

How Will Climate Change Affect the Spiny Lobster Fishery of Xcalak and Banco Chinchorro, Mexico?

¿Cómo el Cambio Climático Afectara la Pesquería de Langosta Espinosa de Xcalak y Banco Chinchorro, México?

Comment le Changement Climatique Affecte la Langouste Pêche de Xcalak et Banco Chinchorro, Mexique

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EXTENDED ABSTRACT

The world is changing – that is irrefutable. How those changes impact society, and how society responds, are perhaps the most daunting challenges we will confront. Some of the communities most vulnerable are those small fishing villages that rely on coastal resources. Those populations are on the frontlines of confronting rising seas, shifting rainfall patterns, changes to coastal winds and currents, and increases in sea surface temperatures. It is incumbent upon each of us to ensure that together we develop adaptation responses that provide robust approaches that ensure that they are resilient to an opaque future. We must communicate the uncertainty to them. We also must strive to reduce uncertainty by ensuring that we are committed to programs that monitor conditions that may impact them. I describe here a project developed to examine how climate may impact the spiny lobster fishery of Xcalak, Quintana Roo, and Banco Chinchorro, Mexico by examining the changes that may occur to the biology, distribution, and abundance of the lobsters, as well changes to the ecological processes that affect their distribution. I then examined how the changes to the spiny lobster resource may impact the fishing community. I also examine how a changing climate may more directly affect the fishing population of Xcalak and Banco Chinchorro. Finally, I developed a communications plan which can be used to monitor for changing conditions, thus providing a better informed community while simultaneously giving managers the data needed to understand when focused adaptation plans should be implemented.

The first step in examining the impacts of a changing climate on the fishing communities of southern Quintana Roo was to examine the vulnerabilities of the fishing community. I was provided projections of the expected changes in environmental conditions by the Caribbean Community Climate Change Centre. Based on their projections, the changes included increased sea level, increased sea surface temperature, decreased rainfall, and increased storm intensity. I then reviewed the literature on the spiny lobster, *Panulirus argus*, to project the impact to the biology and ecology of the species under future conditions. This was done within a spatial context so that projections could be developed for local changes to lobster abundance and distribution.

Subsequently, I coupled these projections to the current fishing regulations and practices to estimate how the changes in the environment will impact catches and future fishing practices. Fishing methodologies were examined, gear was accounted for, and I also assessed the access to a future fishery with a change in lobster distribution. Beyond fishing, I examined the vulnerabilities to the infrastructure and logistics of lobster fishing. This picture of a future fishing community and fishery resource provided the overall information necessary to assess the current vulnerabilities of the fishing communities.

Based on the estimated vulnerability of these communities, I was then able to examine how resilient the community is to the projected changes and how well they will be able to adapt. From my estimations, the communities appear to be resilient to future changes and will likely be able to adapt sufficiently to ensure a productive future barring a sudden collapse of the population of *P. argus*. For example, the fishers that inhabit Banco Chinchorro during the fishing season have a history of building habitations over the water. This makes the fishers somewhat resilient to rising seas. On the other hand, warmer sea surface temperatures will likely drive lobsters to deeper waters. Because all fishing is by snorkel only, this will likely limit the abundance of the more accessible shallow-water sub-population and CPUE may decrease. In the coastal areas associated with the mainland, decreased rainfall may increase underwater visibility thus providing greater sighting success and increased CPUE.

Fishers will adapt. Therefore, while it is not essential to communicate the effects of a changing climate to fishers, their understanding of the changes coming down the road will provide them with a planning horizon that will help them make informed decisions on allocating capital.

However, understanding what changes are occurring is absolutely essential for managers of those resources. This is especially important for those management plans that have specific and actionable climate adaptation strategies with implementation of the strategies based upon specific trigger points. In those instances, managers must be able to implement management approaches and regulations when the resource reaches critical thresholds. Thus, communication between the managers and fishers is increasingly important under changing environmental conditions. Therefore, it is essential to develop effective communication tools.

Effectively communicating the effects of a changing climate to the fishers and fishing community requires an approach that is accessible and understandable. As part of this project, I developed a communications plan that both provides fishers with the information related to a changing climate, and provides managers with the information they need to understand how conditions are changing and where they are on the climate change trajectory. I approached this part of the project by developing a protocol that engages the fishers to relate to managers the observations of the changes that they are already seeing. For example, questions related to the number of days that they are able to fish outside the lagoon at Banco Chinchorro will help to begin the conversation about how coastal winds are changing. Likewise, a dialog related to observations on increasing freshwater runoff from seasonal storms will help to broaden the discussion to changes related to precipitation and to increase their sensitivity to future changes. Effectively engaging the fishers in a dialog related to similar changes may help them understand how the changes are long-term and climate-related. Furthermore, engaging in these dialogs helps managers monitor changes to the environment due to climate and provide a long-term monitoring dataset that will help to identify when to implement adaption actions. Taken together, understanding the vulnerabilities of, and anticipating changes to the fishing resource, the fishing community, fishing practices, and infrastructure provides a way forward to ensuring that fishing communities are resilient to an uncertain future.

KEYWORDS: Climate change, adaptation, spiny lobster, Mexico