**Harvest Control Rules and Climate Resilience**

**Climate change and the threat to our fisheries**

Climate change is here, and it’s already posing threats to United States fisheries. But U.S. fishing has overcome stark challenges before through innovation, collaboration, and a willingness to lead with science. As climate changes continues to cause shifts in fish populations and even their locations, we’ll need to embrace that same spirit to make U.S. fishing climate resilient.

**Harvest Control Rules (HCR) can help us adapt.**

EDF and researchers at University of California-Santa Barbara studied the HCRs for all 504 federally managed fisheries and the eight regional councils that oversee them. After reviewing the advantages for every type of HCR, and looking at how they perform under climate change, we developed six recommendations for achieving climate resiliency.

**Six ways to build climate-resilient fisheries:**

1. **Ditch constant F. Embrace threshold F.**

Threshold F rules have consistent advantages, including reduced risk of overfishing and greater resilience against uncertainty and variability than constant F rules. In the New England, South Atlantic, Gulf of Mexico, Pacific and North Pacific regions, there is stock assessment data and threshold F rules can be implemented now. In other regions, management should make plans to switch to threshold F rules when stock assessment data become available.

1. **Fine tune precautionary buffers, threshold, and limit values.**

For rules that rely heavily on data, small adjustments can greatly improve climate resiliency. Of course, there are tradeoffs: for constant rules, increasing the uncertainty buffer reduces the risk of overfishing but lowers yield, especially for long-lived species. For threshold rules, combining both uncertainty buffers and biomass limits leads to the best risk-yield tradeoff. These rules are also the least sensitive to uncertainty.

1. **Empirical rules all**

Replacing catch-based rules with empirical rules that adjust catch limits based on indices of abundance could increase catches and profits, without risking overfishing. This would apply to fisheries where a reliable index of abundance is available, but funding for staff limits capacity to conduct a stock assessment. Empirical HCRs can also serve as a fail-safe in data-rich regions, in the event that stock assessment models don’t pass peer review.

1. **In catch-based rules, consider climate change.**

The Magnuson-Stevens Act requires annual catch limits for all federally managed stocks. That means some fisheries are using catch-based rules without the necessary data to back them up. There are some ways to incorporate climate change impacts into uncertainty buffers in these rules, which are implemented differently in different regions:

* 1. In the South Atlantic, Gulf of Mexico, and Caribbean regions, add a question on climate change impacts to the questionnaire used to solicit expert opinion on likely stock status.
  2. For other regional councils, climate vulnerability assessments could help identify what precautionary buffers are needed. Building a reliable index of abundance for stocks in these regions, or using length-based stock assessments, would also improve management plans.

1. **Deprioritize environmentally-linked control rules.**

It is tempting to directly incorporate an environmental driver into HCRs. It also rarely succeeds. This approach requires large amounts of data, a stable and predictable environmental relationship, and the ability to improve objectives over simpler control rules. Ultimately, most studies have found these approaches fail to offer advantages over simpler rules and can even lead to greater overfishing risk. For now, environmentally-linked control rules should be deprioritized.

1. **Use management strategy evaluation to compare rules.**

The best HCRs depend on the fishery, the region, management objectives, and environmental condition, among other factors. The most robust method of selecting HCRs is through management strategy evaluation (MSE), which uses a simulation of the entire fisheries management system to measure and compare tradeoffs among approaches under variable conditions and types of uncertainty. There are two steps:

* 1. First, work with stakeholders to identify tractable HCRs and define performance metrics for the rules.
  2. Develop operating models tailored to the life history of the species and the quality of the data, skill of assessment model, and anticipated impacts of climate change in that region.

**It will take more than just HCRs…**

Implementing the most effective HCRs is an important step toward climate resiliency, but additional actions are needed to support these tools. As climate change causes stocks to shift, we’ll have to adapt allocation strategies and increase cooperation across international borders. We’ll also need to work to help fishers improve socioeconomic resilience to mitigate the impacts of climate change. But through innovation, policy changes, and most of all, science, U.S. fisheries can be ready for whatever climate change throws their way.