

# Assessing Fisher Perceptions of the Territorial User Rights for Fishing (TURF) program: A Belizean Case Study

## Evaluación de las Percepciones de los Pescadores sobre el Programa de Derechos de los Usuarios Territoriales para la Pesca: Un Estudio de Caso de Belice

## Évaluation des Perceptions des Pêcheurs à l'Égard du Programme Droits de l'Utilisateur Territorial à la Pêche: Étude de Cas du Belize

ALVES, CATHERINE L.<sup>1\*</sup> and JOHN F. BRUNO<sup>2</sup>

<sup>1</sup>*Environment, Ecology, and Energy Program — University of North Carolina at Chapel Hill  
3202 Murray/Venable Hall, CB #3275, Chapel Hill, North Carolina 27599 USA.*

*\*calves06@live.unc.edu*

<sup>2</sup>*Department of Biology — University of North Carolina at Chapel Hill  
Coker Hall, 120 South Road, CB #3280, Chapel Hill, North Carolina 27599 USA.*

*jbruno@unc.edu*

### EXTENDED ABSTRACT

#### Introduction

Overfishing is one of the greatest threats to marine ecosystems because it disrupts ecosystem functioning and threatens fisheries sustainability (Jackson et al. 2001, Valdivia et al. 2015). Territorial User Rights for Fishing (TURFs) have emerged as a possible solution to overfishing by requiring fishers to report their catch, color-code their vessels, and fish only in designated areas (Foley 2012, Catzim and Walker 2013, Barner et al. 2015). The designated regions are often adjacent to marine reserves, providing fishers with the benefits of the spillover effect from no-take zones (Valdés-Pizzini et al. 2012). These initiatives encourage environmental stewardship in coastal communities by providing effective ownership of fish stocks, further incentivizing sustainable fishing practices (Foley 2012, Barner et al. 2015). By assigning catch shares to fishers, TURFs can prevent the “race to fish” paradigm, which can lead to several social and economic benefits for fishers. Further, by assigning fishers locations to fish, a sense of property ownership is established, resulting in decreased poaching in restricted areas and gradual recovery of fish populations (Foley 2012; Valdés-Pizzini et al. 2012; Catzim and Walker 2013, Barner et al. 2015).

Despite the promise of TURFs, several challenges exist to their overall success, including establishing international governance policies (Christie and White 2007, Matias et al. 2013), and preventing “roving bandits,” which are fishing fleets that enter a fishery from outside the community and exploit the marine resources (Cudney-Bueno and Basurto 2009). Furthermore, ecological (i.e. commercial species density) and socioeconomic (i.e. fisher income) outcomes often take a long time (> 10 years) to improve following TURF implementation (Villaseñor-Derbez et al. 2019), despite the desire for immediate improvements.

TURFs have been implemented worldwide by fisheries agencies and Non-Governmental Organizations (NGOs) like the Environmental Defense Fund (EDF), but little is known about their effectiveness, particularly in the tropics where implementation is only beginning (Barner et al. 2015). Belize was the first country in the Caribbean to nationally implement TURFs, with two pilot sites opening in 2011 and seven sites added in 2017. The purpose of this study was to evaluate how the livelihoods and perceptions of fishers in Belize's TURF program – hereby known as Managed Access (MA) – have changed from the program's inception in 2011 to present. Results from this study can be used to improve the efficacy of the MA in Belize, and in the development of MA-like programs elsewhere.

#### Methodology

We conducted a socio-economic and perceptions survey of 119 fishers in southern Belize from April – June, 2019. We designed the survey off of a survey implemented in 2014 – two years prior to the nationwide rollout of MA in Belize – by the BFD and the Environmental Defense Fund (EDF). This provides a basis for comparison among key responses to fully evaluate the impact of MA participation on the livelihoods and perceptions of fishers. To tease apart question language and structure, the survey instrument was pre-tested during enumerator training among enumerators and natural resource managers at partner NGOs (the Toledo Institute for Development and Environment, TIDE, and the Southern Environmental Association, SEA).

The target population for this study was licensed commercial fishers in 2019 who were over 18 years old. The sampling frame used was fishers who have been involved in MA since 2011, using Area 5 (the Port Honduras Marine Reserve, PHMR), and those who have been involved in MA since 2017, using Area 3 (including Laughing Bird Caye, Silk Cayes and Gladden Spit Marine Reserves). To identify and recruit survey participants, we accessed a list of fishers' names, telephone numbers, and addresses from local NGO partners (TIDE and SEA). Then, we used a stratified random sampling methodology to select fishers from the following communities where fishers were known to live: Dangriga (n = 13), Hopkins (n = 17), Riversdale (n = 7), Seine Bight (n = 5), Placencia (n = 15), Independence (n = 10), Monkey River (n = 15), Punta Negra (n = 7), Punta Gorda (n = 28), and Barranco (n = 3). The difference in fishers surveyed in each community is due to variance

in number of licensed fishers per community (i.e. lower numbers reflect communities with fewer fishers) and difficulty in fisher recruitment across communities (i.e. fishers in some communities were easier to recruit than others).

We traveled with a local field team to fishers' homes, docksides, community centers, and fish markets in each of the communities previously listed. There, we administered the 20 - 40-minute surveys in English and local languages (including Garifuna and Kriol) on electronic tablets using the Open Data Kit (ODK) software (Hartung et al. 2010). Subjects were read an informed consent statement, orally demonstrated their consent to participate in the study, and were given a small refreshment as a survey incentive. Any qualitative data the respondents provided to inform their responses was recorded at the end of the survey. The R Studio statistical software was used to visualize and quantify trends among the data and variables of interest.

### Results and Discussion

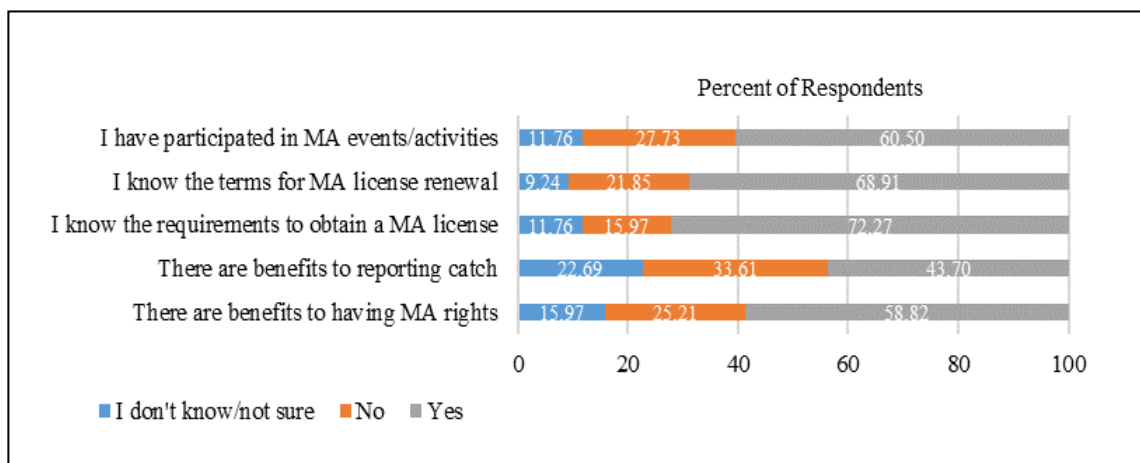
Of the 119 fishers surveyed, 94% were male, while 6% were female. 2% of respondents were 18 - 20 years old, 17% were 21 - 30 years old, 17% were 31 - 40 years old, 32% were age 41 - 50 years, 18% were age 51 - 60 years, and 14% were over 61 years old. This demonstrates that most respondents were between 41 - 50 years old, suggesting an aging population of fishers and a potential demographic shift in the fishing population and industry as a whole. Further, 41% of respondents rely on fishing for 81-100% of their income, indicating that many do not have alternative livelihood strategies. The remaining 59% of respondents have at least one other source of income. From conversations with managers at the Belize Fisheries Department, we can confirm the population surveyed is representative of the greater fisher population.

When respondents were asked about their knowledge of the MA program, we received a wide range of results (Figure 1). Some highlights include that 69% of respondents know the terms for MA license renewal while 72% know the requirements to obtain a license (both questions were verified by having them list at least one of the actual requirements, not just reporting Yes or No). However, 44%

thought that there were benefits to catch reporting, but 34% did not think so. This suggests a need to increase outreach efforts to educate fishers about the benefits of catch reporting. The perceptions of fishers towards the MA program are also highly variable (Figure 2). 81% of respondents agree with the statement that "Most fishers in my community follow the rules and regulations set forth to regulate our fisheries," and 79% agree with "The fishers in my community can sustainably manage our fishery so that we can benefit from it long into the future."

The large percentage of respondents agreeing with the previous two statements suggests fishers have strong trust in their communities and believe they have the ability to work together to manage their fishery. This sense of community was also reflected by some statements about illegal fishing activity in the reserves, fishers fishing where they don't have licenses, and about the fishers in their communities being trusted (Figure 2), demonstrating that respondents believe it is not *their communities* who are breaking the rules, but outsiders. 70% of respondents support MA in the long run, and also think the logbooks are easy to fill out. However, respondents were more split about their perceptions of the enforcement of MA, with 53% trusting it, and 39% not trusting it. Further, 48% of respondents did not agree with the statement that "Enforcement has improved since MA was implemented." These responses indicate that enforcing the rules of MA is still an obstacle to the perceived success and legal adoption of MA. These findings are concordant with a recent study by Wade et al. (2019), which found that fishers negatively perceived the enforcement and illegal fishing activities, demonstrating an area of improvement for policymakers. The results from this study can be shared with natural resource managers in Belize but also in other countries who are adopting programs like MA. The lessons learned from Belize can be shared with conservation practitioners in other countries so the fisheries policies may improve for both the environment and those who rely on it for their livelihoods.

KEYWORDS: Coral reefs, fisheries, livelihoods, policy



**Figure 1.** Summary of responses related to fishers' knowledge of MA licensing process, catch reporting, and perceived benefits of catch reporting and MA rights (n = 119).

**ACKNOWLEDGEMENTS**

Special thanks to our collaborators at the Toledo Institute for Development and Environment (TIDE), the Southern Environmental Association (SEA), and the Belize Fisheries Department. This work was not deemed human subjects research by the UNC Institutional Review Board (# 18-0413). We received research permits from the Belize Fisheries Department (# 000032-19) and the National Institute of Culture and History (# ISCR/H/2/81). This work was supported by the Women Diver’s Hall of Fame, the National Science Foundation Graduate Research Program, the Rufford Foundation, the National Geographic Society, and the UNC Graduate School, Carolina Center for Public Service, and the Institute for the Study of the Americas.

**LITERATURE CITED**

Barner, A.K., J. Lubchenco, C. Costello, S.D. Gaines, A. Leland, B. Jenks, S. Murawski, E. Schwaab, and M. Spring. 2015. Solutions for recovering and sustaining the bounty of the ocean: Combining fishery reforms, rights-based fisheries management, and marine reserves. *Oceanography* **28**(2):252 - 263.

Catzim N and Z. Walker. January 2013. Assessment of the effectiveness of managed access implementation in Glover’s Reef Marine Reserve and Port Honduras Marine Reserve. Report for: Toledo Institute for Development and Environment, Wildlife Conservation Society, Environmental Defense Fund, and the Fisheries Department.

Christie, P. and A.T. White. 2007. Best practices for improved governance of coral reef marine protected areas. *Coral Reefs* **26**:1047 - 1056.

Cudney-Bueno, R. and X. Basurto. 2009. Lack of cross-scale linkages reduces robustness of community-based fisheries management. *PLoS One* **4**(7):e6253.

Foley, J.R. Managed access: Moving towards collaborative fisheries sustainability in Belize. 2012. *Proceedings of the 12<sup>th</sup> International*

*Coral Reef Symposium: Evaluating Management Success*. 1-5.

Hartung, C., A. Lerer, Y. Anokwa, C. Tseng, W. Brunette, and G. Borriello. 2010. Open Data Kit: Tools to build information services for developing regions. *Proceedings of the 4<sup>th</sup> ACM/IEEE International Conference on Information and Communication Technologies and Development*. Article No. 18. London, United Kingdom. DOI: 10.1145/2369220.2369236.

Jackson, J.B. C., M.X. Kirby, W.H. Berger, K.A. Bjorndal, L.W. Botsford, B.J. Bourque, R.H. Bradbury, R. Cooke, J. Erlanson, J.A. Estes, T.P. Hughes, S. Kidwell, C.B. Lange, H.S. Lenihan, J.M. Pandolfi, C.H. Peterson, R.S. Steneck, M.J. Tegner, and R.R. Warner. 2001. Historical overfishing and the recent collapse of coastal ecosystems. *Science* **293**:629— 638.

Matias, A. M. A., J. A. Anticamara, and J. P. Quilang. 2013. High gene flow in reef fishes and its implications for ad-hoc no-take marine reserves. *Mitochondrial DNA* **24**(5): 584-595.

Valdés-Pizzini, M., C.G. García-Quijano, and M.T. Schärer-Umpierre. 2012. Connecting humans and ecosystems in tropical fisheries: Social sciences and the ecosystem-based fisheries management in Puerto Rico and the Caribbean. *Caribbean Studies* **40**(2):95 - 128.

Valdivia, A., C. Cox, and J. Bruno. 2015. Reconstructing baselines for Caribbean predatory reef fishes. *PeerJ Preprints*. <https://doi.org/10.7287/peerj.preprints.805v1>.

Villaseñor-Derbez, J.C., E. Aceves-Bueno, S. Fulton, A. Suarez, A. Hernández-Velasco, J. Torre, and F. Micheli. (2019) An interdisciplinary evaluation of community-based TURF-reserves. *PLoS ONE* **14**(8): e0221660.

Wade, E., A.K. Spalding, and K. Biedenweg. 2019. Integrating property rights into fisheries management: The case of Belize’s journey to managed access. *Marine Policy* **108**(103631). <https://doi.org/10.1016/j.marpol.2019.103631>.



**Figure 2.** Summary of responses related to fishers’ perception of MA program, including the logbook process, illegal fishing behavior, enforcement, time spent fishing, equity of MA right distribution, and support of program in long run (n = 119).