

A tale of two Bahamian fisheries: Using social science to understand management implications of fisher behavior, knowledge, and perception

Una historia de dos pesquerías de las Bahamas: uso de las ciencias sociales para comprender las implicaciones de gestión del comportamiento, el conocimiento y la percepción de los pescadores

Une histoire de deux pêcheries des Bahamas: Utiliser les sciences sociales pour comprendre les implications de gestion du comportement, des connaissances et de la perception des pêcheurs

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EXTENDED ABSTRACT

Interdisciplinary approaches examining marine fisheries are vital to providing holistic views of these systems. Fishery systems are comprised of 3 parts – the fish, the habitat where they live, and the people involved – highlighting their inherent interdisciplinarity. As such, it is as important to understand the role people play as it is to understand the biology of the species and the ecological interactions happening with the related habitats and ecosystems. Understanding the human factor is critical for successful fisheries management. Social Science can be used to accomplish this by allowing us to gain a better understanding of the role people play within fisheries through their actions, their thoughts and perceptions, and determining their willingness to help or contribute. We can explore deeper by examining the actions of people from a particular place or status, ascribing meaning to those actions to see what issues are surfaced and further exploring differences that occur between groups. By interweaving social considerations in fisheries work, we gain a broader perspective towards the quest for achieving sustainable fisheries.

A framework was developed to help explore these interdisciplinary issues within fisheries. It begins with understanding the ecology at play for the species in the target fishery, examining how socio-economic factors influence that ecology or vice-versa, and then using the interplay between them to provide insights on the management implications for the fishery. This framework was utilized to study two fisheries in The Bahamas: the established Caribbean spiny lobster (*Panulirus argus*) fishery and the emerging parrotfish fishery.

The first project used an approach examining biophysical forces impacting spiny lobster paired with chief human activities within the fishery where data from several models and surveys/interviews were coupled to help create a robust assessment. Caribbean spiny lobster is a popular and heavily exploited seafood throughout most of its range and support one of the primary fisheries in The Bahamas (Ehrhardt et al 2010). Over the last decade, Bahamian fishers have begun to use condos (sometimes referred to as casitas) as their primary lobster fishing method in great numbers, with estimates in the millions. This is a major cause for concern as there is limited management for condos and their ecological, social, and management implications have yet to be fully evaluated. The goal of this project was to explore the importance of various factors affecting fishing, consumption, and perspectives on existing and potential management strategies, with an emphasis placed on an examination of the increased usage of condos; implications on how the fishers define, perceive, and adhere to access and property rights within the fishery; and assessing how the convergence of these factors might impact sustainable management. Surveys and semi-structured interviews were conducted over the course of 4 summers with 102 spiny lobster fishers, as well as other stakeholders involved in the fishery who could provide additional context.

The second project sought to understand the social drivers of an emerging parrotfish fishery by conducting a socio-economic survey analyzing motivations, perceptions, knowledge, and attitudes. In both fisheries, the potential for human-induced changes to the ecosystem highlights the need for inquiries acknowledging natural and anthropogenic impacts. Parrotfish are critical for maintaining healthy coral reefs. As key algal grazers, they help to prevent the overgrowth of algae on reefs. Healthy Caribbean reefs have high populations of parrotfish and their removal is a major driver of reef decline throughout the region (Jackson et al. 2014). Protecting these important grazers can help to restore coral reefs. Although parrotfish have not traditionally been a popular species targeted by Bahamian fishers, a fishery for the species has emerged over the past few years. However, there is limited data to help quantify their harvest. Overall, there is currently not enough information to understand what is occurring in the fishery, how fast it's growing, how choices are being made, and how to manage the fishery appropriately. To explore these issues, emphasis on this project was placed on examining changes in the habitat and population; understanding fisher behavior and motivations for how choices within the fishery are being made; and assessing how these factors might impact management based on new related regulations. Surveys were conducted during 2017 and 2018 with commercial, recreational, and subsistence fishers (N=164) to collect information on harvesting characteristics, seafood consumption and sale, and fishers' knowledge and perceptions.

For both projects, fishers' responses were evaluated against several key demographics and evaluated for statistical significance using a chi-squared test for independence.

The investigation within the Bahamian spiny lobster fishery revealed that most fishers use condos, even if they don't build them, with the majority of fishers admitting that fishing from others condos has led to the occurrence of increased

conflicts. The data also highlighted that the quantity of condos in use varies widely by both experience and islands. Overall, fishers agree that condos have positive impacts on the spiny lobster population. Those who have seen a negative impact on spiny lobster are those who tend to still dive on reefs to harvest them, typically those fishers who can't often afford the materials to build condos or the gas to travel far in boats. Lastly, fishers have conflicting views around condo-related property rights. While half of the fishers believe that the person who builds condos owns the condos, the majority agree that no one owns the spiny lobster within the condos. Additionally, close to 70% believe they should be able to fish from other fishers' condos. Ultimately, while many believe condos should be private property, they also believe that once they are set in traditional fishing areas any catch within them should be open to everyone. There are several management implications from this work. First, fishers' views on the fishery and condos will affect acceptance of any related laws and regulations put into place in the future. Second, conflicts within the fishery primarily arise from attempts at exclusion and to differentiate between "access", the *ability* to benefit from resources, and "property", the *right* to benefit from resources, with regards to condos. Future management scenarios involving condos will need to clearly make a distinction between the two, with further consideration for the advantages/disadvantages each provides. Lastly, the varying interpretations of ownership rights within the fishery, coupled with the absence of regulations will only lead to more conflicts among fishers.

Results from the parrotfish-specific fisher survey highlighted that parrotfish are harvested by every group examined for a variety of reasons. Because no clear-cut reason for fishing them has yet to emerge from the data, there is a need to further understand fisher motivations with regards to these species. Fishers also have a limited understanding of the role of parrotfish in coral reef ecosystems. They misunderstand the relationship between parrotfish and corals, as well as the impacts that can be caused by decreasing their population. Similarly, fishers don't see harvesting as a threat to parrotfish populations. While they recognize that humans, and ultimately fishing, are big threats to parrotfish, they don't believe many people are fishing for parrotfish even though more than 50% of those surveyed for this project are currently harvesting it. The most commonly harvested species of parrotfish are blue (*Scarus coeruleus*), rainbow (*Scarus guacamaia*), and stoplight (*Sparimosa viride*). Stoplight parrotfish have also been identified as one of key algal grazers in The Bahamas (Dahlgren et al. 2020). The largest management implication for this fishery is that the research shows that conditions exist for a parrotfish market to develop and expand, especially as requests have led to an increase in demand on some islands. Additionally, fishers' responses indicate that while they will support management strategies, they will only do so with adequate and consistent enforcement, something they feel is currently lacking in Bahamian fisheries overall. Lastly, due to the limited understanding of parrotfish's ecological function, education and awareness are necessary to inform fishers of

the important of parrotfish to reef health and must be an important part of any management strategy that is implemented.

There are several considerations for incorporating social science methodologies in fisheries research. First, social science methods can be time intensive. It's important to consider available resources and potential allies in this work. Second, there is often an inherent distrust of researchers that needs to be overcome for this work to be successful. Third, researchers engaging in social science efforts need to work towards building community in the areas where they work, while also considering the social and cultural contexts at play. Furthermore, it will be important to check and understand any personal biases that may color your interactions or interpretations. Lastly, it's also critical to present multiple voices to help provide diverse perspectives

KEYWORDS: Fisheries Management; Interdisciplinary; Spiny Lobster; Parrotfish; The Bahamas

LITERATURE CITED

- Dahlgren C., Sherman, K., Haines, L., Knowles, L., and Callwood, K. 2020. Bahamas Coral Reef Report Card Volume 2: 2015-2020. Nassau. Available online at: <https://bit.ly/coralreefreportcard2020v2>.
- Ehrhardt, N.M., Puga, R., and Butler MJ IV. 2010. Implications of the ecosystem approach to fisheries management in Large Ecosystems: The case of the Caribbean spiny lobster. In: Fanning L, Mahon R, McConney P, editors. Towards Marine Ecosystem-Based Management in the Wider Caribbean. Amsterdam, NL: Amsterdam University Press, 157–175.
- Jackson, J.B.C., Donovan, M.K., Cramer, K.L., and Lam, V.V. (editors). 2014. Status and Trends of Caribbean Coral Reefs: 1970-2012. Global Coral Reef Monitoring Network, IUCN, Gland, Switzerland .