there are often estimation problems, although this may in part reflect the reliability of the underlying data. The suitability of MSY-compatible reference points as management targets is also sometimes challenged. Environmentalists (and others) have advocated that B_{MSY} should be interpreted as a limit, rather than a target. MSY is also seen as being overly constraining in terms of the range of harvest strategies that may be identified for different fisheries.

Despite these limitations, the scientific and management roles of MSY-compatible reference points have continued to evolve. MSY is now viewed as a long-term average based on a constant fishing mortality rate or other MSY-based harvest strategy. Rather than being static, natural populations continually fluctuate in size, both with and without fishing activity. As a result, harvest strategies based on MSY-compatible reference points will generally result in variable annual catches and at any point in time the current biomass will either be below or above the B_{MSY} level.

More recently, other biological reference points have been considered in addition to biomass targets such as B_{MSY}. In particular, the notion of overfishing ***thresholds*** and ***limits*** has become commonplace. These concepts have arisen due to recognition that targets are frequently exceeded (for a multitude of reasons; e.g. uncertainties about data and stock assessments, political and short-term financial considerations, and environmental fluctuations). More risk-averse management strategies have also developed in response to growing acceptance of the precautionary approach and pressure to incorporate ecosystem considerations into the management of fisheries.

Of particular significance is the 1995 United Nations Fish Stocks Agreement. This agreement establishes in international law some key principles, as follows (see also Appendix One):

a) Two types of precautionary reference points should be used: **conservation, or limit, reference points** and **management, or target, reference points**. Limit reference points set boundaries that are intended to constrain harvesting within safe biological limits within which the stocks can produce maximum sustainable yield. Target reference points are intended to meet management objectives (Annex II, para 2);

b) Fishery management strategies shall ensure that the risk of exceeding limit reference points is very low ... [and] that target reference points are not exceeded on average (Annex II, para 5); and

c) The fishing mortality rate that generates maximum sustainable yield shall be regarded as a minimum standard for limit reference points (Annex II, para 7).

In summary, although different commentators may use different terminology, the following elements could be seen as common to most **rebuilding strategies**:

- The **rebuild target**;
- The expected **timeframe** for rebuilding;
- A minimum acceptable **probability** of achieving the rebuild; and
- The set of **management actions** that will achieve the desired rebuild.

Likewise, a longer-term Fisheries Management Plan would likely include:

- A specified **target** about which a fishery or stock should fluctuate (note that this might or might not be the same as the rebuild target); and
- **Limit reference points** below which the stock should not fall (possibly including a **threshold**), and that trigger a requirement for a formal, time-constrained rebuilding plan.

Part One: Rebuild strategy

A. Rebuild target

Commissioners have already agreed on the spawning stock biomass that produces the maximum sustainable yield (SSB_{MSY}) as the target biomass for SBT. Commissioners have also agreed on an interim target reference point of 20% of unfished spawning stock biomass.

B. Rebuild timeframe

Setting a timeframe for rebuilding a stock needs to take into account the biological characteristics of the stock, any environmental conditions affecting the stock, and the economic, social and cultural factors relevant to fisheries on the stock. Another relevant issue is the comprehensiveness and reliability of the available information on these factors and on stock status.

The characteristics of the individual species/ stock help determine the way and the rate at which a stock is to be rebuilt. The characteristics of the fishery, a e.g. the need to limit impacts on industry as much as possible, are also relevant.

As a starting point, the New Zealand harvest strategy uses a timeframe of between T_{min} and $2*T_{min}$. T_{min} is the theoretical number of years required to rebuild a stock to the target in the absence of fishing. T_{min} reflects the extent to which a stock has fallen below the target, the biological characteristics of the stock that limit the rate of rebuild, and the prevailing environmental conditions that also limit the rate of rebuilding. Allowing a rebuilding period up to twice T_{min} allows for consideration of socio-economic conditions, where complete closure of a fishery could create undue hardships for various fishing sectors and/or when the stock is an unavoidable bycatch of another fishery.

C. Probabilities

As well as determining the target biomass and desired timeframe for achieving it, it is also necessary to consider what level of certainty (probability) to use in determining whether the

stock has reached its target. The stock assessment can provide outputs of both projected biomass levels, and associated probabilities.

For a depleted stock where we want to avoid something bad happening (i.e. stock collapse or recruitment failure), a high threshold may be set (e.g. a 90% probability of stock size increase in the short term). In the middle to longer term, lower probabilities may be acceptable (e.g. a 70% probability of reaching $20\%B_0$ within twenty years).

It should be noted that a probability of 0.5 would only provide a 50% chance of biomass actually reaching the specified target (and conversely, a 50% chance that it is lower than the target). This probability is appropriate for the B_{MSY} target as we would expect to fluctuate around this level once the stock has been rebuilt.

However, use of a probability level greater than 50% ensures that rebuilding plans are not abandoned too soon; in addition, for a stock that has been fished to a low level, there is a need to rebuild the age structure as well as the biomass, and this may not be achieved by using a probability as low as 50%. As an example, the New Zealand harvest strategy considers a stock to have been fully rebuilt when it can be demonstrated that there is at least a 70% probability that the target has been achieved.

D. Management Actions

The Convention establishes setting a TAC and allocating it amongst members as the primary measure for achieving the objective of the Convention. The Convention also specifies that the Commission may, if necessary, decide upon other additional measures (Article 8(3)(b)).

CCSBT 16 reached agreement on a number of measures that were intended to start rebuilding the SBT stock. These measures include agreement on 2-year catch limits that represent a 20% reduction from 2009 catch limits; agreement to adopt a MP to set catch limits in future years; a fall-back position of additional substantial reductions to the TAC if the MP is not adopted; and measures to further scrutinise and strengthen members' implementation of conservation and management measures including catch limits. CCSBT16 also considered a proposal to develop an Emergency Rule, which would respond to changes in recruitment in the fishery.

In general, the types of management actions that could be considered as part of a rebuilding strategy could include (not all are necessarily relevant to SBT):

- Reductions in TACs
- Additional protection for spawning fish, including spatial or temporal closures
- Responding to evidence of below-average recruitment in the fishery (e.g. as proposed under the draft Emergency Rule)
- Closures of specific areas (e.g. areas with high catches of juveniles)
- Changes in the minimum legal size of fish caught (for example by increasing the minimum allowable mesh size of fishing nets)
- Additional MCS measures to ensure catches do not exceed the TAC
- Capacity reduction
- Closure of target fisheries
- Curtailment or closure of fisheries that incidentally catch the species concerned

Part Two: Fisheries Management Strategy

E. Target reference point

In general, fisheries should be managed to fluctuate around a specified target. This approach recognises that fisheries are dynamic and do fluctuate over time, but that there are advantages to identifying the desirable range in which biomass should fall.

As noted, Commissioners have already agreed on a rebuilding target for SBT, along with an interim rebuilding reference point. However, for a longer term fisheries management strategy (that may be appropriate to reflect in the MP), Commissioners might also like to consider other potential target biomass levels. Of particular relevance here are:

(i) The Convention— The objective of the **Convention for the Conservation of Southern Bluefin Tuna** is to ensure, through appropriate management, the conservation and optimum utilisation of southern bluefin tuna. This objective does not specify the level at which optimum utilisation is achieved. For example, many commentators now talk about maximum economic yield, which is generally considered to be achieved with biomass levels above B_{MSY}.

(ii) The **UN Fish Stocks Agreement**— The SFMWG's terms of reference identify that the group shall develop a rebuild strategy and fisheries management plan that is consistent with the UN Fish Stocks Agreement (UNFSA) and the precautionary approach. UNFSA outlines that for overfished stocks, the biomass which would produce maximum sustainable yield can serve as a rebuilding target. However, in general UNFSA suggests that the fishing mortality rate which generates maximum sustainable yield should be regarded as a *minimum* standard for **limit reference points** (i.e. not as a target but as a limit).

The New Zealand harvest strategy outlines that fisheries should be managed to fluctuate around a target based on MSY-compatible reference points or better[2] with at least a 50% probability of achieving the target. Similar harvest strategies in some other jurisdictions set a higher biomass target level. For example, the Australian 'Commonwealth Fisheries Harvest Strategy' (document CCSBT-SFMWG/0904/05) outlines that harvest strategies will seek to maintain stocks, on average, at a target biomass point equal to the stock required to produce maximum economic yield (B_{MEY}). In cases where B_{MEY} is unknown, a proxy of $1.2B_{MSY}$ (or a level 20% higher than a given proxy for B_{MSY}) would be used for a single species fishery.

F. Limit reference points

The purpose of identifying limit reference points is to better enable a management response in the event that stock size has dropped below the target level. For southern bluefin tuna, the relevance would be as a future safeguard against the stock size again dropping to the low levels currently being experienced, where the risks of recruitment failure are much higher.

In general, limits are biological reference points that trigger a requirement for a formal, time-constrained rebuilding plan. Some fisheries differentiate between thresholds or soft limits (at which a rebuilding plan will be triggered, depending on the circumstances of the specific fishery) and hard limits, at which more stringent management measures will be necessary in order to rebuild the fishery (including closure of targeted fisheries). Implementing

[2] MSY-compatible reference points include those related to stock biomass (i.e. B_{MSY}), fishing mortality (i.e. F_{MSY}) and catch (i.e. MSY itself), as well as analytical and conceptual proxies (i.e. approximations) for each of these three quantities.

management action to increase stock size when it reaches a threshold level may reduce the need for more stringent management actions that would otherwise be required if stock size declined further.

In considering limit reference points, key questions include the appropriate biomass level to treat as a limit reference point, as well as the probability associated with determining whether or not the limit has been breached. For example, ½ BMSY or 20% B_0 (whichever is higher) has been used in various fisheries jurisdictions as an intermediate or 'soft' limit/threshold.[3] More stringent limits have also been used, for example B_{MSY}.[4]

The 'hard' limit is the biological reference point at which more active management of the fishery is required in order to ensure rebuilding. For example, closure would generally be considered for target fisheries; it may also be appropriate to consider curtailment or closure of fisheries that incidentally catch the species concerned. Various jurisdictions have adopted a default hard limit of ¼ B_{MSY} or 10% B_0, whichever is higher. Higher biomass levels have also been adopted as a limit reference point in some jurisdictions.[5]

For stocks that have fallen below the limit reference point, a rebuild strategy would need to be agreed. Key factors include:

- What is the timeframe for rebuilding back to the target level? As discussed in the preceding section, the appropriate timeframe would depend on the biology of the species, the extent of stock depletion below the target, and prevailing environmental conditions.
- What probability should be associated with determining the status of the stock in relation to either the limit reference point or the target level? For example, stocks might be considered to have been fully rebuilt when it can be demonstrated that there is at least a 70% probability that the target has been achieved.[6]

In general, monitoring and management action is needed to ensure that fisheries and stocks fluctuate around target levels, particularly when they start to fall below those targets. Management action that may be necessary for stocks that have fallen below the target (but has not yet declined to the limit reference point) is likely to involve reductions in fishing mortality rates and TACs, and/or implementation or modification of input controls such as gear restrictions and seasonal or area closures.

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[3] The use of ½B_{MSY} as a limit that triggers the need for a formal, time-constrained rebuilding plan has been adopted for many fisheries in the United States for up to a decade, and has subsequently been adopted or considered by an increasing number of other national and international organisations including New Zealand.

[4] The Australian Commonwealth Fisheries Harvest Strategy Policy outlines that for stocks above B_{LIM} (equal to or greater than ½ B_{MSY} (or proxy)) but below the level that will produce maximum sustainable yield (B_{MSY}), it is necessary to first rebuild stocks to B_{MSY}. Once stocks reach B_{MSY}, rebuilding shall continue toward B_{TARG} (B_{MEY} or 1.2 B_{MSY}) however the rate of rebuilding shall be determined in a way that considers the appropriate balance between short term losses and longer term economic gains.

[5] A hard limit of 10% B_0 has been implemented in several fisheries worldwide. For example, the U.S. Pacific Fisheries Management Council routinely uses a "40:10 default harvest rule" whereby stocks are fished at a constant optimal rate provided they are above 40% B_0 and are closed once they fall below 10% B_0 (with fishing mortality decreasing linearly between these levels). More restrictive hard limits have also been implemented. A hard limit of 20% B_0 has been adopted for Gulf of Alaska walleye pollock. Australia has also implemented a limit that may result in targeted fishing of key commercial species ceasing at biomass levels below 20% B_0 for some Commonwealth fisheries (Australian Fisheries Management Authority 2007).

[6] Use of a probability level greater than 50% ensures rebuilding plans are not abandoned too soon; in addition, for a stock that has been depleted below the soft limit/threshold, there is a need to rebuild the age structure as well as the biomass, and this may not be achieved by using a probability as low as 50%. For fisheries that have been closed, some research fishing may be required in order to determine stock status.

Summary— draft fisheries management plan for SBT

In summary, the key elements of a fisheries management plan for SBT for Commissioners to consider and decide upon include:

Item	**Status**	**Plausible range based on literature presented in this paper**
Overall objective: To ensure, through appropriate management, the conservation and optimum utilisation of southern bluefin tuna.		
Rebuilding strategy		
The **rebuild target**	B_{MSY}	B_{MSY}
The interim target	20% B_0	?
The expected **timeframe** for rebuilding	**To be agreed**	T_{min}[7] to ??
A minimum acceptable **probability** of achieving the rebuild	**To be agreed**	0.5 to 0.9
Management actions: ▪ agreement on 2-year catch limits that represent a 20% reduction from 2009 catch limits; ▪ agreement to adopt a MP to set catch limits in future years; ▪ a fall-back position of additional substantial reductions to the TAC if the MP is not adopted; and ▪ measures to further scrutinise and strengthen members' implementation of conservation and management measures including catch limits.		
Long-term management strategy		
A specified **target** about which a fishery or stock should fluctuate	**To be agreed**	B_{MSY} to B_{MEY}
A **soft limit/threshold** that triggers a requirement for a formal, time-constrained rebuilding plan	**To be agreed**	½ B_{MSY}[8] to B_{MSY}
A **hard limit** below which fisheries should be considered for closure.	**To be agreed**	¼ B_{MSY}[9] to ½ B_{MSY}
Management actions (examples only): ▪ Reductions in TACs ▪ Additional protection for spawning fish, including spatial or temporal closures ▪ Responding to evidence of below-average recruitment in the fishery (e.g. as proposed under the draft Emergency Rule) ▪ Closures of specific areas (e.g. areas with high catches of juveniles) ▪ Additional MCS measures to ensure catches do not exceed the TAC		

[7] T_{min} is the time required to re-build the fishery in the absence of fishing i.e. the fastest possible rebuild timeframe.
[8] 20% B_0 is also used as an equivalent figure.
[9] 10% B_0 is also used as an equivalent figure.

- Capacity reduction
- Closure of target fisheries
- Curtailment or closure of fisheries that incidentally catch the species concerned

Appendix One: 1995 United Nations Fish Stocks Agreement, Annex II

“Guidelines for the Application of Precautionary Reference Points in Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks.

1. A precautionary reference point is an estimated value derived through an agreed scientific procedure, which corresponds to the state of the resource and of the fishery, and which can be used as a guide for fisheries management.

2. Two types of precautionary reference points should be used: conservation, or limit, reference points and management, or target, reference points. Limit reference points set boundaries which are intended to constrain harvesting within safe biological limits within which the stocks can produce maximum sustainable yield. Target reference points are intended to meet management objectives.

3. Precautionary reference points should be stock-specific to account, inter alia, for the reproductive capacity, the resilience of each stock and the characteristics of fisheries exploiting the stock, as well as other sources of mortality and major sources of uncertainty.

4. Management strategies shall seek to maintain or restore populations of harvested stocks, and where necessary associated or dependent species, at levels consistent with previously agreed precautionary reference points. Such reference points shall be used to trigger pre-agreed conservation and management action. Management strategies shall include measures which can be implemented when precautionary reference points are approached.

5. Fishery management strategies shall ensure that the risk of exceeding limit reference points is very low. If a stock falls below a limit reference point or is at risk of falling below such a reference point, conservation and management action should be initiated to facilitate stock recovery. Fishery management strategies shall ensure that target reference points are not exceeded on average.

6. When information for determining reference points for a fishery is poor or absent, provisional reference points shall be set. Provisional reference points may be established by analogy to similar and better-known stocks. In such situations, the fishery shall be subject to enhanced monitoring so as to enable revision of provisional reference points as improved information becomes available.

7. The fishing mortality rate which generates maximum sustainable yield should be regarded as a minimum standard for limit reference points. For stocks which are not overfished, fishery management strategies shall ensure that fishing mortality does not exceed that which corresponds to maximum sustainable yield, and that the biomass does not fall below a predefined threshold. For overfished stocks, the biomass which would produce maximum sustainable yield can serve as a rebuilding target.”