

1 **Marine resource management and fisheries governance in**
2 **Belize exhibit a polycentric, decentralized, and nested**
3 **institutional structure**

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16 **Highlights**

17 Fisheries; governance; marine resource use; common pool resources; Belize; collective action

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19

20 **Abstract**

21 Overfishing is one of the most severe anthropogenic threats to the world's oceans, marked by
22 widespread degradation of marine food webs and disruption of ecosystem functioning. Global
23 fisheries can be categorized as common-pool resource (CPR) systems because restricting marine
24 resource extraction is extremely challenging, and over-extraction contributes to an overall
25 decline in availability to others. Because of these challenges, establishing effective institutions
26 for the sustainable management of natural resource systems is essential. Community-based
27 fisheries management offers a potential solution to overcome the challenges associated with
28 fisheries as CPRs by including fishers in the management of their fisheries through collective
29 action. The purpose of this study was to examine the institutional robustness (e.g. presence of
30 nested and decentralized enterprises as indicators of resilience to shocks) of over 40 years of
31 fisheries management in Belize. I used a mixed methods approach combining review of
32 secondary literature, semi-structured interviews with key informants across the governmental,
33 non-governmental, and fishers' sectors, and participant observation. The results of this study
34 suggest that Belize has the institutions in place to overcome collective action problems and be a
35 long-enduring CPR system. These conclusions have implications for the enforcement of Belize's
36 new Fisheries Resource Bill (as of late 2019), and in other small-scale fisheries across the globe.

37

38

39 **1. Introduction**

40 Forests and global fisheries are often described as common pool resource (CPR) systems because
41 excluding resource unit (e.g. trees, land, and fish) extraction is challenging, and the
42 [over]consumption can contribute to the overall decline in resource availability to others (Olson
43 1965, Ostrom 1990, Ostrom et al. 1999, Ostrom 2003). Marine fish species are examples of
44 common-pool resources because: 1) they are seemingly available for extraction (Anderson and
45 Uchida 2014), 2) it is difficult to identify, track, and estimate their abundance (Levine and
46 Richmond 2015), and 3) it is challenging to manage the access to the resource across large and
47 sometimes international oceanic boundaries (Cudney-Bueno and Basurto 2009, Urquhart et al.
48 2014, Levine and Richmond 2015). Furthermore, the over-extraction of marine resources has
49 implications for both environmental and livelihood outcomes. The overexploitation of marine
50 systems and lack of effective management institutions manifests itself as overfishing, which
51 leads to degradation of food webs and disruption of overall ecosystem functioning (Jackson et al.
52 2001).

53

54 Because subsistence and commercial fishing provide nearly three billion people with fish protein
55 annually (FAO 2014), it is essential to develop management approaches to restore fish
56 populations and maintain food security. The majority of present-day fisheries management relies
57 on local governance and stock assessments, which report catch per unit effort (CPUE) and
58 estimate maximum sustainable yield (MSY) via population and ecosystem models (Costello et
59 al. 2008, Valdés-Pizzini et al. 2012). To combat the threat of overfishing (Jackson et al. 2001),
60 there has been increased interest in establishing multi-species fisheries, enforcing the use of a
61 variety of gear strategies, setting catch limits (Valdés-Pizzini et al. 2012), restricting fishing in

62 select areas (Gaines et al. 2010), and implementing adaptive management strategies (McDonald
63 et al. 2017).

64

65 Fisheries management measures, including formal licensing procedures and Marine Protected
66 Areas (MPAs), have been the primary management response to overfishing. MPAs function by
67 restricting fishing access to select offshore locations with the intention of increasing fish
68 abundances and diversity within those areas, with fish spilling over to adjacent non-protected
69 areas (Gaines et al. 2010). MPAs then may be coupled with specific restrictions on fishing, e.g.
70 catch share programs and special licenses, ideally leading to increased fish size and abundance to
71 participating fishers (Costello et al. 2008). However, MPAs often fall short of achieving
72 ecological and social benefits due to lack of specified policy and goals (e.g. “paper parks”),
73 enforcement capacity, poaching, and limited spillover, as well as social conflict when fishers’
74 livelihoods are negatively affected by MPAs (Huntington et al. 2011, Gill et al. 2017, Bruno et
75 al. 2019). Common challenges to effective MPA governance also include confused goals,
76 increased conflict, and unrealistic aims to scale-up beyond institutional capacity (Christie and
77 White 2007), which demonstrate a need for improved MPA management.

78

79 One promising way to overcome these issues with CPRs in fisheries is to include fishers in the
80 management of their fisheries by leveraging social capital (Brondizio et al. 2009) and inspiring
81 collective action among community members (Olson 1965, Ostrom 1990, Ostrom et al. 1999,
82 Ostrom 2003). Social capital refers to the value of trust established by networks of individuals
83 and institutions who share common interests (Brondizio et al. 2009). The organization of those
84 institutions has the potential to inspire collective action from communities, where individuals

85 self-organize into groups to perform actions that lead to group benefits that would not be
86 available to a non-group member (Olson 1965, Ostrom 1990, Ostrom et al. 1999, Ostrom 2003,
87 Brondizio et al. 2009, Pinho et al. 2012, Uchida 2017). To encourage collective action among
88 individuals in a community, a common objective and behavior towards resource utilization must
89 be identified, but this is no easy feat (Brondizio et al. 2009, Ostrom et al. 2009, Pinho et al. 2012,
90 Reddy et al. 2013). The success of such collective action depends on the networks of institutions
91 involved, and the direction of motivation, which oftentimes begins on the local level and works
92 up to the state- or country-wide level (Foley 2012, Catzim and Walker 2013, Barner 2015, Ayer
93 et al. 2018).

94

95 Institutions for collective action in small-scale fisheries include fishing cooperatives and
96 associations that advocate for fishers' rights to management officials and that sometimes own
97 shares of the total catch (Armitage et al. 2012, Basurto et al. 2013, Gelcich et al. 2013, Aceves-
98 Bueno et al. 2017, Armitage et al. 2017, Karr et al. 2017, Uchida 2017). Membership to fisher
99 associations and cooperatives has the potential to increase economic opportunities to fishers by
100 way of new market development, product differentiation, and direct sales to consumers (Uchida
101 2017). Such institutions provide a platform for fishers to become a part of community-based
102 fisheries management (CBFM) by including them in the monitoring, enforcement, and overall
103 decision-making processes involved in resource management in their communities (Wiber et al.
104 2004, Armitage et al. 2012, Pinho et al. 2012, Valdés-Pizzini et al. 2012, Islam and Yew 2013,
105 Urquhart et al. 2014). Such participatory co-management may encourage environmental
106 stewardship among fishers because they develop a sense of ownership of their fisheries, which
107 provide additional incentives for sustainable fishing practices and continued collective action

108 (Wiber et al. 2004, Cudney-Bueno and Basurto 2009). The overall polycentric governance
109 structure of CBFM contributes to broad stakeholder involvement, increased policy freedom at
110 local levels, improved spatial fits between knowledge and action, and ultimately better responses
111 to complex changes facing fisheries in the future (Cvitanovic et al. 2018). These benefits can
112 lead to long-term sustainability of conservation measures.

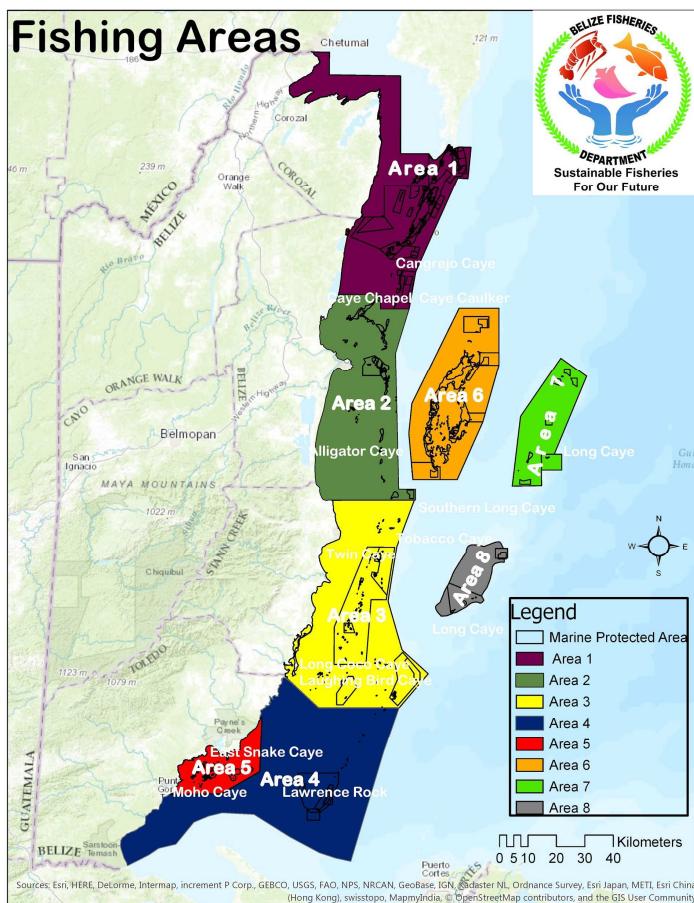
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114 Scholars interested in CPR institutions have identified several design principles that enhance
115 probability of success. For instance, Ostrom identified eight design principles of long-enduring
116 CPR institutions that have been identified as potential means to solve collective action problems
117 (Ostrom 1990). These principles can act as a means to empirically analyze the robustness of
118 institutions in securing environmental and livelihood outcomes because they can be more
119 directly measured. The principles include: 1) clearly defined boundaries (such as a coastal
120 region), 2) connection between local conditions and provisioning rules, 3) collective-choice
121 arrangements, where the users participating in operational rules also have collective-choice
122 rights, 4) monitoring of the resource system by the users, 5) graduated sanctions in place, 6)
123 conflict-resolution mechanisms between all actors, 7) minimal recognition of rights to organize.
124 where external government authorities don't challenge the rights of appropriators to make their
125 own institutions, and 8) nested enterprises (Ostrom 1990). Such design principles can offer a
126 method for determining the potential for the proper management of CPRs well into the future
127 (Cinner et al. 2009, Levine and Richmond 2015).

128

129 The purpose of this study was to assess the robustness of institutions involved in fisheries
130 management in Belize using Ostrom's eight principles of long-enduring CPRs as a guide. I first

131 identified the institutional roles and structure, then examined the impact of that institutional
132 structure on the decision-making power and implementation of the Managed Access program
133 (Figure 1), and lastly determined that marine resource management in Belize exhibits Ostrom's
134 eight principles for long-enduring CPRs (Ostrom 1990). I define "institutional robustness" by the
135 presence of nested and decentralized institutions, as they are more resilient to shocks (Ostrom et
136 al. 2010), and can be identified through the lens of Ostrom's design principles. I used a mixed
137 methods approach that combined review of secondary data, semi-structured interviews with key
138 informants, and participant observation. As of late 2019, a new Fisheries Resource Bill was
139 approved by the government of Belize, introducing many institutional changes to fisheries
140 management across the country. This provides an opportunity to review the history of fisheries
141 management in Belize and look critically into the future. My results suggest that Belize has the
142 institutions in place to be a long-enduring CPR system and overcome collective action problems
143 (Ostrom 1990, 2003), leading to potential long-term sustainability goals being met.



144

145 Figure 1: Managed Access fishing areas in Belize. The polygons represent MPAs. The two pilot
146 sites established in 2011 were: Area 5 (in red), the Port Honduras Marine Reserve (PHMR), and
147 Area 8 (in grey), the Glovers Reef Marine Reserve (GRMR). The remaining Areas were
148 established in 2016. Map from the Belize Fisheries Department 2019.

149

150 2. Case Study Context

151 2.1 Belize Geography, Ecology, and Marine Resource Use

152 Belize is located in Central America. Natural resources are an important contributor to the
153 national economy, including commercial fisheries, eco-tourism (marine and terrestrial), and
154 logging (Karlsson and Bryceson 2016). Belize is home to the second longest barrier coral reef in

155 the world – the Belize Barrier Reef (BBR). The Belize Barrier Reef is part of the larger
156 Mesoamerican Barrier Reef System, which traces the coasts of Belize, Mexico, and Honduras.
157 The reef system incorporates the diverse marine habitats of mangroves, seagrass beds, fringing
158 and patch coral reefs, and several offshore atolls. Because of this rich biodiversity, ecotourism
159 and fishing are two of the most prevalent livelihood strategies among Belizeans (Gopal et al.
160 2015). Lobster, conch, snapper, and grouper are the primary fishery species across Belize, with
161 upwards of 3,000 licensed commercial fishermen per year (Huitric 2005; Catzim and Walker
162 2013). Since the 1980s, national yields for lobster and conch have been relatively stable while
163 effort has increased (Huitric 2005).

164

165 **2.2 Evolving Coastal Zone Management in Belize**

166 Belize has a rich history of relying on natural resources (e.g. forest and marine products) for
167 economic, political, and social benefit (Karlsson and Bryceson 2016), stemming from the
168 colonial occupation of the British until Belize independence in 1973 (Wainwright 2009). Over
169 the last 40+ years, tremendous changes in coastal zone management and fisheries policies have
170 occurred in Belize (Figure 2). Throughout this timeline, non-governmental organizations (NGOs)
171 were formed, which are now some of the key stakeholders and regional co-managers of the
172 marine reserves. The first marine reserve, Hol Chan Marine Reserve (HCMR), was formed in
173 1987, which started a precedent for future marine protection. Shortly after, in 1989, the first
174 International Coastal Resources Management Workshop was held. The focus of the workshop
175 was how to sustainably manage the use and development of coastal ecosystems for the benefit of
176 future generations, which then became the main priority of the Coastal Zone Management
177 Authority and Institute (CZMAI), established in 1998. In 1996, seven protected areas within the

178 BBR became designated as a part of a UNESCO World Heritage Site. In 1997, the Toledo
179 Institute for Development and Environment (TIDE) was formed, pioneering the way for other
180 community-based conservation organizations throughout Belize.

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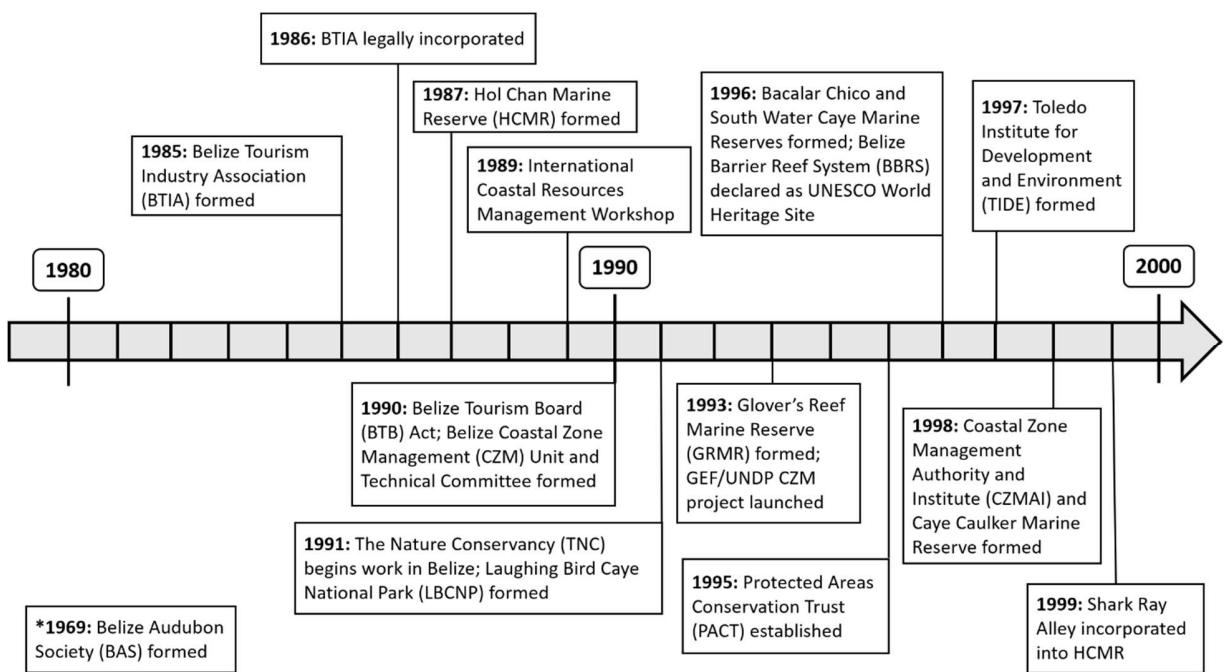
182 In 2000, the Port Honduras Marine Reserve (PHMR) and Gladden Spit and Silk Cayes Marine
183 Reserve (GSSCMR) were developed. TIDE soon became a co-manager of PHMR with the
184 Belize Fisheries Department. In the early 2000s, additional NGOs began to form throughout
185 Belize, including Healthy Reefs for Healthy People in 2003, the Sarteneja Alliance for
186 Conservation and Development (SACD) in 2007, and the Southern Environmental Association
187 (SEA) formed in 2008 from the merging of Friends of Nature (FoN) and the Toledo Association
188 for Sustainable Tourism and Empowerment (TASTE). In 2011, a rights-based fishery known as
189 Managed Access (MA) was piloted at the Port Honduras Marine Reserve (PHMR) and Glover's
190 Reef Marine Reserve (GRMR) (Foley 2012, Belize Fisheries Department 2015 and 2019). This
191 rights-based fishery granted commercial fishers rights to fish in select areas while requiring them
192 to report their catch to management officials. Piloting MA was the first step toward eliminating
193 the "race to fish" associated with Belize's open access fishery regime. After reported decreases
194 in illegal fishing and increased catch by fishers (Catzim and Walker 2013), the MA program was
195 implemented nationwide in 2016, with seven additional sites added to Belize's territorial waters
196 (Figure 1, Belize Fisheries Department 2015 and 2019). Belize currently contains a network of
197 marine reserves with varying levels of access/extraction of marine resources. Within the marine
198 reserves are General Use Zones (GUZ,) where regulated extractive activities are allowed,
199 Replenishment Zones (RZ), where non-extractive activities are permitted, and Preservation

200 Zones (PRZ), which are open to research activities only (Belize Fisheries Department 2015 and
201 2019).

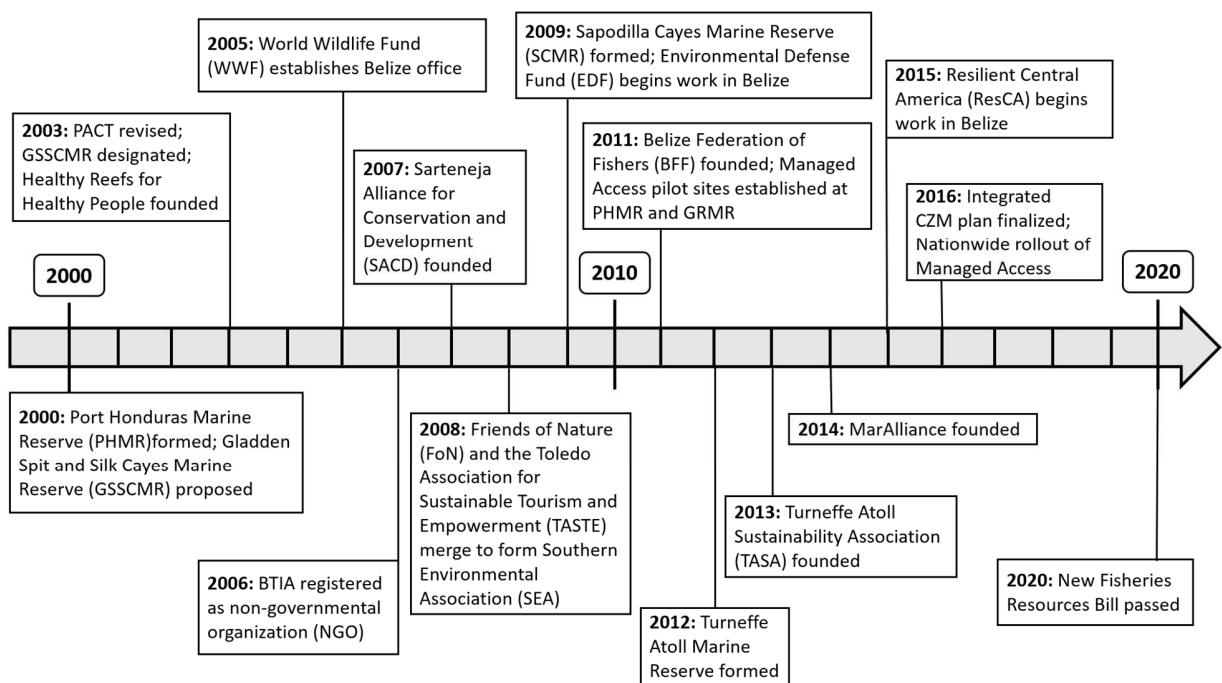
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203 Most of the marine reserves are co-managed by an NGO and/or the Belize Fisheries Department.
204 As of late 2019, a new Fisheries Resource Bill was approved by the Cabinet, after nearly 10
205 years of deliberation by the federal government, scientists, fishers, and NGO co-managers. The
206 Fisheries Resource Bill builds on an indicator-based adaptive management framework for the
207 lobster and conch fisheries of Belize, which was developed in 2017. Included in the bill is the
208 establishment of a Fisheries Council, with representatives from diverse sectors, increased
209 enforcement and monitoring guidelines, and ways to improve fisheries management for
210 sustainability and economic development (Belize Fisheries Department 2019).

211



212



213

214 Figure 2: Timeline of significant milestones in coastal zone/fisheries management in Belize from
 215 1980 to present. Top panel shows 1980-2000 while the bottom panel shows 2000-2020. Source:
 216 key informant interviews and review of secondary literature.

217

218 **3. Materials and Methods**

219 To assess the robustness of institutions (e.g. presence of nested and decentralized institutions
 220 (Ostrom et al. 2010)) involved in fisheries management in Belize, this study sought to answer the
 221 following research questions: 1) What are the institutions involved in fisheries management in
 222 Belize, what are their roles, and how are they structured? 2) How does the structure of
 223 enforcement and monitoring of Belize's Managed Access program (Figure 1) affect decision-
 224 making power and implementation of the program? 3) Does marine resource management in
 225 Belize exhibit Ostrom's eight design principles for long-enduring CPRs (Ostrom 1990) and what
 226 implications does that have for the sustainability of the Managed Access program?

227

228 This study used a mixed methods approach that combined reviewing secondary data, semi-
229 structured interviews with key informants and participant observation (Bernard 1998). The
230 review of secondary data was ongoing throughout the process of this study, and included
231 published and unpublished governmental and non-governmental reports, academic publications
232 (thorough literature searches), and online resources. Semi-structured interviews with key
233 informants and participant observation occurred in June and September 2017, and from April -
234 June 2019.

235

236 Key informants included individuals in leadership positions and natural resource managers in the
237 governmental ($n = 8$) and non-governmental sectors ($n = 26$) within Belize. Key informants were
238 also fishers ($n = 23$), some of whom were leaders in their communities (e.g. served on
239 committees, fisher associations), while others were vocal about voicing their opinions about
240 several fisheries-related topics. Key informants were selected using snowball sampling (Bernard
241 1998) and by ensuring at least one member of each NGO, and at least one person from the Belize
242 Fisheries Department, was interviewed. This process also involved extensive trust-building
243 between myself and all stakeholder groups, particularly when it came to recruiting key
244 informants to be interviewed. Many of my correspondences were facilitated through
245 introductions made by trusted community members, therefore vetting me in the process.

246 Participant observation included: attendance at fisher forums, meetings, and presentations by
247 natural resource managers, and various formal and informal gatherings within the communities.
248 Such community gatherings included the fish and produce markets and the Chocolate Festival in
249 Punta Gorda, the Mango Festival in Hopkins, the Lobster Festival in Placencia, and the fish

250 market in Dangriga. During participant observation and attendance at community gatherings, I
251 followed Bernard (1998)'s guidelines for qualitative data collection and note taking. All
252 respondents remained anonymous throughout this process.

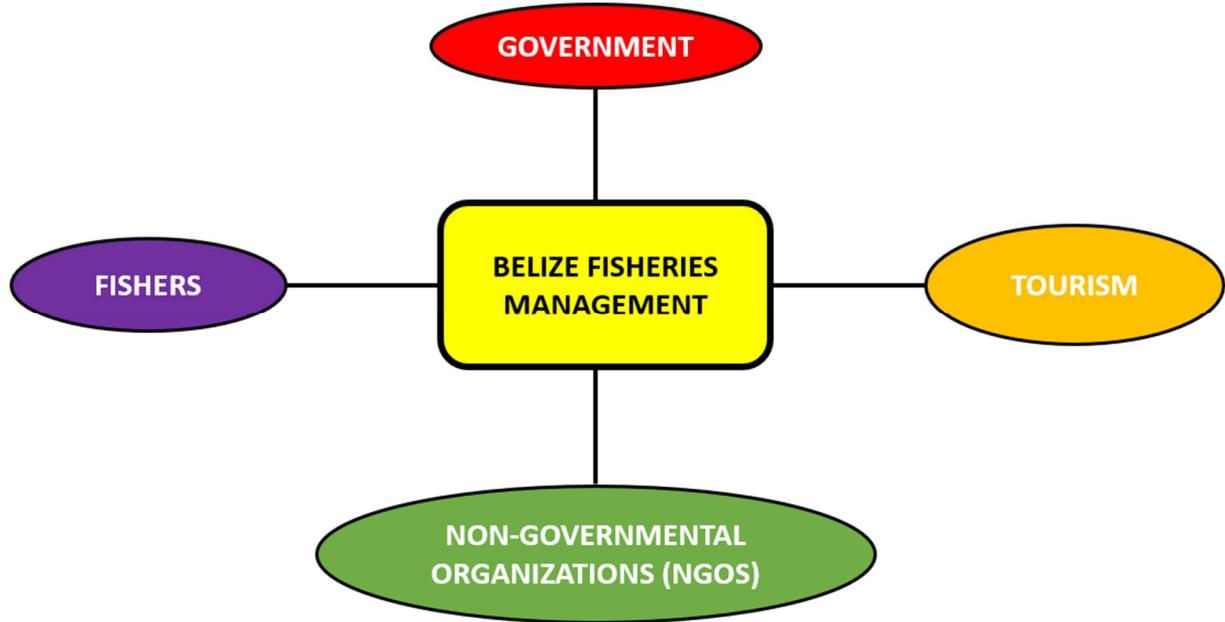
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254 **4. Results**

255 **4.1 The identity, roles, and structure of institutions involved in fisheries management in**
256 **Belize**

257 Here, I describe the complex institutional structure of fisheries management to be polycentric
258 and decentralized, due to the existence of many centers of decision-making formally independent
259 of one another (Ostrom et al. 1961, Ostrom et al. 2010). The institutional structure is also nested
260 because of governance activities organized within multiple layers (Ostrom et al. 2010). The
261 government, tourism sector, NGOs, and fishers sectors represent the type of institutions involved
262 in the fisheries decision-making process (Figure 3). The key informant interviews and participant
263 observations revealed that for many sectors, including the governmental and fishers' sector,
264 institutions are nested within each other, providing for enhanced information transfer,
265 collaboration, and decision-making power. In the NGO, tourism, and fishers sector, many
266 institutions are also decentralized, representing the local community and protected area at
267 regional and national levels.

268



269

270 Figure 3: Visual depiction of the different sectors involved in fisheries management in Belize.

271 Sources: key informant interviews, participant observations and review of secondary data.

272

273 *4.1.1 Government Sector*

274 The first institutional sector involved in fisheries management in Belize represents the federal
 275 government. Because coastal resource management in Belize involves the extraction of natural
 276 resources, use of Belize's territorial waters, and the trade and exporting of marine products,
 277 many governmental institutions are involved. The participant observation, key informant
 278 interviews and review of secondary literature revealed six ministries in the governmental sector,
 279 within which the different governing institutions reside (Figure 4). These nested institutions
 280 (McCabe and Feiock 2005a, Ostrom et al. 2010) set rules for domestic and international trade,
 281 economic development, natural resource management, national security and enforcement of
 282 governmental policies.

283

284 Within the Ministry of Economic Development, Petroleum, Investment, Trade and Commerce is
285 the Belize Trade and Investment Development Service (BELTRAIDE, Government of Belize
286 2019). BELTRAIDE promotes and enables socio-economic development. The Belize Port
287 Authority and Belize Customs and Excise are two institutions within the Ministry of Transport
288 and National Emergency Management. The Belize Port Authority is led by the Ports
289 Commissioner (a.k.a. Harbour Master) and is responsible for regulating and developing Belize's
290 ports, harbors and shipping as well as ensuring the safety of all vessels navigating within
291 Belize's territorial waters (Belize Port Authority 2019). Belize Customs and Excise develops and
292 implements policies to ensure increased safety/security and develop the effective platforms for
293 effective trade and revenue collection (Belize Customs and Excise 2018). International trade
294 policies are developed by the Belize Customs and Excise, which are essential to the export of
295 lobster and conch as the primary marine products exported from Belize (Belize Customs and
296 Excise 2018).

297

298 The Belize Tourism Board (BTB), and the National Institute of Culture and History (NICH) are
299 within the Ministry of Tourism, Civil Aviation, and Culture (Ministry of Tourism and Civil
300 Aviation 2019). The BTB is a partner between the government and the private (tourism) sector in
301 Belize, working closely with four tourism stakeholder groups (hotels, tour operators, tour guides,
302 and the cruise industry (Belize Tourism Board 2020)). The role of BTB in natural resource
303 management will be explained in the subsequent section. NICH is a statutory body that preserves
304 and shares Belize's historic and ethnic roots (National Institute of Culture and History 2020).

305

306 The Belize Coast Guard (Belize Ministry of National Security 2016a), Belize Police Department
307 (Devex 2020), Belize Defence Force (Belize Defence Force 2020) and National Emergency
308 Management Organization (NEMO, National Emergency Management Organization 2020) are
309 housed within the Ministry of National Security (Belize Ministry of National Security 2016b) as
310 entities all responsible for ensuring the safety and security of those in Belize. The Belize Coast
311 Guard and Belize Defence Force are part of the professional military with soldiers trained in
312 ensuring the safety and security of those in Belize. The Belize Coast Guard enforces maritime
313 laws and protects Belize's territorial waters (Belize Ministry of National Security 2016a), while
314 the Belize Defence Force is more focused on the defense of Belize and supporting the Civil
315 Authorities in maintaining order in Belize (Belize Defence Force 2020). The Belize Police
316 Department works on more local levels to preserve law and order across the country, with three
317 police for every 1000 inhabitants (Devex 2020). NEMO is responsible for providing citizens
318 with information regarding emergency preparedness, storm tracking, and natural disasters
319 (National Emergency Management Organization 2020).

320

321 The Belize Agricultural Health Authority (BAHA, Belize Agricultural Health Authority 2020)
322 and the Belize Department of Cooperatives (Ministry of Food, Agriculture, and Immigration
323 2017a) is housed within the Ministry of Food, Agriculture, and Immigration (Ministry of Food,
324 Agriculture, and Immigration 2017b). The BAHA oversees animal health, plant health,
325 quarantine and food safety services that prioritize the health and wellness of those it serves while
326 strengthening national food security and facilitating trade/commerce. BAHA is directly involved
327 in the production, management, and trade of the marine products (lobster, conch, finfish) that are
328 sold domestically and internationally (Belize Agricultural Health Authority 2020). The

329 Department of Cooperatives provides regulatory services for entrepreneurial development
330 programs related to the cooperative sector in Belize. The fisheries cooperatives (explained
331 below) are regulated by this department (Ministry of Food, Agriculture, and Immigration 2017a).

332

333 The Forest Department (The Forest Department 2019), Department of the Environment (The
334 Department of the Environment 2020), Fisheries Department (The Belize Fisheries Department
335 2013), Protected Areas Conservation Trust (PACT, Protected Areas Conservation Trust 2019)
336 and Coastal Zone Management Authority and Institute (CZMAI, Coastal Zone Management
337 Authority 2019) are all housed within the Ministry of Agriculture, Fisheries, Forestry, the
338 Environment, and Sustainable Development (Government of Belize 2020). The Forest
339 Department enforces the policies and regulations for the sustainable management of Belize's
340 forested ecosystems (The Forest Department 2019). The Department of the Environment focuses
341 on establishing, recommending and enforcing policies that improve environmental quality, limit
342 pollution, and promote public engagement (The Department of the Environment 2020).

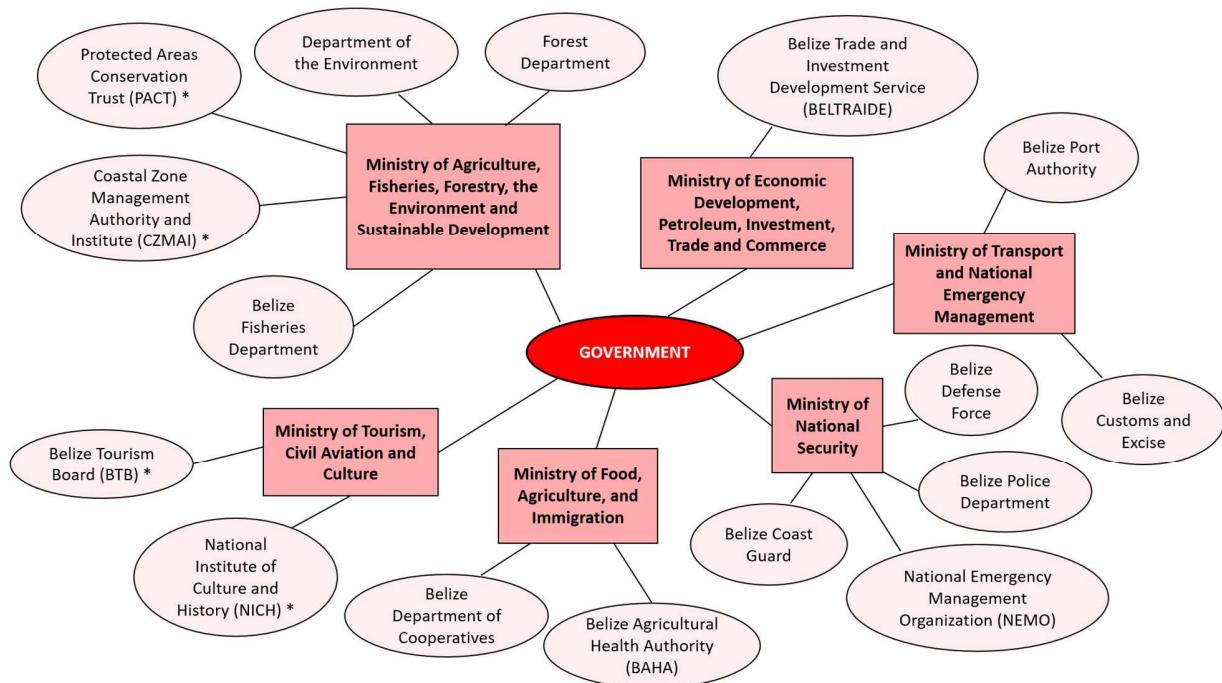
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344 The Fisheries Department is responsible for the development and enforcement of management
345 policies surrounding aquatic and fisheries resources, with a focus on sustainability for present
346 and future generations. They are the primary government agency involved in fisheries
347 management policies across Belize, working closely with the tourism and NGO sectors (The
348 Belize Fisheries Department 2013). PACT is a national conservation trust which manages
349 Belize's National Protected Areas System (NPAS) through strategic partnerships and investment
350 opportunities (Protected Areas Conservation Trust 2019). CZMAI is a statutory body within the

351 government responsible for the development and implementation of coastal zone management
352 (CZM) strategies in Belize (Coastal Zone Management Authority and Institute 2019).

353

354



355
356 Figure 4: Visual depiction of the governmental agencies involved in fisheries management in
357 Belize. Each governmental organization is nested within a Ministry. The Belize Tourism Board
358 (BTB) is also represented in the tourism sector. Asterisk indicates statutory body. Sources: key
359 informant interviews, participant observations and review of secondary data.

360

361 *4.1.2 Tourism Sector*

362 The key informant interviews, participant observation and review of secondary data revealed
363 three main tourism sector institutions involved in fisheries management in Belize: The Belize
364 Tourism Board (BTB, Belize Tourism Board 2020), the Belize Tourism Industry Association

365 (BTIA, Belize Tourism Industry Association 2020) and the Belize Hotel Association (BHA,
366 Belize Hotel Association 2020, Figure 5). The tourism sector is included in this paper for a
367 variety of reasons: A) fishers sell their catch to restaurants, resorts and hotels, B) many fishers
368 are also tour guides (they even take tourists out to go recreational fishing, thereby relying on
369 “healthy” marine ecosystems for guests), and C) they are a big economic and decision-making
370 stakeholder in determining, expanding, and enforcing marine protected areas.

371

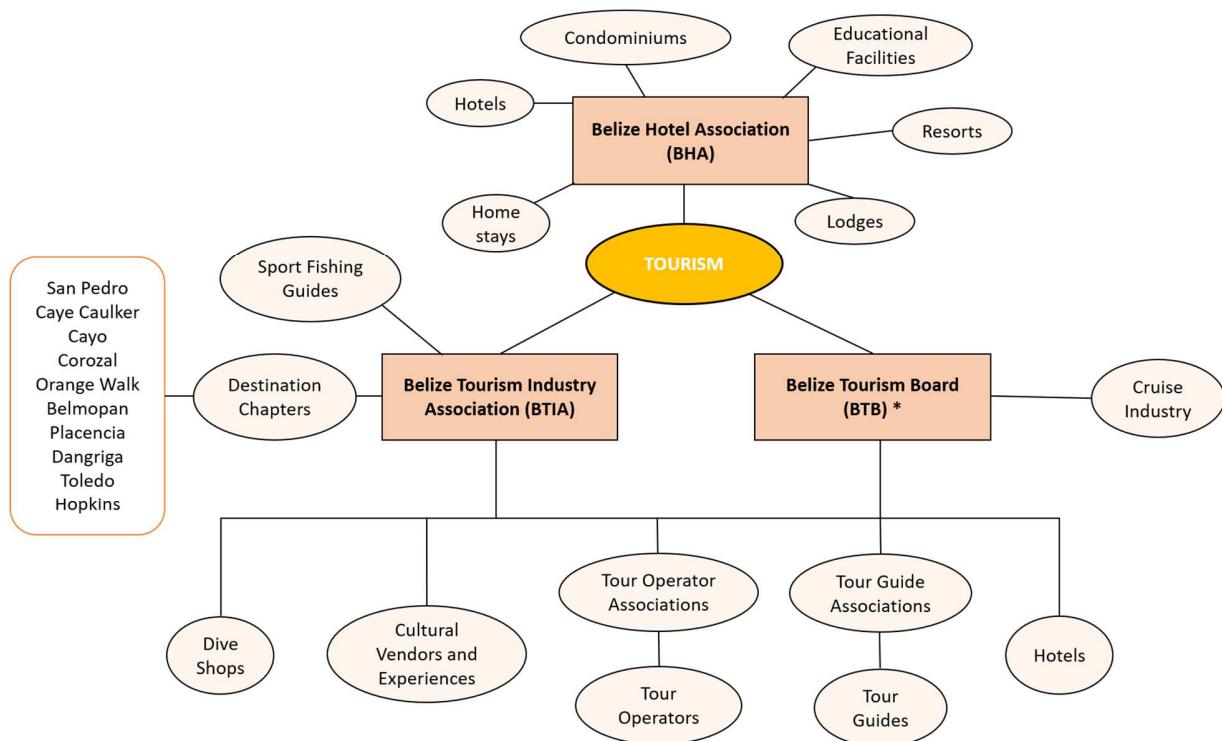
372 Both the BTB and BTIA act as connections between the private and public sectors of the tourism
373 industry. As previously stated, the BTB is a statutory body within the Ministry of Tourism
374 (government sector) that acts as a strategic partner between the government and the private
375 tourism sector. It develops, markets and implements tourism programs to fulfill the emerging
376 needs of local and international tourism markets. The organizational structure of BTB includes
377 branches such as Marketing and Industry Relations, Destination Planning and Cruise,
378 Information Technology, and Finance (Belize Tourism Board 2020). The BTIA is an umbrella
379 organization for the tourism industry’s private sector because it has representation on almost
380 every government, legislative, advisory and consultative committee. BTIA is governed by a
381 president and board of directors while the management of everyday operations is led by an
382 executive director and secretariat (Belize Tourism Industry Association 2020).

383

384 Both the BTB and BTIA represent dive shops, cultural vendors and experiences, tour operator
385 associations, tour operators, tour guide associations, tour guides, and hotels. All tour guides and
386 tour operators do not have to be members of their respective associations, but they need to be
387 registered with the BTB. The cruise industry is only represented by the BTB while sports fishing

388 guides are only represented by the BTIA. The BTIA also has local chapters based on the
389 destination, including (but not limited to) those in San Pedro, Caye Caulker, Cayo, and Corozol
390 (Belize Tourism Industry Association 2020b). Lastly, the BHA is a non-profit, NGO and
391 Belize's oldest private sector tourism organization. It supports the sustainable growth of member
392 hotels and the tourism industry in Belize via marketing initiatives, inter-and intra-sector
393 partnerships and training services. Its membership includes educational facilities, resorts, lodges,
394 condominiums, homestays and hotels (Belize Hotel Association 2020).

395



396
397 Figure 5: Visual depiction of the tourism institutions involved in fisheries in Belize. Asterisk
398 indicates statutory body in the government sector. Sources: key informant interviews, participant
399 observations and review of secondary data.

400

401 *4.1.3 Environmental Non-Governmental Organization (NGO) Sector*

402 The NGOs included in this paper focus on the environment and sustainability, and are not
403 exhaustive of all NGOs in Belize. However, since the early 1990s, local and international NGOs
404 have been working in Belize to promote the environmental conservation and sustainability of
405 natural resources (Figures 1 and 6). Some NGOs are also co-managers of marine reserves with
406 the Belize Fisheries Department. For the purpose of this paper, I divided the NGOs into those
407 that are international with a local Belize chapter, and those that are local to a community or
408 region within Belize. Making that distinction is important when considering the institutional
409 stability, resources, and governance potential of all of these NGOs. Through many semi-
410 structured interviews with key informants, participant observation and detailed review of
411 secondary data, I describe all NGOs involved in coastal resource management and conservation
412 in Belize (Figure 6).

413

414 Many of the NGOs local to a community focus on particular regions, marine reserves or a
415 combination of the two. Many combine research, environmental monitoring, enforcement of
416 fisheries policies, environmental outreach, and community development. The NGOs are led by a
417 suite of full-time staff members, and overseen by boards of directors, which consist of
418 community members, and representatives from the tourism and fisher sectors. The Southern
419 Environmental Association (SEA) is based in Placencia, Belize, and is a co-manager of the
420 Gladden Spit and Silk Cayes Marine Reserve (GSSCMR) and Laughing Bird National Park
421 (LBNP, Yello Belize 2020). The Belize Federation of Fishers (BFF) is an umbrella organization
422 that represents many individual fishers and fisher associations, but not all of them. Membership
423 to BFF is voluntary. The BFF is led by an executive managing committee of 16 community
424 representatives, many of whom are in leadership positions in their communities/fisher

425 associations. The BFF was registered as a fisher community-focused conservation organization
426 for commercial fishers in 2011, and incorporated in 2013 (BFFishers 2015). The Toledo Institute
427 for Development and Environment (TIDE) is based in Punta Gorda, Belize, and works primarily
428 in the Maya Mountain Marine Corridor of southern Belize. TIDE co-manages the Port Honduras
429 Marine Reserve (PHMR) with the Fisheries Department, co-manages Payne's Creek National
430 Park, and manages TIDE Private Protected Lands (TIDE 2020).

431

432 The Sarteneja Alliance for Conservation and Development (SACD) is based in Sarteneja, Belize,
433 and serves the stakeholder communities of the Corozal Bay Wildlife Sanctuary (CWBS, SACD
434 Belize 2020). The Belize Audubon Society (BAS) is another NGO co-manager of Lighthouse
435 Reef Atoll, where the Belize Blue Hole and Half Moon Caye are located. BAS is headquartered
436 in Belize City and is the oldest environmental NGO in Belize, having been founded in 1969
437 (Belize Audubon Society 2015). The Turneffe Atoll Sustainability Association (TASA) is also
438 located in Belize City, and it co-manages the Turneffe Atoll Marine Reserve (TAMR, Turneffe
439 Atoll Marine Reserve 2020). The Coalition for Sustainable Fisheries was formed in 2018
440 primarily to advocate for a gillnet ban throughout Belize and consists of conservation
441 organizations, tourism operators, and sports and commercial fisherfolk (The Coalition for
442 Sustainable Fisheries 2020). Fragments of Hope (FoH) is another NGO local to Belize, which
443 focuses on coral restoration projects and sustainable management of coastal habitats (Fragments
444 of Hope, Belize Ltd. 2015).

445

446 On the other hand, international environmental NGOs with chapters in Belize focus on a variety
447 of environmental issues, both marine and terrestrial, and their international status enables them to

448 leverage broader resources. Many of these international organizations combine science-based
449 conservation work with stakeholder engagement and community development. They often
450 collaborate with many of the Belizean-based NGOs, fisher communities and government
451 agencies to meet common conservation goals. One such environmental NGO is Healthy Reefs
452 for Healthy People, with projects across the entire Mesoamerican Barrier Reef System (MBRS),
453 in Mexico, Belize, Guatemala and Honduras (Healthy Reefs 2020). Healthy Reefs collaborates
454 with NGOs and government agencies to co-produce annual ecological monitoring “Report
455 Cards” on the status of the MBRS. MarAlliance is another international NGO, based in
456 Sarteneja, Belize, which focuses on improving the conservation of threatened marine species and
457 their habitats, most notably sharks and rays. They have other projects across the MBRS as well
458 as in Cabo Verde and Micronesia (MarAlliance 2020). Oceana is another international NGO with
459 projects in Belize. Oceana was established in 1999 in the United States as an ocean advocacy
460 group dedicated to protecting and restoring the world’s oceans. Their work in Belize includes the
461 passing of legislation banning offshore oil drilling, decreasing ocean plastic pollution and most
462 recently, petitioning for the elimination of gill net use by fishers (Oceana 2020). Blue Ventures
463 also works Belize on grassroots marine conservation initiatives (Blue Ventures Conservation
464 2020).

465

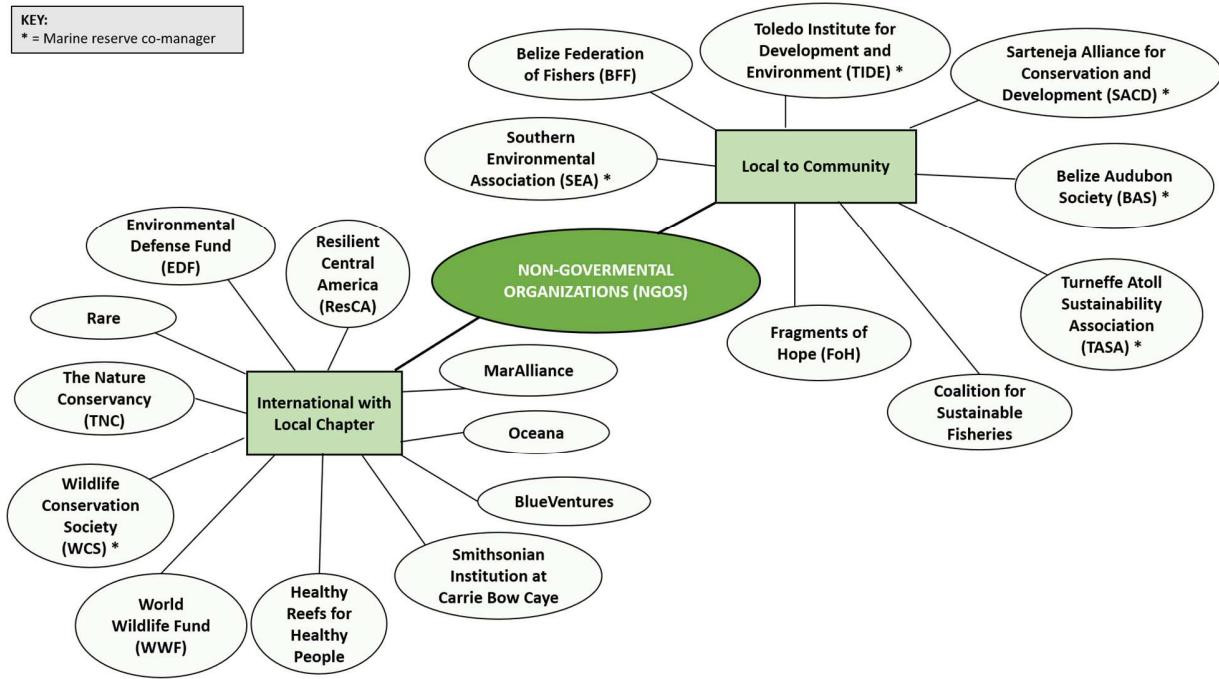
466 Headquartered on Carrie Bow Caye is a Smithsonian Institution Field Station for their Caribbean
467 Coral Reef Ecosystems (CCRE) Program. The Carrie Bow Field Station includes a scientific
468 laboratory, housing for visiting scholars, SCUBA facilities, and other resources for long-term
469 monitoring of the Belize Barrier Reef System. The World-Wide Fund (WWF, formerly World
470 Wildlife Fund) is another international organization that has been working in Central America

471 since 1987. They were instrumental in the establishment of Belize's first MPA, the Hol Chan
472 Marine Reserve. Since then, they have been involved in developing a season for spiny lobster,
473 developing the Turneffe Atoll as an MPA and in the completion of Belize's National Integrated
474 Coastal Zone Management Plan (World Wide Fund for Nature 2020). The Wildlife Conservation
475 Society (WCS) has also been working in Belize for several decades, with projects including
476 improved enforcement of fishing regulations, education and outreach programs, and spawning
477 aggregations research. WCS is also the only international organization that serves as a co-
478 manager of the Glover's Reef Marine Reserve (GRMR) with the Belize Fisheries Department
479 (Wildlife Conservation Society 2020).

480

481 The Nature Conservancy (TNC) has been working in Belize since 1991, on projects ranging
482 from seaweed aquaculture to seafood traceability in cooperatives (The Nature Conservancy
483 2020). They are working closely with Resilient Central America (ResCA) to improve seafood
484 traceability at the National Fishermen Cooperative in Belize City (The Nature Conservancy
485 2019, 2020). The Environmental Defense Fund (EDF), and Rare collaborated with the
486 government, NGOs, and fisher communities to transition fisheries management from an open-
487 access regime to the rights-based/TURF program Managed Access from 2009-2017. They have
488 also been integral in the development of the new Fisheries Resource Bill of 2020 (Environmental
489 Defense Fund 2020, Rare 2020).

490



491

492 **Figure 6:** Visual depiction of the environmental non-governmental organizations (NGOs)
493 involved in fisheries management in Belize. About half of them are local to a community in
494 Belize, while the other half are international organizations with local chapters. Asterisk indicates
495 an organization is a co-manager of a marine reserve (with the Belize Fisheries Department).
496 Sources: key informant interviews, participant observations and review of secondary data.

497

498 *4.1.4 Fishers Sector*

499 From key informant interviews and participant observation, I divided the fishers sector into three
500 broad categories with unique license requirements: sport, recreational, and commercial (Figure
501 7). Sport fishers are required to have a specific license to participate in catch-and-release of these
502 species: tarpon, permit, bonefish, and snook. Recreational fishers do not need licenses. As of
503 July 2016, all commercial fishers are required to obtain a Managed Access license, which grants
504 them rights to fish in 1-2 of the areas outlined in Figure 1 (Belize Fisheries Department 2015 and
505 2019). All fishers are required to abide by the coastal zone management rules and follow

506 guidelines for marine reserves (i.e. they are not allowed to extract marine products where it is
507 prohibited). All three of these groups of fishers can economically benefit from their fishing
508 activities, because commercial fishers sell their marine product to formal and informal markets
509 within Belize, and the sport and recreational fishers often rely on income related to the tourism
510 sector (source: key informant interviews and participant observation).

511

512 Commercial fishers include individual fishers, fishers' associations (of which many are a part),
513 Rainforest Seafoods, Ltd., cooperatives, and the Belize Federation of Fishers (BFF). The Belize
514 Federation of Fishers was previously described. Many fishers are members of – and therefore
515 sell their product to – one or all of the following fishing cooperatives: National Fisherman
516 Cooperative (in Belize City), the Northern Fishermen Cooperative (in Independence/Mango
517 Creek and Belize City), and the Placencia Produc es Cooperative. These three cooperatives fall
518 under the governing body, the Belize Department of Cooperatives. National and Northern
519 Fishermen Cooperatives purchase only lobster and conch, primarily for export, while Placencia
520 Produc es Cooperative purchases lobster, conch and finfish. For fishers to be members of these
521 cooperatives, they must pay an annual membership fee. Fishers benefit from cooperative
522 membership by not only getting competitive prices for marine products, but also opportunities
523 for small grants, raffles, and professional development. Fishers can also choose to sell lobster
524 and conch to Rainforest Seafoods, which has collection facilities in Mango Creek/Independence
525 and Dangriga, Belize, and exports the product internationally (Rainforest Seafoods 2020).

526

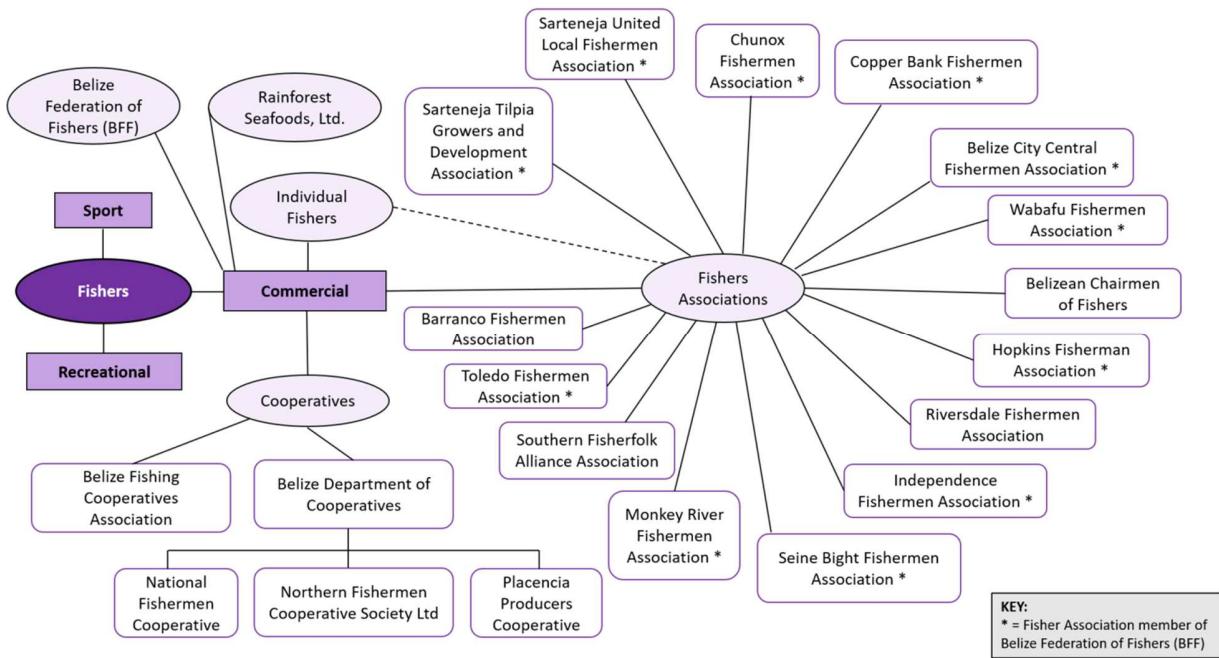
527 Providing the most direct opportunities/benefits for fishers is membership/participation in a
528 fisher association. Most of the fishers' associations across Belize represent the commercial

529 fishers of individual coastal fishing communities at regional and national scales. A complete list
530 of the fishers associations can be found in Figure 7. Several communities have representation by
531 multiple fisher associations. For instance, fishers engaged in aquaculture activities in Sarteneja
532 can be represented by the Sarteneja Tilapia Growers and Development Association, and if they
533 are also commercial fishers, be represented by the Sarteneja United Local Fishermen
534 Association. Similarly, Dangriga has two fishers' associations: the Wabafu Fisherman
535 Association ("Wabafu" is a Garifuna word meaning "people power") and the Belizean Chairmen
536 of Fishers. In the Toledo District, and around Punta Gorda Town, fishers are represented by the
537 Toledo Fishermen Association, and the Southern Fisherfolk Alliance Association. To be a
538 functioning fisher association, there needs to be regular fee-paying membership, annual
539 meetings, and meetings throughout the year. Executive meetings must also be held where
540 records/minutes of the meetings are maintained and shared with the membership (source: key
541 informant interviews).

542

543 Individual fishers may be members of one fisher association, 1-2 cooperatives, and the BFF (by
544 way of their fisher association), any combination, or not represented by any of these
545 organizations. Membership to a fisher association and/or cooperative is voluntary, and not all
546 individual fishers are members/represented by any fisher-oriented organization. This provides a
547 challenge when considering the equitable representation of fisher's needs at local, regional, and
548 national scales (i.e. some voices and viewpoints will be excluded due to this structure).

549



550

551 Figure 7: Visual depiction of the fishers' organizations in fisheries management in Belize. Note
 552 this figure primarily focuses on the commercial fishing sector. Asterisk indicates Fisher
 553 Associations as members of the Belize Federation of Fishers (BFF). Sources: key informant
 554 interviews, participant observations and review of secondary data.

555

556 *4.1.5 Summary*

557 Overall, the governmental, tourism, NGO, and fishers sectors involved in fisheries management
 558 in Belize demonstrate highly polycentric, nested, and decentralized institutions. In total, there are
 559 16 governmental institutions housed within six ministries all involved in the rulemaking,
 560 enforcement, and oversight of different aspects of fisheries management in Belize. The tourism
 561 sector is represented by three primary institutions, but they represent the breadth of actors
 562 involved in tourism at local and national scales. The NGO sector is vast, with international (n =
 563 11) and local (n = 8) agencies invested in environmental and fisheries sustainability in Belize.
 564 Because many of the NGOs are involved in their local communities, and because decision-

565 making and implementation of policies occurs at the local level, independent of one another, a
566 decentralized structure is represented by these entities. Lastly, the fishers sector represents a
567 complex arrangement of cooperatives, fisher associations, and individual interest groups, which
568 demonstrates the varying degrees of self-organization and collective action potential of the actors
569 here.

570

571 **4.2 The enforcement and monitoring of Belize's Managed Access program is decentralized**
572 From 2017-present, I conducted 57 key informant interviews to describe and understand the
573 institutional framework for the enforcement and monitoring of the Managed Access program
574 (Figure 8). In Figure 8, the Belize Fisheries Department (BFD) is depicted as the highest
575 governing body because the BFD sets the rules and regulations for the licensing process, logbook
576 reporting, and enforcement of MA (Belize Fisheries Department 2015 and 2019). The
577 individuals representing the BFD in this depiction include the Fisheries Administrator, who
578 oversees the entire BFD. Working closely with her are the Marine Scientific Research (MSR)
579 Permit Officer, and the Managed Access Liaison Officers in Belize City and Punta Gorda. The
580 decision-making and implementation of fisheries management in Belize (Figure 8) is
581 decentralized (Ostrom 1990 and 2010, Dietz 2003, Bardhan 2005, Chuenpagdee and Jentoft
582 2018) because the Belize Fisheries Department, a centralized governing body, has the final
583 decision-making power, but the implementation of those decisions are done at the local,
584 community-level, where each MA area is represented by its own committee. These MA
585 committees consist of representatives from many of the sectors described in section 4.1. The
586 basis for the MA program was to pair marine reserves with the territorial user rights for fishing
587 (TURF) areas, so each of the eight MA areas has a marine reserve paired with it. As such, each

588 area is [co-]managed by a government and/or NGO agency (Belize Fisheries Department 2015
589 and 2019).

590

591 Because MA implementation was driven by a partnership between the Environmental Defense
592 Fund (EDF) and the Belize Government, there are representatives from EDF and BFD on the
593 Managed Access Technical Team (MATT). From 2014-2017 the MATT was an extension of the
594 BFD and was responsible for implementing MA on a national level. Members of the MATT
595 provided leadership, advice, and knowledge to those on the Managed Access Working Group
596 (MAWG). The MAWG consists of the members of the MATT, but also the leadership
597 (Executive Directors) of the co-manager NGOs, representatives from the Forest Department,
598 individuals from the fisher communities, and academic partners. The role of the MAWG was to
599 develop, implement, and oversee Managed Access (Belize Fisheries Department 2019). From
600 2013-15, the MAWG and BFD underwent an extensive consultation process with key
601 stakeholders of the fishing industry to develop the framework and plan for MA implementation
602 nationwide. The MAWG provides a link between each MA area and the BFD by providing
603 information transfer, and resources for enforcement, licensing and logbook reporting (source:
604 key informant interviews). The governance of each of the eight MA areas (excluding Area 9:
605 deep water) involves diverse stakeholder groups (Figure 8). The primary management institution
606 for each MA area is the MA Committees, which consist of elected persons from the fishing
607 communities, and representatives from the BFD and co-managers. The purpose of the MA
608 Committees is to provide community leadership, scrutinize license applications, improve
609 transparency in the license granting process, inform their communities about program updates,

610 and assist with improved data collection/reporting (Foley 2012, Belize Fisheries Department
611 2015 and 2019).

612

613 Area 1 is co-managed by the Sarteneja Alliance for Conservation and Development (SACD), the
614 Forest Department, and the BFD. SACD collaborates with the Forest Department to manage the
615 Corozal Bay Wildlife Sanctuary. Area 1 encompasses these three marine reserves, which are all
616 managed by the BFD: Bacalar Chico, Hol Chan and Caye Caulker. The fisher communities who
617 mostly use Area 1 are Sarteneja, Chunox, Copper Bank, Caye Caulker, and San Pedro. Area 2 is
618 managed by the BFD and is the only MA area that does not consist of a marine reserve. The
619 fishing communities who mostly use Area 2 are the same as Area 1, but may also include Belize
620 City. Area 3 is co-managed by the Southern Environmental Association (SEA), the Forest
621 Department and the BFD. SEA manages the Gladden Spit and Silk Cayes Marine Reserve and
622 works with the Forest Department to manage the Laughing Bird Caye National Park. BFD
623 manages South Water Caye, and the parts of Area 3 that are not managed by SEA or the Forest
624 Department. The fishers that mostly use Area 3 come from these communities: Dangriga,
625 Hopkins, Riversdale, Seine Bight, Independence, Placencia, and Monkey River.

626

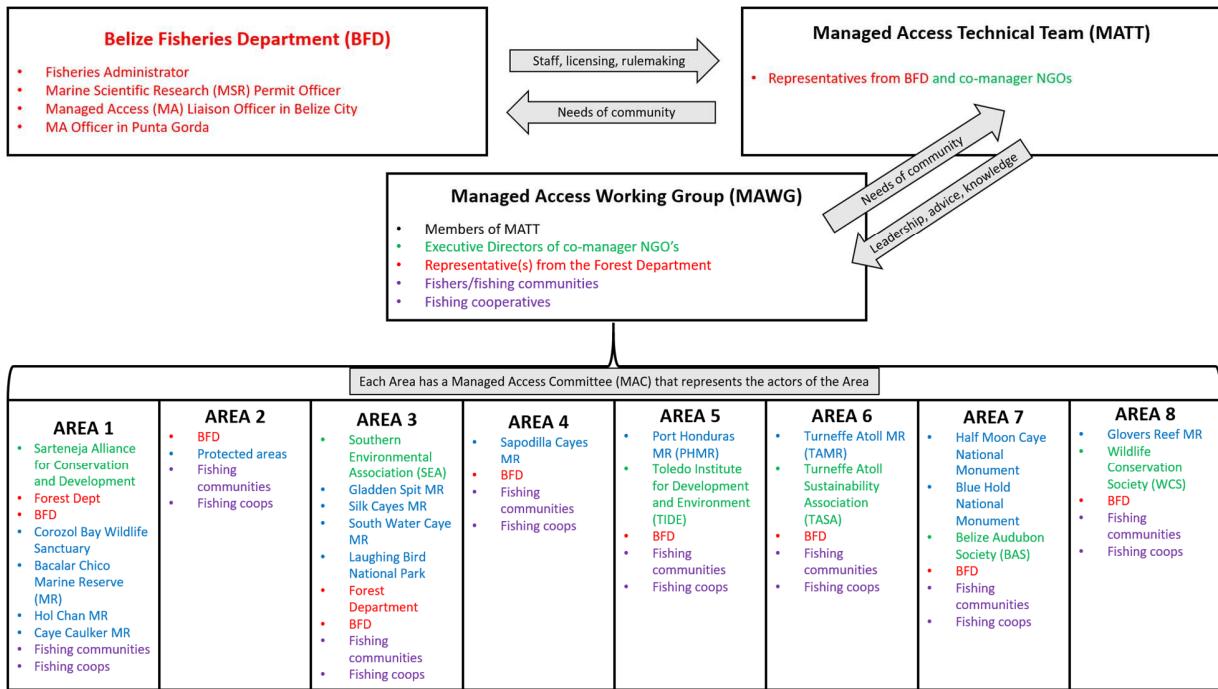
627 Area 4 includes the Sapodilla Cayes Marine Reserve, which is managed by the BFD. The fisher
628 communities that mostly use Area 4 are from Monkey River, Punta Negra, Punta Gorda, and
629 Barranco. Area 5 is the entirety of the Port Honduras Marine Reserve (PHMR), which is
630 managed by the Toledo Institute for Development and Environment (TIDE). TIDE works closely
631 with the BFD to issue licenses to fishers and to improve enforcement of the area. There are
632 general use areas of the marine reserve where fishing is allowed, but also conservation and

633 replenishment zones, where fishing is restricted. The fishing communities who mostly use Area
634 5 are Monkey River, Punta Negra, Punta Gorda and Barranco. Like Area 5, Area 6 is also a
635 marine reserve. Area 6 is the Turneffe Atoll Marine Reserve (TAMR), which is co-managed by
636 the Turneffe Atoll Sustainability Association (TASA). The fishing communities who mostly use
637 Area 6 are Belize City, Chunox, Caye Caulker, San Pedro.

638

639 Area 7 comprises the Lighthouse Reef Atoll, which is home to the Half Moon Caye and Blue
640 Hole National Monuments. These sites are co-managed by the Belize Audubon Society (BAS0
641 and the BFD. The fishers who mostly use Area 7 are from these communities: Belize City,
642 Chunox, Caye Caulker, San Pedro, Copper Bank and Sarteneja. Area 8 is the Glover's Reef
643 Marine Reserve (GRMR), which is co-managed by the Wildlife Conservation Society (WCS).
644 The fisher communities who mostly use Area 8 are from Dangriga, Riversdale, Hopkins, Seine
645 Bight, Placencia, and Independence. Area 9 is the only area that does not have a formal Managed
646 Access Committee, and is where all fishers are allowed to fish. Area 9 is mostly deep slope
647 fishing, which is very gear- and resource-intensive, so not many fishers go there. It is, however,
648 being explored as a new fishery option (Belize Fisheries Department 2019).

649



650

651

652 **Figure 8:** Depiction of the institutions (and individuals) involved in the co-management of the
 653 Managed Access program in Belize. Red indicates the governmental sector. Blue represents
 654 marine reserves and/or protected areas. Green represents the NGO sector. Purple represents the
 655 fishers' sector. Arrows indicate the roles and information transfer between the levels. Sources:
 656 key informant interviews, participant observations and review of secondary data.

657

658 In summary, the enforcement and monitoring of the Managed Access program in Belize is highly
 659 decentralized (Ostrom 1990, Dietz 2003, Bardhan 2005, Chuenpagdee and Jentoft 2018). This
 660 structure has implications for how decisions are made and implemented from the national levels
 661 down to the individual fisher communities. The presence of fishers, NGO leaders, and
 662 governmental representatives on each MA committee provides for improved information transfer

663 and implementation between the local and national levels. Furthermore, having each MA area
664 overseen by a committee enables for more equitable representation of the users of each area.

665

666 **4.3 Ostrom's eight design principles for long-enduring common-pool resource systems**

667 **applied to Belize's Managed Access program**

668 The results in this section suggest that fisheries management in Belize exhibits all eight of
669 Ostrom's design principles for long-enduring CPRs (Ostrom 1990, Table 1), but some are more
670 established than others. This leads to an imbalance of governing power and areas of
671 improvement for the program in the long run. For instance, the MA fishing areas within Belize's
672 exclusive economic zone (EEZ) represent the clearly defined boundaries of the resource system
673 (Foley 2012, Fujita et al. 2017, Belize Fisheries Department 2015 and 2019), for which the
674 provisioning rules of the actors apply. MA committees not only connect the local conditions to
675 provisioning rules but they also give collective-choice arrangements to the fishers because they
676 are platforms for fishers to represent the interests of their communities to natural resource
677 managers (Belize Fisheries Department 2015, 2019 and key informant interviews). The local
678 community-based NGOs as co-managers of marine reserves provide further connection between
679 the local context and provisioning rule development at the national level (Belize Fisheries
680 Department 2015, 2019 and key informant interviews). The NGOs, in collaboration with the
681 BFD, do the majority of the monitoring and enforcement of the resource system, which takes the
682 responsibility of monitoring away from the users (fishers). However, fishers are quite aware of
683 transboundary and non-licensed users in their area, leading to a potential increase in fisher-led
684 monitoring efforts in the future. Many fishers expressed interest to me in learning more from co-

685 managers about what they can do to help with the enforcement efforts (sources: key informant
686 interviews and participant observation).

687

688 If users are found breaking the provisioning rules, then there are graduated sanctions in place.
689 Currently, the BFD observes a three-strike rule; first a verbal warning, second a written warning,
690 and third is arrest (Catzim and Walker 2013, Belize Fisheries Department 2015, 2019, key
691 informant interviews). However, the new Fisheries Resource Bill is much stricter and involves a
692 multi-step process for citing infractions, providing evidence, charging, and then serving time in
693 jail (Belize Fisheries Department 2019, key informant interviews). If a fisher receives an
694 infraction, the MA committee may decide to deny them their commercial license in the following
695 year (Belize Fisheries Department 2015, 2019, key informant interviews). This is a particularly
696 important part of the devolution of power from the national to local level, where representative
697 fishers from the fishing communities are involved in the vetting and licensing process each year.
698 It also offers room for continued input and empowerment of fishers and their communities
699 during the implementation of the Fisheries Resource Bill.

700

701 To resolve any conflicts that arise between resource user groups, certain mechanisms are in
702 place, including fisher forums and outreach to fishers by co-managers. A majority of the
703 conflicts that arise between users involves competing for access to fishing grounds,
704 disagreements between fishers and managers, and conflicts between Belizean and transboundary
705 fishers. Especially in southern Belize, non-licensed, non-Belizean fishers are accessing fisheries
706 resources often at night, which causes great conflict among fishers who abide by the
707 management rules (source: semi-structured interviews). Through my participant observation at

708 several fisher forums, mechanisms to solve conflicts occur at least once a year between all
709 marine stakeholders of the eight MA areas, and offer a place of information-sharing. However,
710 not all fishers are in attendance, very few have the opportunity to speak, the few who do are
711 occasionally cut short, and they do not prefer to be shown graphs of data from the co-managers.
712 In Belize, there is minimal recognition of rights to organize as the government recognizes and
713 does not challenge the rights of the users to self-organize by way of active fishers' organizations,
714 the BFF, and cooperatives (Belize Fisheries Department 2019, key informant interviews,
715 participant observation).

716

717 The final design principle for long-enduring CPRs that Belize fisheries management exhibits is
718 nested enterprises (Ostrom 1990, Table 1). Excellent examples of nested institutions can be
719 found in Figure 4 and 8, where Figure 4 depicts each governmental agency nested within a
720 Ministry, and Figure 8 demonstrates that the governance of each MA area is nested within the
721 Managed Access Working Group, the Managed Access Technical Team, and all overseen by the
722 Belize Fisheries Department. Furthermore, in the near future, a Fisheries Council will be formed,
723 consisting of representatives from the government, tourism, fisheries and NGO sectors, an expert
724 in fisheries science, and the Fisheries Administrator. These entities will be nested under the
725 umbrella of the Fisheries Council, which will be an established advisory body to make
726 recommendations to the Minister of Agriculture, Fisheries, Forestry, the Environment and
727 Sustainable Development (Belize Fisheries Department 2019).

728

729 Table 1: Ostrom's design principles for long-enduring CPRs applied to Belize's marine resource
730 governance context

Design Principle	Belize Context	Source(s)
1 Clearly defined boundaries	Belize's exclusive economic zone (EEZ) and the eight distinct MA areas where commercial fishers are granted access/ownership rights.	Foley et al. 2012, Fujita et al. 2017, Belize Fisheries Department 2015 & 2019
2 Connection between local conditions and provisioning rules	The existence of MA committees, where fishers can serve and represent the interests of their communities. Local, community-based NGOs are co-managers of marine reserves. Fishers organizations and BFF represent the interests of fishers on local and national scales.	Belize Fisheries Department 2015 & 2019, key informant interviews
3 Collective-choice arrangements	Fishers serving on MA committees can provide input about who gets MA license in subsequent years. Fishers also consulted during the development of MA and rewriting of the Fisheries Resource Bill. However, BFD has final say about how the resource units get accessed and used.	Belize Fisheries Department 2015 & 2019, key informant interviews
4 Monitoring of resource system by users	Majority of the monitoring and enforcement are done by Fisheries Officers at BFD and NGOs. But, fishers are pretty aware of transboundary fishers/notice a non-licensed user in their area. Potential for fishers to increase monitoring of areas in future.	Belize Fisheries Department 2015 & 2019, participant observation
5 Graduated sanctions	Currently, there is a 3-strike rule by BFD (first is a verbal warning, second is a written warning, and third is an arrest). However, the Fisheries Resource Bill is much stricter (infractions, evidence, being charged, possible jail time). If a fisher has an infraction, they may not be able to get commercial license next year (as decided by MA committee)	Belize Fisheries Department 2015 & 2019, key informant interviews
6 Conflict-resolution mechanisms	Fisher forums, which occur at least once a year between all marine stakeholders of each MA area, offer a place for information sharing between co-managers and fishers. However, from my participant observation, not all fishers attend, only a few vocal fishers voice concerns, sometimes fishers don't have enough time to speak, and they don't like seeing graphs/data.	Belize Fisheries Department 2015 & 2019, participant observation
7 Minimal recognition of rights to organize	Government recognizes active fishers' organizations, BFF and cooperatives and does not challenge the rights of the users to make their own institutions.	Belize Fisheries Department 2015 & 2019, participant observation, key

		informant interviews
8 Nested enterprises	Figure 8 depicts highly nested enterprises involved in governing the MA program. Fishers from local communities are often represented by fishers' associations, which advocate for them at regional and national levels. NGOs are local to villages and regions, but often serve on national committees. Included in the 2019 Fisheries Resource Bill is the development of a Fisheries Council, which will be an advisory body consisting of individuals representing the governmental, tourism, fisheries and NGO sectors, as well as someone with expertise in fisheries science and the Fisheries Administrator.	Belize Fisheries Department 2015 & 2019, participant observation, key informant interviews

731

732 In summary, fisheries management in Belize demonstrates all eight components of a long-
 733 enduring CPR system, as defined by Ostrom (Ostrom 1990), suggesting the actors have the
 734 potential to overcome collective action problems in the long run. There are (1) clearly defined
 735 boundaries of the resource system, (2) a connection between local conditions and provisioning
 736 rules, (3) collective-choice arrangements by the fishers on MA committees, (4) monitoring of the
 737 resource system by the users, (5) graduated sanctions in place for rule infractions, (6) conflict-
 738 resolution mechanisms, (7) minimal recognition of rights to organize by the government, and (8)
 739 nested enterprises (Ostrom 1990, Table 1). While the MA program in Belize is less than a
 740 decade-old in action, the presence of all eight CPR design principles suggests it will be a
 741 sustainable program well into the future.

742

743 **5. Discussion**

744 **5.1 Belize's Fisheries Management Policies Demonstrate Institutional Robustness**
 745 Through extensive review of primary and secondary literature, semi-structured interviews with
 746 key informants, and participant observation, this study examines the institutional robustness of

747 Belize's fisheries management strategies. Applying Ostrom's design principles for long-enduring
748 CPRs to the context in Belize provides a method of comparison among other common-pool
749 resource systems. The results of this study indicate that fisheries institutions are robust and
750 resilient to future shocks due to their polycentric, decentralized, and nested governance structure
751 (Chuenpagdee and Jentoft 2018). For example, fisheries management in Belize demonstrates
752 polycentric governance because the governmental, NGO, tourism, fishers, and academic sectors
753 each represent the many centers of decision-making that often function independently of one
754 another (Ostrom et al. 1961, Ostrom 2010). In the case of Belize, these various sectors each play
755 an important role in the monitoring, decision-making, enforcement and provisioning rules in the
756 common pool resource system (Ostrom 2010). Polycentric fisheries governance has been found
757 to overcome several limitations found in other systems because it promotes broad levels of
758 stakeholder engagement, increases policy freedom at local levels and ensures governance
759 responses are implemented at appropriate scales (Cvitanovic et al. 2018).

760

761 However, the institutions involved in fisheries management in Belize also function in a
762 decentralized way because the decision-making power is distributed to those at the local
763 community level (Ostrom 1990, Dietz 2003, Bardhan 2005). For example, TIDE co-manages the
764 Port Honduras Marine Reserve in southern Belize by working closely with fishers from several
765 communities (Punta Gorda, Punta Negra, Monkey River, and Barranco). As an institution, TIDE
766 builds trust with the fishers while also communicating their needs to the Belize Fisheries
767 Department. Decentralization has been found to be a very effective tool in effective governance
768 of natural resources because it takes the strain off of centralized forms of governance while

769 granting the decision-making power to the users of the system (Ostrom 1990, Dietz 2003,
770 Bardhan 2005, Wright et al. 2016).

771
772 Further contributing to institutional robustness is the nested nature of several key institutions
773 involved in fisheries management in Belize (McCabe and Feiock 2005b, Ostrom et al. 2010).
774 Like previously described, each government agency is nested within a Ministry, which oversees
775 multiple agencies with similar objectives and provides for linkages between such agencies. The
776 fishers' sector is another nested enterprise, where individual fishers can be represented by fishers
777 associations local to their community, and then several fishers associations are a part of the
778 Belize Federation of Fishers (BFF), which represents fishers at the national level. This nesting
779 can lead to improved stability in the face of global change and ongoing stresses (Chuenpagdee
780 and Jentoft 2018). Therefore, if polycentric, decentralized and nested governance structure exists
781 in fisheries management institutions, as it does in Belize, then we may expect institutional
782 robustness and resilience to shocks in the future (Chuenpagdee and Jentoft 2018).

783

784 **5.2 Belize has the Potential to be a Long-Enduring Common Pool Resource System**

785 This study demonstrates that Belize contains the necessary institutions in place to become a
786 long-enduring CPR system and potentially overcome obstacles to collective action. While
787 fisheries management policies in Belize represent all eight of Ostrom's design principles for
788 long-enduring CPRs (Ostrom 1990), these three components could be improved upon to achieve
789 further institutional stability: the monitoring of the resource system by the users, conflict-
790 resolution mechanisms, and minimal recognition of rights to organize. This could be because

791 more time is needed to fully implement these components of community-based management in
792 Belize.

793

794 For example, in a comparison of Hawaii's community-based subsistence fisheries area
795 legislation to that of American Samoa, the program in American Samoa comprised more of the
796 design principles, primarily due to the successful implementation of its program (Levine and
797 Richmond 2015). The Hawaii program has the potential to consist of the common-pool resource
798 design principles, but only if effective institutions are in place (Levine and Richmond 2015). My
799 study demonstrates that Belize has a variety of institutions and a diverse governance structure to
800 ensure the design principles endure in the long-term. In two additional co-managed fisheries, one
801 in Kenya and one in Madagascar, Cinner et al. (2009) found their systems to also be lacking
802 several design principles to overcome CPR problems. Monitoring of resources and surveillance
803 were two of the missing components of these co-management regimes, while clearly defined
804 geographic boundaries, collective choice arrangements, graduated sanctions and nested
805 enterprises were partially implemented (Cinner et al. 2009). Like in Belize, monitoring and
806 surveillance were two components in Kenya and Madagascar co-managed fisheries needing
807 improvement, demonstrating the challenge of encouraging users to become more involved in the
808 monitoring and surveillance of the resource system. This study provides a jumping-off point for
809 future analysis of fisheries institutions in Belize and a basis of comparison for other common-
810 pool resource systems globally.

811

812 **5.3 Fisher Associations are Mechanisms for Collective Action**

813 The fishers' associations in Belize and other small-scale fisheries contexts are platforms for
814 fishers to engage in collective action. They are self-organizing, where several motivated
815 individuals recognize a need for increased representation at the local, community-level (Ostrom
816 2003). Because Belize has a wide range of fishers' associations, ranging geographically across
817 the country, the likelihood of fisher representation at local levels is much higher than if there
818 were very few associations (Partelow et al. 2020). However, not all commercial fishers are
819 members of fisher associations, leading to discrepancies in equity, inclusivity, and representation
820 across geographic scales. Therefore, some voices are lost while others are amplified. The
821 inequitable representation of fishers by fisher associations can also lead to corruption (Hanich
822 and Tsamenyi 2009, Cross 2016, Nunan et al. 2018) and biases in the decision-making processes
823 (Semitiel-García and Noguera-Méndez 2019).

824

825 The self-organization of resource users into associations has the potential for individuals to build
826 social capital and facilitate cross-level governance (Brondizio et al. 2009). Fisher associations
827 can provide a platform for individual fishers to build trust within their communities and advocate
828 for themselves at the national level, particularly with the NGO and governmental sectors. Fisher
829 associations and cooperatives offer benefits to members that otherwise would not be available to
830 non-group members (Uchida 2017). In a freshwater fishery in the Amazon, fishers identified a
831 need for regulating their fisheries when the state failed to provide them with effective institutions
832 to do so. Over time, this decentralized, community-based management led to protection of
833 freshwater fish populations and stabilized livelihoods (Pinho et al. 2012). Similarly, in the
834 Scotia-Fundy region of coastal Canada, fishers became more involved in the management and
835 monitoring of marine resources by participating in fisher's association (Wiber et al. 2004).

836

837 Furthermore, inland fishers in Bangladesh who participated in a community-based fisheries
838 management (CBFM) regime had greater access to fisheries resources and improved livelihoods
839 compared to non-CBFM participating fishers (Islam and Yew 2013), demonstrating the
840 livelihood benefits of participatory fisheries management. In small-scale fisheries contexts where
841 fisher associations are lacking, but that have horizontal and vertical linkages held by community-
842 based organizations, as was the case in Jamaican marine reserves, collective action may not be
843 sustained well into the future (Alexander et al. 2015). Belize's Managed Access program offers a
844 potential solution to collective action problems because of the rights-based nature of the
845 program, which gives access and governance rights to the users of the system (Viana et al. 2018,
846 Barner et al. 2015, Catzim and Walker 2013).

847

848 **5.4 Complexity in Information Transfer and Collaboration between Institutions**

849 However promising Ostrom's CPR design principles are in Belize, there is incredible complexity
850 in information transfer and collaboration between institutions, which has implications on
851 management, economy, environment, and institutional stability. Often, different sectors work
852 together and act as nested enterprises (McCabe and Feiock 2005b, Ostrom et al. 2010). One
853 example of that is the Nature Conservancy working closely with ResCa (both NGOs) to improve
854 the seafood market traceability of the fishers who sell their product at the National Fishermen
855 Cooperative. They are maximizing on the economic incentive of fishers to accurately report their
856 catch. Through this, they are making up for shortcomings in the logbook reporting process by the
857 Belize Fisheries Department. This is an example of smaller scale institutions (the NGOs and
858 cooperatives) filling the gaps that exist in the government's capacity to accurately conduct stock

859 assessments. It is therefore imperative for policymakers to receive accurate numbers of catch per
860 unit effort by fishers so they may set feasible and data-driven catch limits (Schiermeir 2002,
861 Reddy et al. 2013, Carruthers et al. 2014).

862

863 The membership of the Belize Federation of Fishers (BFF) is another example of complex
864 institutional cross-over and information transfer. Those who serve on the leadership board of
865 BFF are also in positions of power in the fisher associations and serve on the MA committees.
866 They are therefore in charge of deciding who gets commercial licenses for their areas and are
867 involved in advocating for their communities on a national level. By nature of this design, there
868 is exclusion from the benefits of BFF organization. Fishers who are not members of fisher
869 associations and fisher associations not members of BFF are excluded from the advocacy
870 benefits provided by BFF. Furthermore, there are certain costs and benefits to having the same
871 individuals serving on BFF for multiple years. Having the same individuals involved provides
872 the benefits of improved information transfer, maintained trust, and not many changes in the
873 structure, e.g., shocks (Wiber et al. 2004, Foley 2012, Wade et al. 2019). On the other hand,
874 having the same individuals in these positions excludes others from the chance of being
875 involved, therefore leading to uneven representation, exclusion, and missing voices (Bodwitch
876 2017). It could also increase the likelihood of corruption and biases in decision-making, as the
877 same individuals making the decisions could be advancing their own agenda(s) rather than
878 advancing the needs of the collective “group” they represent (Hanich and Tsamenyi 2009, Cross
879 2016, Nunan et al. 2018, Semitiel-García and Noguera-Méndez 2019).

880

881 There is also a connection between fishers, the tourism industry, and the government, because
882 many fishers, particularly those in southern Belize, are also tour guides. By becoming tour
883 guides, fishers become stewards of their local environment, sharing their knowledge of the
884 marine system with others (Bennett et al. 2018). However, such opportunities are highly
885 location-specific and not available for all commercial fishers across Belize. This discrepancy
886 leads to conflict among fishers in the same or neighboring communities (sources: key informant
887 interviews, participant observation). Furthermore, to work as tour guides, fishers must attend
888 training sessions and receive their license from the Belize Tourism Board (BTB) and the Belize
889 Tourism Industry Association (BTIA). The license and training are also pretty costly, and require
890 annual fees to be renewed. These policies demonstrate the integration between the governmental,
891 tourism and fisheries sectors, but also that becoming a fisher-tour guide has its own slew of
892 complexities in policies and agency.

893

894 **6. Conclusion**

895 This case study demonstrates that over 40 years, Belize has developed polycentric, decentralized
896 and nested institutions to sustainably manage its fisheries and coastal resources. This variety in
897 governance structure can potentially lead to Belize overcoming the collective action problems
898 associated with its fisheries being a common pool resource system (Olson 1965, Ostrom 1990,
899 Ostrom et al. 1999, Ostrom 2003, Levine and Richmond 2015). The partnerships across scale
900 between local NGOs, fishers' associations, and the federal government are examples of cross-
901 scale linkages that contribute to overall institutional stability, robustness, and improved
902 information transfer across scale (Cudney-Bueno and Basurto 2009, Chuenpagdee and Jentoft

903 2018). All actors of this resource system are encouraged to engage in collective action to reach
904 shared sustainability goals (Urquhart et al. 2014, Valdés-Pizzini et al. 2012).

905

906 An additional challenge to sustainable fisheries management in Belize is implementing the new
907 Fisheries Resource Bill amid the ongoing COVID-19 pandemic. The pandemic led to small-scale
908 coastal fisheries adapting to the market disruptions, increased health risk of fishers, processors,
909 and communities, and exacerbated vulnerabilities to other stressors (Bennett et al. 2020).

910 Because fisheries management in Belize is already institutionally robust, I am confident resource
911 users and managers are continuing to collaborate to meet shared sustainability and livelihood
912 outcomes. However, projecting into the future, the successful implementation of the Fisheries
913 Resource Bill will require long-term buy-in by the fisherfolk and improved inclusion of them in
914 the management processes. I suggest that the new bill should be implemented by maximizing the
915 existing institutional structure, drawing upon the strengths of the local NGOs, enhanced
916 participation by the fishers, and in valuing interagency partnerships. The Fisheries Council will
917 ensure that a variety of voices across institutional and geographic scales will be heard during the
918 adaptive management process (Belize Fisheries Department 2019). While Belize is not unique in
919 its evolving natural resource management policies, it can become a global leader in sustainable
920 fisheries.

921

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944

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1. PROBLEM: Fisheries management requires effective institutions to overcome common-pool resource problems, promote sustainability and inspire collective action

2. PURPOSE: Examine institutional robustness (e.g. presence of nested & decentralized enterprises as indicators of shock resilience) of over 40+ years of fisheries management in Belize

3. APPROACH: Use mixed-methods approach combining review of secondary literature, semi-structured interviews with key informants across governmental, non-governmental, and fishers' sectors, and participant observation

4. RESULTS: Fisheries management implementation and enforcement in Belize is polycentric, nested and decentralized. Fisher Associations are tools for collective action.

5. IMPLICATIONS: Belize has institutions in place to overcome collective action problems and be a long-enduring common-pool resource system.