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Harvest Control Rules

Shaping effective long-term fisheries management

Overview

Harvest strategies, also called management procedures, represent the latest generation of science-based approaches to effective fisheries management. When properly developed, these full-cycle strategies ideally start with precise management objectives and include monitoring of the stock after implementation so managers and stakeholders have a clear sense of the best path forward for the fish and the fishery.

Harvest control rules (HCRs) are the operational component of a harvest strategy, essentially pre-agreed guidelines that determine how much fishing can take place, based on indicators of the targeted stock's status. These indicators come in two categories: empirical and model-based.

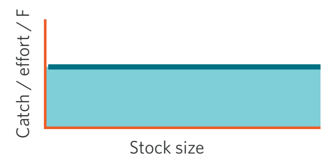
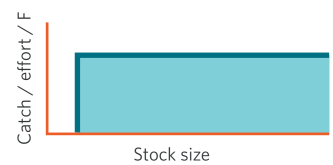
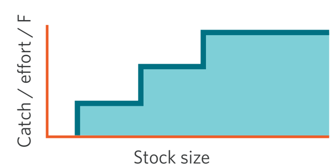
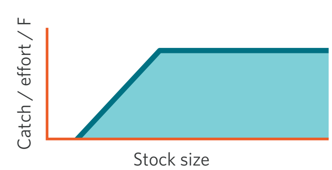
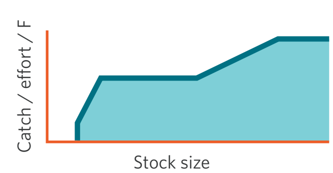
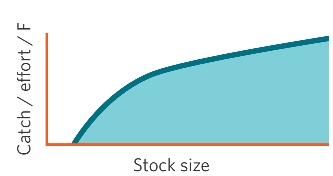
For empirical harvest control rules, the indicators come from one or more direct measures of stock status, such as an abundance survey or calculations of how much effort it takes to fish, known as a catch per unit effort index. For model-based HCRs, an abundance level estimated by a stock assessment model is typically the indicator.

HCRs range from basic, constant catch strategies—under which catch levels do not change—to complicated, multistep rules that set allowable catch based on triggers. Often the first management action in an HCR is prompted when the population size of a fish species reaches a target reference point. In other designs, no action would be taken until the fishery reaches what is called a threshold reference point or a trigger reference point. That level may be above or below the target and serves as the trigger for action based on the fishery's management objectives.

There are four main types of HCRs: constant rule, threshold rule, step rule, and sliding rule. Management actions to regulate fishing can be based on catch, effort (e.g., number of fishing days), or fishing mortality rate (F). HCRs can also require modifications to other controls, such as the length or scale of time-area closures or size limits.

Figure 1

Main Types of Harvest Control Rules

HCR type	Description	What it looks like
Constant	Allows for a constant level of fishing based on one value, regardless of stock status. The single value could be mortality (F), total allowable catch, days at sea, etc.	
Threshold	Fishing is allowed at a single target level until a limit is reached, at which point fishing is stopped.	
Step	Incorporates steps so higher fishing levels are permitted as the stock's status improves.	
Sliding (simple linear)	A sliding rule allows for a continuous adjustment in fishing controls. Higher fishing levels are permitted with improved stock status.	
Sliding (complex linear)	Same as above, but linear combinations can be complex, meaning that different responses may be triggered at different thresholds.	
Sliding (nonlinear)	Similar to the sliding forms, but the adjustments are nonlinear. This may be logarithmic (i.e., a smooth increase in fishing levels as stock status improves, as shown) or logistic (more S-shaped—i.e., a smooth increase up to a constant control measure at larger stock sizes).	

Source: Aaron M. Berger et al., *Introduction to Harvest Control Rules for WCPO Tuna Fisheries*

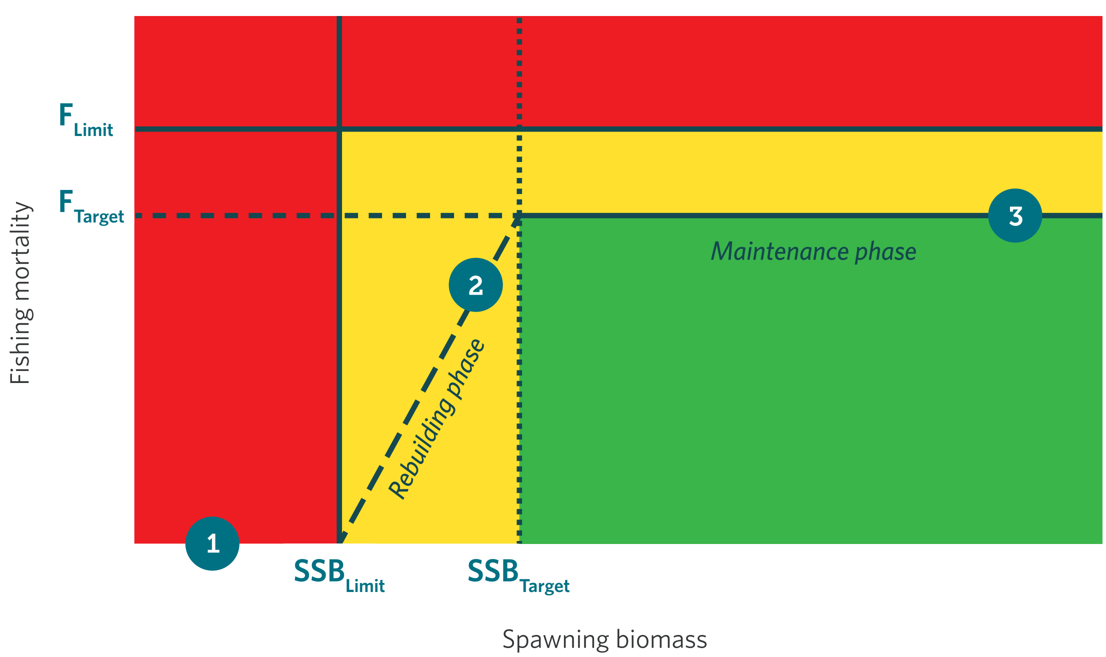
Currently, regional fisheries management organizations (RFMOs) that manage tuna fishing focus primarily on sliding and step rules as they develop HCRs. One tuna RFMO study compared the effectiveness of constant and sliding rules and found sliding rules to be more precautionary on average, generally resulting in greater abundance and only slightly lower annual catches.[1] When looking specifically at the different sliding rules, versions that allowed higher catch levels in the "healthy" state typically required more stringent management intervention once reference points were reached. That trade-off resulted in greater variability in catch or effort from year to year.

Figure 2

How a Harvest Control Rule Works

The results of a fish stock assessment can be represented graphically by what is known as a Kobe plot. The example below shows a simple linear sliding HCR. The fishery's ideal state is green, its cautionary state is yellow, and the state to avoid is red. In this example, the indicator of stock status is spawning stock biomass (SSB), as estimated by a stock assessment model. The HCR has the following specifications:

1. If SSB is below SSB_{Limit}, suspend the fishery and institute a scientific monitoring quota until the limit is reached or exceeded.
2. If SSB is between the limit (SSB_{Limit}) and the target (SSB_{Target}), reduce fishing mortality in accordance with the rebuilding phase of the HCR.
3. If SSB is greater than or equal to the target (SSB_{Target}), fish at the target mortality rate (F_{Target}).



Conclusion

Harvest control rules provide more benefits than the traditional approach of conducting stock assessments and then negotiating fishing limits or quotas. Pre-agreed management actions taken in response to stock status indicators increase the efficiency and transparency of management. They also help avoid costly and difficult political negotiations.

Once managers define potential HCRs, the management strategy evaluation (MSE) process can be used to determine which approaches would best meet the pre-defined objectives for a fishery. In particular, the MSE can test the rule's ability to perform over a range of uncertainties, increasing the likelihood that it will achieve its intended goals in the face of the inevitable unknowns in fisheries. For these reasons, all five of the tuna RFMOs have developed, or are developing, harvest control rules for the stocks under their purview.

Endnote

1 Aaron M. Berger et al., *Introduction to Harvest Control Rules for WCPO Tuna Fisheries* (November 2012), https://www.wcpfc.int/system/files/MOW1-IP-06-Intoduction-HCRs-WCPO-Fisheries-%28MI-WP-03%29.pdf.

For further information, please visit:

pewtrusts.org/harveststrategies

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