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SIOFA, Resource Management of Alfonsino and Harvest Control Rules

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Relates to agenda item: 6.3 Working paper ☒ Info paper ☐

SIODFA

Abstract

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This is all well and good but what does it mean in practice? Two interpretations of what is a harvest control rules (HCRs) have developed. The initial understanding was that a HCR would define one or more management actions that would be taken when the state of the fishery falls below a pre-defined or pre-agreed threshold. For example, if an estimate of the biomass (or, e.g. the spawning biomass) of an exploited stock was below the agreed threshold, fishing would be stopped, or fishing effort would be reduced in a pre-agreed and non-negotiable manner. The intention was that if a management action that was required in response to a particular condition of the stock could be agreed before the stock arrived in that state then this would avoid delays or disagreements in implementing a the management response caused by different stakeholders trying to negotiate differing responses that reflected their current interests.

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SIOFA, Resource Management of Alfonsino and Harvest Control Rules

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1. WHAT IS A HARVEST CONTROL RULE?

Eide (2017) tells us that "Harvest Control Rules are predefined heuristic decision rules to provide quota advice for managed fisheries" and that "frequently statistical methods and biological assumptions expressed in mathematical models are used to provide the Harvest Control Rules with initial information (indicators values)".

This is all well and good but what does it mean in practice? Two interpretations of what is a harvest control rules (HCRs) have developed. The initial understanding was that a HCR would define one or more management actions that would be taken when the state of the fishery falls below a pre-defined or pre-agreed threshold. For example, if an estimate of the biomass (or, e.g. the spawning biomass) of an exploited stock was below the agreed threshold, fishing would be stopped, or fishing effort would be reduced in a pre-agreed and non-negotiable manner. The intention was that if a management action that was required in response to a particular condition of the stock could be agreed before the stock arrived in that state then this would avoid delays or disagreements in implementing a the management response caused by different stakeholders trying to negotiate differing responses that reflected their current interests.

The relevant point is that decision makers are free to agree on any criterion/criteria that would trigger implementation of the HCR. For example, these could include:

- Insufficient mature females, i.e. spawning stock biomass, in the current stock
- Low biomass
- Catch rates that are uneconomic
- The advent of particular inclement oceanographic conditions
- Or whatever.

Those who accept for their fishery to be regulated by a HCR are also free to negotiate whatever response to a threshold trigger should be, e.g.

- Close the fishery for the rest of the season
- Close the fishery until some agreed stock condition occurs – i.e. there is a recovery of its biomass
- Close, or reduce the harvest from, the fishery until there is a market recovery
- Implement some form of catch restriction
- Implement some form of effort restriction
- Agree that no new entrants should be permitted in the fishery until some condition is satisfied
- Etc.

This type of HCR has more commonly been implemented in fisheries under national jurisdiction. Experience has shown that when the level of the target stock occurs that (should) trigger the implementation of the pre-agreed HCR,, fishing operators exert pressure to lower the threshold levels that had previously been agreed upon arguing financial and/or social pressures, which may be consistent with interpretations of the Ecosystem Approach to Fisheries Management.

The second application of a HCR is more restrictive and is well accepted in the RFMOs. It is the response that should/must occur when the biomass or spawning stock biomass state of a stock falls below a defined reference point or level. The three reference points of concern are described below. The concept of reference points for fisheries management has been around for over two decades (Caddy & Mahon 1995).

- *Limit Biomass Reference point - B_{lim}*

If the limiting biomass is reached, managers are required to take immediate action to protect the stock, conventionally by closing the fishery or reducing the allowable catch. The stock indicator should not fall below this value.

- *Target Biomass Reference Point - B_{tar}*

This is the stock biomass that resource managers attempt to attain. Commonly it is also the biomass level at which the maximum sustainable yield is attained, B_{MSY}.

- *Precautionary Biomass Reference Level* – B_{PA}

This is a biomass level that it is hoped is 'safe'in terms of resource conservation and usually will be offered when there is insufficient information to determine a confident B_{MSY}.

Certainly for the first two of these reference levels good information is required on the status and dynamics of the target fish stock. This is often not the case and such is the situation for the alfonsino fisheries in the Southern Indian Ocean.

2 THE FISH STOCKS AGREEMENT

The 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks – *the Fish Stocks Agreement* - makes explicit reference to the notion of precautionary reference points. Appendix II of the Fish Stocks Agreement notes that 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. 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. WHY THERE SHOULD BE INTEREST IN HARVEST CONTROL RULES

3.1 Expectations of the Parties

Annex L of the 2017 Report of the MoP notes:

> Paragraph 6a of CMM 2016/01 actions [sic] the SIOFA Scientific *Committee* ***to provide advice and recommendations to the Meeting of the Parties on the status of stocks of principal deep-sea fishery resources targeted***, and, to the extent possible, taken as bycatch and caught incidentally in these deep-sea fisheries, including straddling fishery resources ***by 2019*** (my emphasis).

> Stock Assessment in the SIOFA jurisdiction is currently challenged by the lack of an analysis and review process for available data held by Parties across the key fish stocks. …Initially, the working group will focus on assessments for orange roughy and alfonsino in the Agreement Area. The formation of the IWG will be useful in promoting engagement of specialist scientists in the stock assessment process, which is fundamental to success. Equally, it will enable the Scientific Committee to review assessments with the knowledge that all members and participants have had the opportunity to review data, contribute to the structure of the assessment models and identify research needs/priorities and management advice before the assessments are reviewed by the Scientific Committee.

An important question we should consider is whether these expectations will be met.

3.2 Characterizing the Alfonsino Fisheries from a Resource Management Perspective

Resource management models conventionally depend on information such as:

i. Catch per unit effort data that accurately reflect the abundance of the targeted stocks
ii. Independent estimates of resource abundance, usually estimates from acoustic surveys
iii. Knowledge of the age structure (or perhaps size structure), ideally over time.

In relation to (iii) a relatively large (enormous?) amount of data exists on the size composition of alfonsino catches from the SIOFA Area. These data remain to be analyzed in detail. Regarding (ii) it is unknown what acoustic surveys have been undertaken of alfonsino but I believe that there have been relatively few and none of the data have been appropriately analyzed. Point (i) confronts a complex issue that CPUE data do not provide a direct indication of resource abundance other that indicating trends in the fishery. But, even this higher-level of analysis, i.e. annual changes in catch per day at sea or day in which fishing was undertaken has not been undertaken (as far as I know). This is a requirement that should be addressed.

The conventional model relating catch to biomass is given by

$$C = qfB$$

Where,

q = the catchability coefficient, i.e. that fraction of the stock that is taken by one unit of fishing effort
f = fishing effort, measured in the same units as for q
B = biomass of the species/stock in question.

Hence:

$$C/f = qB$$

Thus, as the biomass is reduced so would be the CPUE, C/f. However, it has been well understood (for over half a century – see Paloheimo & Dickie 1964) that in targeted fisheries, i.e. those where aggregations of fish are first located before the gear is set, the CPUE can be sustained at high levels irrespective of declines in the biomass of the stock, conceptually down to the capture of the last aggregation of fish, following which the resource is extirpated and the fishery collapses. This is often referred to as *hyperstability, i.e.* maintenance of high catch rates up until or near the point of stock collapse. Implicit in the second term is that the biomass gets depleted long before this is indicated by declines in the CPUE. Of course the performance of the fishery declines long before the point that stock extirpation occurs but the point remains valid – in targeted fisheries use of CPUE as an indicator of abundance is fraught with the risk of invalid indication of stock abundance.

A further complication exists. The fishery for alfonsino in the Southern Indian Ocean consists not of one but of two distinct fisheries:

i. An aimed bentho-pelagic trawl fishery that exclusively (?) targets relatively large and thus mature individuals of alfonsino and
ii. A directed-mid-trawl fishery.

The *aimed bentho-pelagic trawl fishery* depends on first locating commercially viable aggregations of alfonsino. This may, and often does, require extensive searching operations on often widely separated seafloor features possibly involving days of steaming between features, e.g. South Indian Ridge to Walters Bank and then back again. Then once an aggregation is found, the trawl is set on the fish and with 'luck' a good catch is taken (see my other note about zero catches). This is the type of fishery undertaken by the Cook Island flagged vessels and, in the past, by those of Austral Fisheries, Perth. Tows are characteristically short and rarely longer than 20 minutes and at times far shorter in duration[1].

The directed mid-water trawl fishery tows a large trawl through the water column. I describe it as 'directed' as the vessels use sonar to locate aggregations of alfonsino ahead of the vessel and the heading of the vessel is constantly changed so that the trawl is towed through the aggregation. Here too, searching is undertaken but in this fishery the gear is continually in the water and tows are usually at least three hours in duration. No contact is made with the sea floor. Data indicates that in the past this fishery has targeted smaller and usually immature individuals of alfonsino. This type of fishery is undertaken by the Japanese vessel *F.T.Tomi Maru No. 58* and probably the second Japanese vessel in the SIO alfonsino fishery, the *F.T. Kaiyo Maru*.

Further complicating this complex fishery is that all vessels actively base both their searching and fishing operations on detailed forecasts and on-the-grounds measurements of seawater temperature. Thus, lack of catch due to lack of fish may also be, or be caused by unfavourable water conditions - in this case the absence of fishing success is caused by the presence of unfavourable water conditions. In any event, favourable water conditions are a *sine qua non* for successful fishing operations for alfonsino.

I know of no resource assessment methods that usefully, much less robustly, handle all these factors that affect a vessel's fishing success.

3.3 THE SHADOW OF THE MARINE STEWARDSHIP COUNCIL

The concept of harvest control rules figures prominently in the standards and guides issued by the Marine Stewardship Council (MSC), a highly respected eco-certification organization that is assumed to have major influence on the behaviour of fish buyers over what species they will purchase and from where.

Evaluation of Harvest Control Rules & Tools (MSC 2014) are assessed as part of their Principle 1 - **Sustainable target fish stocks -** A fishery must be conducted in a manner that does not lead to over-fishing or depletion of the exploited populations and, for those populations that are depleted, the fishery must be conducted in a manner that demonstrably leads to their recovery. These are assessed as part of the Harvest Strategy (Management) activity under their heading P11.2.2 "Harvest Control Rules & Tools".

I have appended the MSC table SA5: PI 1.2.2 Harvest control rules and tools PISGs to provide insight as to their guidance on how this element of their first Principle should be scored in relation to a harvest control rule.

[1] Quantitative data on tow periods is given in the Bottom Fishery Inpact Assessment provided by the Cook Islands to this meeting.

4. HOW MIGHT WE USE HARVEST CONTROL RULES?

It is notable the Fish Stocks Agreement makes no reference to stock biomass in its reference to precautionary reference points and indeed Apostolaki & Hillary (2009) in their EU- review paper note that "although they used *TAC* as the harvest control component, it could just as easily have been fishing effort (however this is defined) that was altered year-to-year in the HCR.". Guidance on scoring this attribute is given on p 25 of the Standard and Guidance document (MSC 2014).

If the SIOFA Scientific Committee is unable to express a view on the state of the alfonsino stock(s) in terms of their biomass by June 2019, which will be just over one year from the next Scientific Committee meeting, it seems propitious that we may be able to have a regulation for conservation and management of the alfonsino fisheries expressed in terms of fishing effort through a HCR or the HCR may depend on variables such as trends in the annual catch per unit effort – whatever it is.

For example, the HCR may state that there be no additional effort permitted in the alfonsino fishery until:

i. there is a documented understanding of the relation between fishing effort and expected stock structure and,
ii. there is evidence of a stabilization, if not an increase, in CPUE.

4. LITERATURE CITED

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MSC 2014. . MSC Fisheries Standard and Guidance v2.0 (Extracted from Annexes SA, SB, SC and SD of the Fisheries Certification Requirements v2.0). Marine Stewardship Council. 290pp.

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Appendix

Follows Closely MSC (2014) SA2.5
Harvest control rules and tools PI (PI 1.2.2)

Table SA5: PI 1.2.2 Harvest control rules and tools PISGs

(Are there?) There are well defined and effective harvest control rules (HCRs) in place.

Scoring Issues	SG60	SG80	SG100
(a) HCRs design and application	Generally understood HCRs are in place or available that are expected to reduce the exploitation rate as the point of recruitment impairment (PRI) is approached.	Well defined HCRs are in place that ensure that the exploitation rate is reduced as the PRI is approached, are expected to keep the stock fluctuating around a target level consistent with (or above) MSY, or for key LTL species a level consistent with ecosystem needs.	The HCRs are expected to keep the stock fluctuating at or above a target level consistent with MSY, or another more appropriate level taking into account the ecological role of the stock, most of the time.
(b) HCRs robustness to uncertainty		The HCRs are likely to be robust to the main uncertainties	The HCRs take account of a wide range of uncertainties including the ecological role of the stock, and there is evidence that the HCRs are robust to the main uncertainties.
(c) HCRs evaluation	There is some evidence that tools used or available to implement HCRs are appropriate and effective in controlling exploitation	Available evidence indicates that the tools in use are appropriate and effective in achieving the exploitation levels required under the HCRs.	Evidence clearly shows that the tools in use are effective in achieving the exploitation levels required under the HCRs.