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The importance of harvest strategies and two examples of harvest strategies in practice

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This paper sets out the need for and importance of harvest strategies and provides two examples of existing harvest strategies: the CCSBT Management Procedure (a harvest strategy established by a tuna regional fisheries management organisation (RFMO)) and the Eastern and Tuna Billfish Fishery swordfish harvest strategy (an Australian domestic harvest strategy established pursuant to Australia's *Commonwealth Fisheries Harvest Strategy Policy and Guidelines*). The purpose of the paper is to set out how harvest strategies work in practice to build comfort with and understanding of the concept amongst CCMs. This paper is intended to be considered alongside the *FFA Member CCMs' proposal for a conservation and management measure to develop and implement a harvest strategy approach for key tuna species in the WCPO* (WCPFC11-2014-DP09).

Harvest strategies, in their purest form, are highly deterministic, comprehensive and integrated, but to achieve them in the Western and Central Pacific Fisheries Commission (WCPFC) will be challenging.

WCPFC's work on harvest strategies

The WCPFC has started a process to determine agreed management objectives for key fish stocks with a view to translating these objectives into effective management frameworks. The *Report of the Expert Working Group to WCPFC 10: Management Objectives, performance indicators and reference points* sets out just some of the complex issues to be considered and resolved in determining objectives in a multi-gear and multi-species fishery.

A key component of harvest strategies is agreeing reference points. WCPFC has already undertaken considerable work on reference points: in 2012, the Commission adopted a limit reference point of B20% for skipjack, bigeye, yellowfin and South Pacific albacore tuna. Further, the Commission is actively considering the adoption of target reference points for key tuna species (for example the PNA Members and Tokelau proposal to establish 50% of the estimated recent average spawning biomass in the absence of fishing as a target reference point for skipjack tuna). These developments are a key step in developing harvest strategies for those species. The work done by the Commission and previous MOW meetings on reference points and objectives represent some of the essential elements of a harvest strategy.

Australia has adopted target and limit reference points domestically. The operational objective of Australia's Harvest Strategies is maximum economic yield. Estimating MEY can be difficult and requires a lot of information and data. Very few Australian fisheries have the information needed to accurately estimate MEY or the biomass at which MEY occurs (B_{MEY}). When MEY cannot be estimated directly, Australia has adopted a proxy for achieving MEY of $B_{48\%}$ (48% of unfished spawning stock biomass). This is similar to the target reference point of B_{50} being suggested by PNA Members and Tokelau for Skipjack Tuna in the WCPO.

Australia has also adopted a default limit reference point of 20% of unfished spawning stock biomass (B_{20}). In most cases, it has been decided that there should be a 90% probability of being above this limit reference point. In Australia, being below a limit reference point results in additional management responses and requires the development of a stock rebuilding strategy.

Building on the work of the Scientific Committee, Commission and the MOW process, the FFA draft conservation and management measure seeks the Commission's agreement to formalise this work and formally develop harvest strategies for major tuna stocks under the Commission's purview. While progress is being made on developing harvest strategies for individual species, the measure recognises that elements of individual harvest strategies may be developed in a piecemeal approach, given the multi-gear and multi-species nature of the fishery. Within the WCPFC context, this is

inevitable but it is important that the elements of each harvest strategy are seen to fit into an overarching framework or long-term vision.

The importance of harvest strategies: an Australian perspective

In 2007, the Australian Commonwealth Government introduced the *Commonwealth Fisheries Harvest Strategy Policy and Guidelines* with the aim of delivering long-term sustainability and economic profitability for Commonwealth fish stocks, while providing the fishing industry with a more predictable operating environment. Australia applies a transparent, evidence-based precautionary decision-making framework, informed by the best scientific information available.

Australian harvest strategies set out the management actions necessary to achieve defined biological and economic objectives in a fishery. They contain a process for monitoring and conducting independent assessments of the biological and economic conditions of the fishery and pre-defined rules that control the intensity of fishing activity according to these assessments. Harvest strategies have improved both stock status and economic performance of Australian managed fisheries. Generally, Australian industry are supportive of harvest strategies as they have produced more stable fishing conditions and predictable decision-making. The harvest strategy policy is widely regarded as having been a very successful initiative for improving the management of Commonwealth fisheries. Globally, it is clear that where well-designed harvest strategies are applied and adhered to, there has been a noticeable improvement in, or maintenance of, fish stocks.

Objectives and reference points

Management objectives often focus on the biological sustainability of the target stock and broader environmental impacts, profitability of the catching sector and minimisation of management costs. In the Pacific, management objectives may also focus on employment, food security and fishing licence revenues.

Reference Points allow the fisheries manager to determine whether the objectives for the fishery are being achieved. Common reference points are Maximum Sustainable Yield (MSY), the largest catch that can be taken from a stock continuously without affecting the catch of future years and Maximum Economic Yield (MEY), the reference point that maximises the profitability of the fishery.

Rights

Australia's Commonwealth fisheries allocate secure ongoing fishing rights in the form of quota through the provision of Statutory Fishing Rights (SFRs) which are outlined in the specific Fisheries Management Plans.

SFRs can be considered as a share of the fishery or a 'slice of the pie', they are not measured in kg or tonnes. Each year, Australia sets a total allowable catch (TAC) for each quota species. This TAC is then divided equally to each SFR. The TAC may change each year, this means that the amount fish each SFR allows a person to take can also change each year.

Harvest Control Rules

Australia develops harvest control rules that adjust the TAC to meet the management objectives of the fishery. If the stock declines the TAC is reduced and if the stock grows the TAC is increased. As the TAC is fully allocated, everyone holding SFRs shares the reduction or increase in catch proportionally.

Harvest control rules (also known as management strategies) pre-determine the management decisions to respond to a decline (or increase) in a fish stock to ensure that difficult decisions are taken when necessary, rather than avoided for political or short-term reasons.

For example, harvest control rules need a target level (B_{48}), a timeframe (10 years) and a probability of achieving the target (50%) to work properly. Agreement on these factors is a management decision, not a scientific decision. Some harvest control rules are designed not only to meet a target, but to avoid a limit (B_{20}) with a high degree of certainty (90%).

It is best practice to evaluate harvest control rules within a modelling framework, known as management strategy evaluation (MSE), before implementing them in a fishery to ensure that the harvest control rule is likely to achieve the management objective. Typically harvest control rules are changed as a result of this work.

It is important to note that harvest control rules form an essential element of a comprehensive harvest strategy.

Example 1: CCSBT Management Procedure (harvest strategy adopted by a tuna RFMO)

The Commission for the Conservation of Southern Bluefin Tuna (CCSBT) is a regional fisheries management organisation (RFMO) responsible for managing southern bluefin tuna (SBT) throughout its range. Historically, SBT has been overfished and the stock is currently estimated to be 9% of unfished spawning stock biomass, although recent signs are that the species is recovering.

An SBT harvest strategy (termed a management procedure by CCSBT) was agreed in 2011. The harvest strategy changes the total allowable catch (TAC) based on the updated monitoring data that includes global catch, specified longline CPUE and results from the SBT aerial survey.

From 2002 to 2011, CCSBT conducted extensive work to develop a harvest strategy in order to guide its global TAC setting process for SBT. The CCSBT tested a variety of candidate management procedures with an operating model of the fishery that simulated the characteristics of the SBT stock and fishery and projected future outcomes for SBT stock biomass under a range of different possible harvest strategies. The candidate management procedures were tested against a range of uncertainties so that a robust procedure could be identified. The final management procedure, known as the "Bali Procedure", was recommended by the CCSBT's Scientific Committee in July 2011.

CCSBT adopted the Bali Procedure and the following associated management parameters as its management procedure at the CCSBT's eighteenth annual meeting in October 2011:

- the management procedure is designed to achieve a 70% probability of rebuilding the stock to the interim rebuilding target reference point of 20% of the unfished spawning stock biomass by 2035;
- the TAC is set for a three-year period
- the minimum TAC change (increase or decrease) within the three-year period is 100 tonnes;
- the maximum TAC change (increase or decrease) within the three-year period is 3,000 tonnes.

The harvest strategy has been used to guide the setting of the global SBT TAC for fishing years since 2012.There is a one year lag between TAC calculation by the harvest strategy and implementation of that TAC (e.g. the 2015-2017 TAC was calculated in 2013).

The CCSBT also adopted the meta-rule process as the method for dealing with exceptional circumstances (e.g. stock collapse) in the SBT fishery. The meta-rule process describes: (1) the process to determine whether exceptional circumstances exist; (2) the process for action; and (3) the principles for action.

The establishment of the CCSBT harvest strategy has greatly simplified the previous process in place to agree catch limits and has enabled the Commission to concentrate on other important agenda items. To date the exceptional circumstance provisions have not been triggered and global TACs have been set based on the outputs of the harvest strategy. It should be noted that it took almost 10 years to develop a CCSBT Management Procedure and it was for a single species (SBT) and was negotiated between the six Members of the Extended Commission.

Example 2: Eastern Tuna and Billfish Fishery swordfish harvest strategy (an Australian domestic harvest strategy)

Australia's Eastern Tuna and Billfish Fishery (ETBF) is a longline fishery with five species under quota, one of which is Broadbill Swordfish. Australia takes the majority of swordfish in the south-western Pacific Ocean and tagging indicates there is little east-west movement of Swordfish in this area.

Given that Australia does not manage the entire swordfish stock the harvest strategy in place for swordfish is based on commercial catch rates and size structure. The management objective for this fishery is to harvest swordfish at a level that is profitable for industry (essentially MEY). Therefore, the target reference point corresponds to a commercial catch rate which would achieve a biomass of B_{48}, which corresponds to catch rates profitable for industry (MEY).

To achieve its objective, the ETBF swordfish Harvest Strategy collects data from the fishery and uses these data in a series of decision rules to set the total allowable catch (TAC). In particular, the TAC is updated in response to the following key indicators of existing fishing conditions:

- trends in the biomass of prime-size (or optimal-sized) fish available to the fishery,
- the proportion of large-sized fish in the catch, and
- trends in the availability of small-sized fish in the fishery.

When fishing conditions are favourable for Swordfish, the TAC will increase and when conditions are unfavourable the TAC will decrease.

Trends in the availability of the given size class in the fishery are based on the annual time-series of standardised catch rates. Catch rates are standardised to account for changes in the fishing operation when targeting different species and includes changes in oceanographic conditions. Incorporating information on the size structure of the catch into the harvest strategy also allows changes in the structure of the fish population under different levels of exploitation to be monitored.

A management strategy evaluation was conducted to project the likely performance of the fishery under the various harvest strategies being considered. Potential harvest strategies are tested in a virtual world via simulation modelling before the best performing harvest strategy to meet the stated management objective is implemented in the fishery. The ETBF swordfish harvest strategy has been in place for three years and further evaluation and modification of the harvest strategy has occurred since then to ensure it continues to meet its objectives.