The Caribbean fisheries of today and the future: Opportunities for a regional climate vulnerability assessment

Las pesquerías del Caribe de hoy y del futuro: Oportunidades para una evaluación regional de vulnerabilidad climática

Les pêches des Caraïbes d'aujourd'hui et de demain: Possibilités d'évaluation régionale de la vulnérabilité climatique

GEMMA CARROLL[1], EDUARDO BONÉ MORÓN[1], SEPP HAUKEBO[1]
[1]*Environmental Defense Fund. 257 Park Avenue South, Ny, Ny 10010* Gcarroll@Edf.Org, Ebone@Edf.Org, Shaukebo@Edf.Org

EXTENDED ABSTRACT

Fisheries across the globe are already feeling the effects of climate change, including warming waters, ocean acidification, shifting ocean currents, deoxygenation, and changes in storm frequency and intensity (e.g. Doney et al. 2009; Keeling et al. 2010; Kossin et al. 2020). Many marine species are experiencing climate-driven changes in abundance (Free et al. 2019) and shifting their distribution and behavior to seek cooler waters (Morley et al. 2018). The tropics, where most species already live close to their thermal limit, are one of the regions most vulnerable to reductions in fisheries productivity and revenue (Cheung et al. 2010; Lam et al. 2016), and some important fishery species are expected to be lost entirely from the waters of tropical nations as they move poleward (Oremus et al. 2020). This reorganization of fisheries production will inevitably create new conflicts between nations and require a reimagining of existing fisheries management measures and governance structures.

Fortunately, strong fisheries management that reduces overfishing and rebuilds depleted stocks can help buffer fisheries against some of the challenges posed by climate change (Gaines et al. 2018; Free et al. 2020). In addition to traditional management measures, incorporating an understanding of climate change impacts into fisheries planning and management strategies can help create fisheries systems that are more resilient and better prepared for the future. By acting on the best available scientific information about how fisheries might change in the future, fisheries management can be forward-looking and adaptive, to ensure that stocks, ecosystems, and human communities can respond effectively to the increasing burden of climate impacts (Bell et al. 2020).

One approach to incorporating climate change into fisheries planning and management is to conduct a climate vulnerability assessment (CVA) for a suite of important fishery species. The CVA process is a useful preliminary step toward incorporating climate impacts into fisheries planning because it enables scientists, managers, and fishery participants to identify which species will be more or less vulnerable to changes that are projected to occur in their system (e.g., Mamauag et al. 2013; Hare et al. 2016). This can help multi-species management efforts, by directing livelihoods away from fishing the most vulnerable species, and creating new markets, robust supply chains and sustainable fishing practices for species that are expected to be less vulnerable. It can also be a useful way of identifying the most salient climate threats facing a fishery, which can help increase scientific understanding and guide targeted mitigation efforts and investments.

The Environmental Defense Fund (EDF) is conducting a Climate Vulnerability Assessment (CVA) for the Caribbean region as part of ongoing efforts with key stakeholders to build sustainability and climate resilience in this rapidly changing region (Salas et al. 2007; Puga et al. 2017). The CVA approach is based on a new Excel-based tool (available at fishe.edf.org) adapted from the work of Hare et al (2016) with data-limited scoring language for variables of climate exposure (i.e., measures of physical system change), and species sensitivity attributes (i.e. biological traits). The outputs of the CVA include rankings of relative vulnerability among species and their potential for future distribution shifts. A desktop literature-based assessment will be complemented and refined by a participatory, stakeholder-driven workshop including representatives from the scientific, management, and fisheries communities, to incorporate diverse types of knowledge of potential impacts of climate change into vulnerability scoring, and to develop a community of practice to increase collaboration and consensus among participants.

Initial findings from the desktop CVA for important and representative pan-Caribbean species illustrate different levels of climate vulnerability for species with different distributions and life history traits. We found the greatest climate exposure to be experienced by species with shallow, inshore distributions including some baitfish and flats species, and those that depend on seagrass or mangrove habitats that are warming rapidly and are highly exposed to damage from sea level rise and increases in storm frequency and severity (Wilson 2017; Edwards 2021). Species such as large, predatory teleost fish and sharks that have life history strategies including slow growth and complex reproductive cycles were found to be most sensitive. This sensitivity translated to the highest vulnerability scores for species like reef sharks that also experienced high fishing pressure and had limited larval or adult dispersal capacities, or a fixed home range.

This preliminary desktop CVA analysis is a first step toward greater understanding of climate impacts on fishery species in the Caribbean and will generate important advice on how to implement adaptive, climate-ready measures into existing management frameworks in the region. The next phase of this work that solicits collaboration with stakeholders

involved in both commercial and recreational fisheries in the Caribbean will fill important research gaps on species vulnerability and will enable a more holistic picture of vulnerability as understood by people with diverse, local expertise including on-the-water experience. The knowledge gained through the CVA process will promote the readiness of fisheries and communities to respond to climate challenges and opportunities, and guide management policies and mitigation efforts that will work best for a changing ocean.

KEYWORDS: climate change, vulnerability assessment, Caribbean, adaptive management, fisheries

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