

# Participatory assessment of climate vulnerability in Caribbean recreational fisheries

## Evaluación participativa de la vulnerabilidad climática en la pesca recreativa del Caribe

## Évaluation participative de la vulnérabilité climatique dans la pêche récréative des Caraïbes

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### EXTENDED ABSTRACT

#### INTRODUCTION

The Caribbean is home to some of the most picturesque fishing locations in the world, and opportunities to catch some of the largest and most exciting sport fish in tidal flats, blue water, and reef ecosystems (Fedler, 2010). Thousands of anglers are drawn to the region each year, and their contributions to the tourism sector are an important source of economic development and livelihoods for local communities (Fedler, 2019). However, tropical ecosystems are experiencing rapid and accelerating changes in climate, including rising ocean temperatures, sea level rise, and increases in storm intensity. While some effects of climate change including habitat loss, species redistribution, and declines in productivity and survival of fishes may be unavoidable, some of the worst impacts could be buffered by adaptive management strategies and sustainable fisheries management practices (Free et al., 2020). To effectively prioritize adaptation and mitigation efforts, it is critical to use the best available information to project climate change impacts on recreational species and the fisheries and communities that depend on them.

We conducted a comprehensive climate vulnerability assessment (CVA) for three recreationally important species in Belize and The Bahamas: bonefish (*Albula vulpes*), tarpon (*Megalops atlanticus*), and permit (*Trachinotus falcatus*). This CVA combined a desktop review of available literature on climate change impacts and species sensitivity attributes, then convened a multi-stakeholder working group comprised of experts from the scientific, management, and guiding communities in Belize, The Bahamas, and the United States of America who contributed their local ecological knowledge, and made recommendations for strategies that could be undertaken by governments and communities in Belize and The Bahamas to increase climate resilience in the recreational sector. Our work provides a new understanding of risks posed by climate change to tropical fisheries in coming decades and is a first step toward developing stronger local capacity and preparedness within the recreational fishing sector to respond to these changes.

#### METHODS

To assess climate vulnerability in Caribbean recreational fisheries, we first conducted an extensive literature-based desktop analysis to score a) climate exposure – the expected magnitude of changes in ocean climate likely to be experienced by each species by 2050, and b) species sensitivity – biological traits that might increase species' likelihood of responding negatively to climate exposure and limit their ability to cope, resist, or recover from the effects of climate change (i.e., adaptive capacity; Hare et al., 2016). Taken together, these constitute the vulnerability of a species to expected climate change impacts.

We assembled a group of 17 experts based in Belize, The Bahamas, and the United States who had expertise in recreational fishing, fisheries management, and/or fisheries and climate science in these countries. This combination of scientific knowledge and local expertise helped develop a comprehensive and complementary picture of climate change and its likely impacts on fishery species throughout the Caribbean, and of the impacts of these changes on outcomes for recreational fisheries and communities. This group was engaged in discussions around study design as well as community and capacity-building needs, before convening over the course of a two-day virtual workshop in March 2022 to exchange information on climate change impacts, contextualize and refine desktop vulnerability scores for key species, and identify challenges and opportunities for responding to climate impacts in Belize and The Bahamas. During the workshop we used two complementary sessions to allow participants to provide their insights into climate exposure and species sensitivity: 1) a scientific knowledge session, and 2) a local “on the water” session for ground truthing.

#### RESULTS

Based on the desktop analysis, bonefish, tarpon and permit all exhibit ‘very high’ vulnerability to expected climate impacts due to the likelihood of rising ocean temperatures, increased storm damage, and sea level rise damaging the sensitive nearshore habitats that they rely on. Slow rates of population growth and complex reproductive strategies are also likely to hinder their ability to recover from climate perturbations. However, while the expert stakeholder group predicted a

‘very high’ magnitude of climate impacts in the Caribbean region, they perceived tarpon and permit to be less vulnerable to these impacts than bonefish. Consultations with the group suggested downgrading of the final vulnerability score for permit from ‘very high’ to ‘high’. The group also identified individual, community, and government-level strategies to enhance climate resilience at the individual, community, and national to international levels. Our work assesses the climate vulnerability of species fished by the Caribbean recreational fishing sector and highlights how participatory processes can build capacity and collaboration to help achieve the goal of identifying and adapting to climate change

### DISCUSSION

Climate change will continue to cause major threats to recreational fisheries in the Caribbean over the next 30 years, compounding a host of other anthropogenic stressors affecting species, habitats, and ecosystems and presenting challenges to the management of natural resources in the region. By incorporating local knowledge with scientific research, we took a step towards better understanding these impacts on nature and their repercussions for fisheries systems. Specifically, the opportunities and key management recommendations outlined here can build upon a strong foundation of policies and scientific research. Fishery managers, guides, scientists, and non-government organizations working in the Caribbean have initiated policies, regulations, and research that create pathways for strengthening recreational fisheries management that can boost resilience to climate impacts across social-ecological systems. Additionally, the challenges and successes that Belize and The Bahamas have navigated can help chart a route for other countries in the Caribbean, and more broadly, to address similar issues. Many of the lessons and guidance are not unique to recreational fisheries and may be applicable to marine resource management more generally. With adequate planning, flexibility, collaboration, optimism, and the necessary level of resources across the region, the recommendations outlined in this study can be advanced to help sustain the natural resources and livelihoods that are tied so closely together in this biologically and culturally rich region.

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

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