

1 **Title: Challenging gender inequity in wildlife conservation: A women’s group leading sea**
2 **turtle conservation efforts in El Salvador**

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45 **Author Contributions**

46 L. Massey and P. McCord Camerden designed the interviews and conducted the fieldwork
47 portion of this research as part of a graduate program at the Scripps Institution of Oceanography
48 at the University of California, San Diego (UCSD), and coauthored a Capstone Project Report
49 that is on file with UCSD. A. Ahern helped coordinate and conduct all qualitative interviews in
50 the field and assisted with translation and logistics. A. Gaos, J. Seminoff, and A. Ahern
51 participated on L. Massey and P. McCord Camerden’s Capstone Project Committee and
52 provided writing support for the Capstone Project Report. M. Liles provided expert advice on sea
53 turtle research in El Salvador and project development support. L. Massey performed the data
54 analysis and drafted the final manuscript. All coauthors contributed to editing the final
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56

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66

67 **Ethics Approval**

68 This research (Project #170820) was reviewed by the Director of the University of San Diego
69 (UCSD) Human Research Protection Program, Institutional Review Board (IRB) Chair, or IRB
70 Chair's designee and is certified as not qualifying as human subjects research according to the
71 Code of Federal Regulations, Title 45, part 46 and UCSD Standard Operating Policies and
72 Procedures; and therefore, does not require IRB review. The lead author can provide the
73 documentation with this determination upon request.

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77
78 **ABSTRACT**

79 Effective management of natural resources often requires diverse strategies implemented by a
80 variety of conservation practitioners. Despite stark gender inequality challenges in many regions
81 of the world, women can and do play a fundamental role in conservation initiatives in rural and
82 other communities. However, examples of women’s involvement in conservation initiatives,
83 notably in Latin America, are limited in the literature. We conducted interview-based research to
84 learn more about the role that a women-led group named the Asociación de Desarrollo Comunal
85 de Mujeres de la Barra de Santiago (AMBAS)—plays in sea turtle and other conservation
86 initiatives in an artisanal fishing community in rural El Salvador. We identified four major
87 themes from interview and survey responses (1. gender challenges; 2. interest in helping the
88 environment; 3. local ecological knowledge; 4. community perceptions) that underscore the
89 value of incorporating women’s ecological knowledge into conservation efforts while also
90 drawing attention to the continued challenges that women face in environmental decision
91 making. These data also suggest that conservation strategies that provide both environmental *and*
92 economic benefits can inspire conservation commitment, regardless of whether they are led by
93 men or women. This study contributes to the nascent dataset of examples highlighting the
94 essential roles of women in conservation, and reinforces the notion that multi-gender
95 participation is essential to maximize positive impact in conservation and wildlife recovery.

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Key Words: conservation, sea turtles, women, hatchery, gender inequality, local ecological
knowledge, El Salvador

100 **1. INTRODUCTION**

101 Conservation initiatives to protect biodiversity and natural resources are predominantly
102 led and controlled by men (e.g. Flintan 2003; Watson 2005; Schneider 2013; Taylor 2014; James
103 et al. 2021). This is in large part due to social norms and expectations that limit opportunities for
104 women beyond traditional domestic duties, including the responsibility to care for the household
105 (Levy et al. 2015; Kibria 2016; World Bank 2021). However, women often have unique
106 knowledge about natural resources, as they use, interact with, and understand the environment
107 differently than men (Zwiefel 1997; Razafindratsima and Dunham, 2015; Farnworth et al. 2016;
108 James et al. 2021). There is growing evidence demonstrating positive conservation outcomes
109 when women are integrated into environmental resource management, particularly in forests and
110 fisheries (e.g. Byers and Sainju, 1994; Argarwal 1997; Westermann et. al. 2005; Kusters et al.
111 2006; Argarwal 2009; Leisher et al. 2016). Despite this, women’s leadership and involvement in
112 conservation and natural resource management remains limited and continues to face social and
113 cultural challenges. In rural, low-income areas, women’s interests are often underrepresented due
114 to their limited access to land rights, lack of formal education, and exclusion from decision-
115 making processes (Davidson 1993; Badola and Hussain 2003; Deda and Rubian 2004; Kameri-
116 Mbote 2007; Sodhi 2010; SOFA Team and C. Doss 2011), which ultimately leads to a gender
117 gap in natural resource governance. This is notably true in Latin America (UN ECLAC 2021),
118 with limited examples in the literature highlighting the essential role of women in conservation
119 and natural resource management (e.g. Kleiber et al. 2015; Torre et al. 2019; Solano et al. 2021).

120 El Salvador is a low-income country (Lanjouw 2001, USAID 2010) and despite
121 particularly stark gender inequalities in rural parts of the country, women play a critical social
122 role—through ensuring food security for their households—as well as an environmental
123 stewardship role via engaging in conservation and natural resource management efforts. During

124 the country's 12-year civil war from 1980 to 1992, many families were forced to migrate from
125 the highlands to coastal areas, which led to heavy exploitation of marine resources (Gammage et
126 al. 2002). Most rural residents in El Salvador continue to depend on natural resource extraction
127 for their livelihoods (Hutton and Leader-Williams 2003). This includes the illegal collection of
128 sea turtle eggs for sale and consumption, a practice that continues to be rife in the country.
129 Nonetheless, prompted by the recent discovery that the country hosts important nesting beaches
130 for the critically endangered hawksbill sea turtle (*Eretmochelys imbricata*) population in the
131 eastern Pacific Ocean (Vásquez and Liles 2008; Gaos et al. 2010, 2017; Liles et al. 2011), efforts
132 to reduce egg exploitation have gained substantial national and international attention. In
133 addition to hawksbills, three other sea turtle species nest along the coast of El Salvador,
134 including green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and olive ridley
135 (*Lepidochelys olivacea*) turtles (Vasquez et al. 2008). All are locally threatened by human
136 consumption of eggs, coastal development, and harmful fishing practices (Liles et al. 2011). The
137 existing national conservation framework for sea turtles focuses largely on the protection of
138 eggs, and includes a network of sea turtle hatcheries operated by numerous local non-profit
139 organisations. These efforts depend primarily on financial resources used to incentivize
140 *tortugeros* (i.e. sea turtle egg collectors) to bring eggs to hatcheries, where they are protected
141 throughout incubation until hatchlings emerge and are released to the sea (Liles et al. 2016).

142 Representing a rare exception to the predominance of gender inequalities in El Salvador,
143 a women-led organisation called the Asociación de Desarrollo Comunal de Mujeres de la Barra
144 de Santiago (AMBAS; the Association of Community Development of Women in Barra de
145 Santiago, in English), has successfully led a variety conservation efforts in the country. The
146 organisation was founded in 1999 and has approximately 35 active members. Indeed, one of

147 AMBAS's most well-known conservation initiatives is the operation of a seasonal sea turtle
148 hatchery, which is highly relevant to El Salvador's national conservation priorities.

149 Sea turtle hatcheries were heavily promoted following the 2009 sea turtle egg ban on the
150 consumption, sale, and possession of sea turtles, their eggs, and their parts for purposes other
151 than conservation. This complete ban, instituted by El Salvador's environmental management
152 authority, the Ministerio de Medio Ambiente y Recursos Naturales (MARN, the Ministry of the
153 Environment and Natural Resources, in English), only allows eggs to be sold to hatcheries as an
154 economic incentive to discourage illegal trade (República de El Salvador 2009). Prior to the ban,
155 almost 100% of eggs were collected and legally sold for human consumption (Vasquez et al.
156 2008). There is global precedent for providing financial incentives for sea turtle protection such
157 as purchasing eggs from collectors (Campbell et al. 2007; Ferraro and Gjertsen 2009; Madrigal-
158 Ballesterero and Jurado 2017). Although many countries have laws in place to protect nesting
159 beaches, most low-income countries lack resources for adequate enforcement (Ferraro 2007),
160 and illegal take and black market sale still occur. Financially-incentivized programs, such as
161 payment for sea turtle eggs can reduce illegal egg collection (Ferraro and Gjertsen 2009) and
162 potentially help with poverty reduction (Pagiola et al. 2005).

163 In this study we sought to gain insights into the role, perceptions, and ambitions of
164 AMBAS members, as well as other community stakeholders, in an effort to better understand the
165 conservation successes of this women-led organization. To do so, we conducted a series of
166 interviews and surveys, including semi- and unstructured interviews. We analyzed and
167 categorized interview responses to evaluate primary themes prompting success of the group and
168 identified challenges moving forward. Our research represents one of the first efforts to evaluate
169 the role of women in sea turtle conservation in El Salvador and Central America.

170 **2. MATERIALS AND METHODS**

171 **2.1 Study site.** Barra de Santiago is a small artisanal fishing community (approximately
172 2,500 residents) located in the department of Ahuachapán along the Pacific coast of southwest El
173 Salvador, near (~ 12.8 kilometers) the border of Guatemala (Figure 1). The entire community is
174 located on a peninsular sand bar that divides the Barra de Santiago estuary and mangrove forest
175 habitat to the north from the Pacific Ocean to the south. The surrounding mangrove forest
176 (11,519 hectares) is considered the largest in El Salvador’s western region (MARN 2016) and
177 supports approximately 75% of the commercially important faunal species present in El Salvador
178 (Ramsar Convention on Wetlands 2015). The mangrove forest habitat was designated as a
179 Natural Protected Area by MARN in 2007 and a Wetland of International Importance by the
180 Ramsar Convention in 2014 (MARN 2016).

181 **2.2 Interview Design.** We conducted our investigation in two phases. In the first phase,
182 we conducted 11 semi-structured interviews (Gill et al. 2008; Merriam 2009; Jamshed, 2014)
183 with seven AMBAS members and four *tortugueros*. The purpose of the first-phase interviews
184 was to help the research team get to know the community members and learn how to best design
185 the subsequent surveys (i.e. paper/pencil questionnaires) that would be distributed to a larger
186 sample size of AMBAS members (Merriam, 2009). Based on our analysis of the interview
187 responses, we drafted and distributed questionnaires to 17 AMBAS members, which comprises
188 nearly half of the approximated 35-member group. We also conducted two unstructured
189 interviews (Gill et. al. 2008; Merriam 2009; Jamshed 2014), one with a regional park ranger who
190 is considered to be the community leader, and one with a local park ranger to learn general
191 information about Barra de Santiago’s demographics, ecosystems, and natural resource
192 management.

193 **2.3 Interviews.** We interviewed seven AMBAS members who hold various membership
194 roles, including the treasurer, the sea turtle hatchery manager, the founder, and regular
195 participating members. In addition, we interviewed four male fishers who also identify as
196 *tortugeros* in order to gain insight about community perceptions of AMBAS. The interviews
197 consisted of 23 open-ended, conversational questions about basic demographic information (e.g.
198 age, family size, income), information about AMBAS (e.g. activities, community participation,
199 community perceptions), and information and opinions regarding Barra de Santiago’s
200 environment and natural resources (e.g. sea turtles, mangroves, environmental laws, climate
201 change impacts). We included some questions specific to hawksbill sea turtles given their
202 prioritized conservation effort in El Salvador. These open-ended questions were designed to
203 encourage detail-oriented responses from the respondent (Knoblauch 2005). The more personal
204 questions pertaining to the respondent’s home and work life (e.g. their age, the number of family
205 members in their homes, and their main source of income) were asked first to establish trust and
206 build a connection and rapport with each respondent. More challenging questions that dealt with
207 sensitive subjects (e.g. illegal harvest of endangered wildlife or opinions on climate change)
208 were asked towards the end of each interview (Whitehead 2005). Each question was crafted in a
209 way that asked for the respondent’s opinion on the subject at hand (e.g. all questions started with
210 ‘In your opinion...’ or ‘Do you feel...’). Although we followed a list of interview questions, we
211 allowed respondents to digress from the question list and discuss other relevant topics at will.
212 Our aim was to have a meaningful conversation with each respondent and to minimise the
213 impression that this was a formal questionnaire or test (Shackeroff and Campbell 2007). All
214 interviews took place either at the respondent’s home or the AMBAS founder’s home (a
215 common and comfortable meeting spot for AMBAS gatherings and community events) and were

216 audio-recorded from start to finish without pause to preserve the integrity of each session. Either
217 the AMBAS founder or a local wildlife biologist who works with AMBAS was present during
218 all interviews for the respondents' comfort.

219 **2.4 Survey.** We analyzed the results of the interviews by extracting major themes in the
220 responses (Aronson 1995) and used those to restructure the interview question list into a 20-
221 question, close-ended multiple choice/multiple answer questionnaire written in Spanish. The
222 questionnaire included some of the same basic questions regarding demographics (e.g. age,
223 family size) and AMBAS membership information (e.g. reason for joining, program
224 participation), but also revised questions that focused in more detail on the women's knowledge
225 and experience with sea turtles, hatchery operations, and conservation and natural resource
226 challenges. The questionnaires were distributed during a lunch event at the AMBAS founder's
227 home. In cases of illiteracy, the survey was read aloud to the respondent by either a Salvadoran
228 volunteer or a member of our research team, and the respondent answered the questions verbally.
229 The interviewer filled in the responses on the respondent's behalf with their permission.

230 **2.5 Unstructured Interviews.** We conducted two unstructured interviews (Gill et al.
231 2008; Merriam 2009; Jamshed 2014) with no pre-determined list of questions. The first interview
232 was with a MARN local park ranger in Barra de Santiago. This interview took place on the park
233 ranger's patrol boat through the mangroves as he shared his knowledge of the local wildlife and
234 natural resource pressures. The second informal interview was with the lead MARN regional
235 park ranger, who is the community leader of Barra de Santiago, and the AMBAS founder's
236 husband. The regional park ranger was interviewed in multiple instances at his home where he
237 took time to share his knowledge as a life-long resident of Barra de Santiago, the history of his

238 career as a local and regional park ranger, and answer our additional questions. Unstructured
239 interviews were not audio recorded; the information was recorded via pencil and paper.

240 3. RESULTS

241 *3.1 Interview Results.* The 11 interview respondents ranged in age from 28 to 63 years
242 (average = 46 years). From the first-phase interviews, we learned that AMBAS leads two
243 primary conservation programs in Barra de Santiago: a sea turtle hatchery and a mangrove
244 conservation program, both dependent on the availability of funds. In our interview with the
245 AMBAS founder, she explained that apart from sea turtle conservation, they conduct additional
246 activities including capacity building workshops, trash cleanups and mangrove conservation
247 initiatives that restore the natural hydrology of the wetland. When funding is available,
248 participants in these initiatives may receive financial compensation for their time and labor.

249 Four major themes emerged that were common across most interview responses (see list),
250 which we discuss in corresponding sections below. Select representative quotes are presented in
251 Table 1.

252 (1) Over half of the respondents (63%) stated that at first, the community of Barra de
253 Santiago did not support AMBAS, either because they did not think women should be
254 involved in conservation work or they did not see any benefits of their initiatives.

255 (2) Almost all AMBAS respondents (85%) expressed an interest in learning about and/or
256 helping the environment as part of their rationale for joining AMBAS.

257 (3) All respondents (100%) shared knowledge about Barra de Santiago's natural resource
258 and wildlife conservation challenges, including local sea turtles and their threats.

259 (4) Almost all respondents (90%) stated that the AMBAS sea turtle hatchery is viewed
260 positively within the community because it provides local income via sea turtle egg

261 payments. These same respondents also stated that they view the sea turtle hatchery as a
262 long-term solution for reducing egg poaching.

263 **Table 1. Representative Quotes from AMBAS and *Tortuguero* Respondents**

264 (insert table)

265 **Theme (1) Gender Challenges:** When discussing the community's response to AMBAS
266 being led by women, over half of the respondents (63%), including the male fishers/*tortugueros*,
267 indicated that the organization initially lacked support, but that perspective has since shifted.
268 Cultural beliefs that women should be confined to domestic roles and/or a perception that their
269 work did not provide any benefit to the community led to this initial lack of support. The
270 remainder of respondents (36%) reported mixed opinions (both positive and negative) of
271 AMBAS. In general, those respondents explained that those who are involved in AMBAS
272 projects (and receive income benefits) view the organisation positively. One *tortuguero*
273 mentioned that today, some members of the community view AMBAS women negatively (Table
274 1).

275 The AMBAS treasurer explained that her husband left her because he didn't support the
276 work she was doing, and thought she should stay 'in the house making tortillas.' The AMBAS
277 founder explained that there was significant pushback from members' husbands in the early
278 years because they felt women should be performing domestic duties at home, and further noted
279 that most of the current members are single women because so many married women do not
280 have the support of their partners.

281 Two AMBAS members commented on the good reputation of the mangrove conservation
282 program, explaining that residents eagerly await the opportunity to earn money and help restore
283 water flow to the mangrove channels filled in with sediment from river drainage. These and

284 similar statements emphasise the importance of the economic benefits that, in addition to the
285 environment benefits, led for increased support for AMBAS.

286 **Theme (2) Interest in Helping the Environment:** When discussing their reasons for
287 joining AMBAS, almost all members (85% of AMBAS respondents) indicated a desire to help
288 the environment (see Table 1). The one exception was the founder's daughter, who explained
289 that she initially participated in AMBAS activities only because she expected she would need to
290 carry on her mother's legacy. She later explained that she decided to join AMBAS officially after
291 attending an inspiring climate change workshop in Costa Rica, and has since started managing
292 some of AMBAS's activities.

293 **Theme (3) Local Ecological Knowledge:** When discussing Barra de Santiago's
294 challenges around natural resources and endangered wildlife, all respondents (100%), including
295 the *tortugueros*, shared knowledge about local sea turtles and their threats (see Table 1). While
296 most of their experience is with olive ridley sea turtles (i.e. the most common species nesting in
297 the area and the most common eggs brought to the hatchery), many respondents recounted
298 hawksbill sightings and, to a lesser extent, leatherback and green turtle sightings. Both the sea
299 turtle hatchery manager and a *tortuguero* explained that hawksbills are consistently sighted
300 swimming near a local rocky reef. One *tortuguero* recalled a year when he saw a hawksbill turtle
301 came ashore to nest, but since the AMBAS hatchery was not open that particular year, all of the
302 eggs were illegally harvested (Table 1). He further explained that hawksbill turtles commonly
303 forage among the reefs in the nearby town of Los Cóbanos (Figure 1). The sea turtle hatchery
304 manager explained that hawksbill turtles stopped regularly nesting in Barra de Santiago around
305 1995–1996, but since then, local fishers have observed individuals foraging on the route between
306 the Port of Acajutla (Figure 1) and Barra de Santiago (Table 1). The founder's daughter

307 explained that park rangers will often bring stranded or injured hawksbill turtles to her home so
308 that her father (a regional park ranger) and mother can rehabilitate them. She further recalled
309 seeing a leatherback turtle nest on the beach when she was young.

310 Over half of the respondents (63%), including the *tortugueros*, noted that sea turtles get
311 entangled and killed in fishing nets. Many mentioned that commercial shrimp trawl vessels often
312 operate too close to shore and many refuse to deploy legally-mandated turtle excluder devices
313 (TEDs), which function like a trap door on a trawl net to allow sea turtles to escape (National
314 Research Council, 1990). Another younger AMBAS member explained that sea turtles that
315 drown in nets often get thrown overboard and their bodies wash up on the beach (Table 1). One
316 of the *tortugueros* estimated from his observations that 30–40 dead olive ridley turtles wash
317 ashore per year off Barra de Santiago. The sea turtle hatchery manager explained that in the
318 1990s, a large fleet of shrimp trawling boats fished off the coast, but the fleet has since been
319 reduced to eight boats. She recalled that a carpet of dead turtles washed up on the beach in 1990
320 (Table 1).

321 **Theme (4) Community Perceptions:** When discussing the sea turtle hatchery, almost all
322 respondents (90%), including the *tortugueros*, stated that they view the hatchery as a long-term
323 solution to protect sea turtles via the reduction of illegal egg poaching. The hatchery manager
324 expressed a desire for year-round funding for the hatchery, explaining that any eggs laid after
325 December 31 (i.e. the last day of seasonal hatchery operation) are lost to the black market. The
326 hatchery manager explained that during the peak of nesting season from July through December,
327 *tortugueros* deliver sea turtle eggs to the hatchery and are compensated at \$2.50 per dozen eggs
328 (comparable to the black market rate). For every dozen eggs brought to the hatchery, *tortugueros*
329 are required to donate two additional eggs, which is intended to increase conservation awareness

330 and ethic through the *tortugueros*' active participation in the conservation effort. On two nights
331 per month, known as *veda* nights (*veda* is the Spanish word for 'ban'), hatcheries cannot
332 purchase sea turtle eggs, but they can still accept them as donations. Therefore, if a *tortuguero*
333 gathers eggs on a *veda* night, they must either donate all the eggs to the hatchery or assume the
334 risks involved with selling them on the black market. Some people choose to stay home on *veda*
335 nights, but many choose to volunteer their time and donate the eggs they collect to the hatchery.
336 This is another method intended to develop a conservation ethic among the *tortugueros*.

337 Only one AMBAS member stated that she sees the hatchery only as a short-term solution.
338 She explained that she would like to see AMBAS find other economic alternatives for
339 *tortugueros*, including a boat motor repair business and training for local tour guides. She further
340 explained that she thinks there should be more resources dedicated to monitoring and raising
341 awareness. She would like to see a permanent environmental police station in the region, noting
342 that in recent years fish landings have declined, resulting in fewer economic opportunities and
343 more poverty, which increases illegal harvest of natural resources. She feels the town needs more
344 revenue from tourism so it can rely less on natural resources. Similarly, although the AMBAS
345 founder supports the hatchery as a long-term operation, she did express a desire to build
346 community livelihoods around something other than sea turtle eggs in the future, including
347 souvenir handicrafts and locally-owned bakeries.

348 **3.2 Surveys.** The 17 survey respondents ranged in age from 13 to 64 years (average = 32
349 years). Here, we present a subset of the survey results relevant to the themes inferred from the
350 interviews. When asked their reasons for joining AMBAS, 94% of respondents selected a desire
351 to help the environment, 24% selected camaraderie in a women's group, and 12% selected a
352 desire to help the community. The majority of respondents (88%) had never participated in

353 environmental efforts prior to their involvement with AMBAS. When asked about their
354 involvement in AMBAS's conservation projects, 65% indicated that they participate in trash
355 collection initiatives on the beach, 53% indicated that they participate in mangrove
356 cleanup/restoration projects, 35% indicated that they help collect sea turtle eggs for the hatchery,
357 and 12% indicated that they work directly on hatchery management activities. All respondents
358 (100%) indicated that they believe the hatchery system is a viable long-term solution to reduce
359 illegal egg poaching, and 71% indicated that they have sighted more hawksbill turtles in the area
360 since the AMBAS hatchery began operation in 2008 despite the lower occurrence of hawksbill
361 eggs being sold to the hatchery compared to olive ridley eggs.

362 **3.3 Informal Interviews.** We interviewed a regional park ranger who is very
363 knowledgeable about Barra de Santiago's natural resources and wildlife and has been involved in
364 conservation activities for decades. In 1974, he joined a small group of volunteers that collected
365 sea turtle eggs on the beach in Barra de Santiago and took them to a hatchery, which he said was
366 the first hatchery in El Salvador. He reported that he frequently sees juvenile hawksbill turtles
367 foraging in Zapatero Channel (a channel that is part of the natural protected area in the estuary).
368 He explained that his current goals are to make Barra de Santiago a zero-waste community as
369 well as start El Salvador's first crocodile hatchery.

370 We interviewed one of five local MARN park rangers that work in Barra de Santiago. He
371 reported seeing up to three juvenile hawksbill turtles foraging together in the entrance to
372 Zapatero Channel on several occasions. He told us that he was an assistant on an industrial
373 shrimp trawling boat about 20 years ago, and explained that trawl vessels land substantially less
374 shrimp today than back when he was an assistant, due to overfishing. He commented that today,
375 industrial trawlers can kill up to 15–20 sea turtles per night during the olive ridley nesting season

376 (significantly more than estimated by a *tortuguero* respondent). If the sea turtle is a female, the
377 fishers cut them open and take out any eggs they find. To avoid detection, they cut up the body
378 into multiple pieces so the parts sink instead of washing up on shore. He said that by law,
379 industrial fishing boats are not allowed to fish within three nautical miles from the shore, and
380 five nautical miles from a protected wetland, and are required to use TEDs, but they violate these
381 laws constantly, which corroborates multiple respondents' accounts from the interviews. He said
382 that industrial boats are tipped off before official inspections, allowing them to remove evidence
383 of non-compliance and avoid penalties for violations.

384 **4. DISCUSSION**

385 Despite numerous international agreements and other platforms acknowledging women's
386 contributions to environmental management and identifying the need for gender sensitive
387 responses to sustainability efforts (UNEP 1992; UN 1994, 1995, 1997, 2002, 2016; UN Women
388 2020), gender is still often neglected or inadequately addressed in conservation initiatives (e.g.
389 Westerman and Benbow 2014). The women of AMBAS experienced negative pushback for
390 participating in activities outside social and cultural expectations, especially in the early years of
391 the organisation. While government reforms have begun to address gender inequality (Bell
392 2013), our findings are consistent with other studies that found women in El Salvador still suffer
393 from discrimination, femicide, domestic violence (Hume 2009), lack of education, and limited
394 economic opportunity (USAID 2010). These systemic inequalities stem from a culture of
395 *machismo* (Prieto-Carrón, 2007; USAID 2010), which assumes male superiority and dictates
396 traditional gender roles where men dominate the public space and women are relegated to
397 subservient, domestic, and unpaid roles. As revealed during this study, AMBAS members
398 continue to experience prejudice, but reportedly to a lesser extent. A majority of the respondents
399 from the interviews explained that AMBAS has garnered more support as the community

400 realises the significant environmental and economic benefits their programs provide. Their
401 collective motivation to help the environment, which was very evident from both interview and
402 survey responses, coupled with their strategy to provide economic incentives for community
403 participation in conservation initiatives has made the organisation a fundamental component of
404 the Barra de Santiago community.

405 ***4.1 Underscoring the Value of Women's Ecological Knowledge.*** Incorporating
406 ecological knowledge from local resource users has received increasing recognition as a critical
407 component of effective conservation initiatives (Gilchrist et al. 2005; Brook and McLachlan
408 2008; Wedemeyer-Strombel 2019), and has been shown to add value to science by providing
409 detailed insights into the ultimate causes of change and by contributing a rare historical
410 perspective (Chalmers and Fabricius 2007). Furthermore, a growing body of research shows
411 better conservation outcomes when women are integrated into environmental resource
412 management (e.g. Byers and Sainju, 1994; Argarwal 1997; Westermann et. al. 2005; Kusters et
413 al. 2006; Argarwal 2009; Leisher et al. 2016). Our results confirm that in addition to local park
414 rangers and *tortugueros* (all male), the women of AMBAS have a wealth of valuable knowledge
415 about sea turtles, including information on foraging areas, nesting beaches, hatchery practices,
416 and threats. Among the most notable discussions were those about the high rates of sea turtle
417 mortality caused by industrial fishing activities. Although El Salvador's fisheries authority,
418 Centro de Desarrollo de la Pesca y la Acuicultura (CENDEPESCA, General Directorate for
419 Fisheries and Aquaculture Development, in English), has regulations in place that require shrimp
420 trawling vessels to use TEDs and maintain a minimum distance from shore (República de El
421 Salvador 2004), several of the respondents reported that both laws are frequently violated.
422 Consistent with this observation, it is well-documented that incidental bycatch in industrial

423 fisheries, particularly shrimp trawling, is a leading threat to sea turtles worldwide (National
424 Research Council 1990), and is of particular concern in El Salvador (Liles and Thomas 2010).
425 While employing TEDs on trawls has been shown to significantly reduce incidental capture,
426 many countries do not require TEDs, or as is the case in El Salvador, they do not enforce their
427 legal requirement (Epperly 2003).

428 There is very little information on hawksbill sea turtles in Barra de Santiago. Most
429 hawksbill research takes place at or near the known major nesting sites in other areas of El
430 Salvador (Gaos et al. 2010, 2017; Liles et al. 2011). Many of the respondents discussed
431 hawksbill turtle foraging, which they explained occurs most often in the mangrove estuary
432 adjacent to Barra de Santiago. Although mangrove foraging by hawksbills would be unheard of
433 elsewhere in the world, this observation conforms with information from other regions of El
434 Salvador confirming that mangrove ecosystems serve as important foraging and nesting areas for
435 juvenile and adult hawksbills (Liles et al. 2011; Gaos et al. 2012, 2018), particularly in Jiquilisco
436 Bay (Figure 1). A large proportion of AMBAS respondents (71%) from the survey questionnaire
437 indicated that they have observed more hawksbill turtles near Barra de Santiago since the
438 opening of the AMBAS hatchery in 2008 despite the lower occurrence of hawksbill eggs brought
439 to the hatchery. While perhaps true, it is difficult to ascertain the validity of this observation
440 without dedicated monitoring efforts. Nevertheless, increased hawksbill sightings in the area
441 would be a reasonable expectation considering the significant hawkbill conservation efforts
442 (~160 kilometers) to the south, in Jiquilisco Bay, that have produced thousands of hatchlings
443 during nesting beach conservation efforts starting in 2008. Prior to that, nearly all hawksbill eggs
444 in the region were harvested for human consumption (Liles et al. 2011; Gaos et al. 2017).

445 ***4.2 Conservation Payment Programs as a Bridge to Conservation Commitment.*** Our results
446 revealed that AMBAS’s conservation initiatives have inspired conservation commitment in Barra
447 de Santiago, largely because the organization provides a reliable source of income for locals, in
448 addition to environmental benefits. According to USAID, about 90% of people living in rural
449 communities rely on natural resources for some or part of their income, significantly more than
450 urban populations (USAID, 2006). Residents of Barra de Santiago have few economic
451 opportunities available to them, and many have little or no savings to fall back on in the event of
452 an emergency, such as crop failure, flood damage, family health issues, or other crises. Some
453 have no choice but to turn to over-extraction or illegal use of natural resources during difficult
454 economic times. This leads to mangrove forest deforestation, over-fishing, and sea turtle egg
455 consumption and sales on the black market.

456 Management strategies that include financial incentive-based conservation programs to
457 encourage sustainable practices are becoming more common (Ferraro and Gjertsen 2009;
458 Gjertsen and Nielsen 2010; Hazzah et al. 2014). Direct payment programs for local communities
459 can be an essential component of a holistic conservation approach (Dutton and Squires 2008). In
460 the case of Barra de Santiago, many of those interviewed explained that residents are eager for
461 the next AMBAS activity because they look forward to the employment opportunity. Almost all
462 of those interviewed explained that the community had a positive view of AMBAS’ hatchery
463 program because it provided income, and as time wore on, they also came to value the program’s
464 role protecting sea turtles.

465 Hatcheries are a common sea turtle conservation strategy throughout the world,
466 especially in low-income countries where environmental law enforcement is typically weak
467 (Ferraro 2007; Ferraro and Gjertsen 2009). Our results show that AMBAS’s sea turtle hatchery

468 serves a critical role, both for community awareness of endangered sea turtles and for
469 community income via egg payments. Almost 100% of the respondents from the interviews
470 consider the AMBAS sea turtle hatchery system as a long-term, viable solution for sea turtle
471 protection because eggs are otherwise poached and sold to the black market. All AMBAS
472 respondents (100%) that filled out the survey indicated that they believe the hatchery system is a
473 viable long-term solution to reduce illegal egg poaching, which reinforces the theme inferred
474 from the interviews with AMBAS members and *tortugueros*. This perspective coincides with the
475 insights in Liles et al. (2015), where *tortugueros* in Jiquilisco Bay, El Salvador (Figure 1)
476 indicated that the primary importance of hawksbill turtles is the economic value attached to egg
477 payments, and hatcheries are viewed as an equitable conservation strategy. Although some
478 previous studies have highlighted negative consequences of sea turtle hatcheries using poor
479 management practices, such as adverse biological impacts on egg incubation (Boulon et al.
480 1996), hatchling sex (Morreale et al. 1982) and hatchling survival (Pilcher and Enderby 2001),
481 when managed under appropriate conditions, hatcheries can increase hatchling production and
482 control sand temperatures to produce hatchlings of both sexes (Liles et al. 2019). Further,
483 hatchery programs can motivate local residents' active participation in conservation success
484 (Liles et al. 2016), which in turn encourages local commitment to conservation action
485 (Wedemeyer-Strombel 2019).

486 **5. CONCLUSION**

487 In this study, we characterised the prominent role of a women's organisation leading
488 conservation and natural resource management efforts in a rural coastal community in Latin
489 America that is highly dependent on natural resources. We also documented community
490 perceptions of AMBAS both in terms of how the community views their programs and how they
491 view AMBAS as a women-led conservation organization. Our results highlight how women can

492 overcome the gender inequality they face when confronting conservation and natural resource
493 management challenges. An organization founded and led by women is an anomaly in the male-
494 dominated landscape of El Salvador. Cultural norms typically exclude women from leadership
495 positions, and the women of AMBAS push the boundaries of their socially prescribed, traditional
496 domestic roles.

497 Our results also underscore the value of integrating women’s ecological knowledge into
498 conservation efforts. Two of Barra de Santiago’s most valued natural resources are sea turtle
499 eggs and mangrove wood, and AMBAS is the leading community organisation that manages
500 both. Their mangrove conservation program has restored 15 acres of critical forest habitat, which
501 will improve the community’s capacity to buffer storm surges (Zhang et al. 2017) and will serve
502 as a nursery area for numerous commercially important marine species (Nagelkerken et al.
503 2008). Their sea turtle hatchery released over 250,000 hatchlings to the sea from 2011-2017
504 (Caceros 2021, unpublished). Furthermore, via our surveys AMBAS members provided key
505 information about local hawksbill distribution and behavior, which has the potential to help
506 shape future hawksbill-centric conservation measures; these data are highly consistent with
507 knowledge about hawksbills in other areas of El Salvador (Liles et al. 2015; Gaos et al. 2017).
508 Had we only conducted interviews with men in the Barra de Santiago community, we would
509 have missed learning about an entire sector of ecological expertise about local sea turtles.

510 Lastly, our results support the notion that conservation strategies that provide both
511 environmental *and* economic benefits can inspire conservation commitment, regardless of
512 whether they are led by men or women. The interview and survey responses show that
513 AMBAS’s sea turtle hatchery is a source of pride for the community, both for successfully

514 reducing the illegal poaching of sea turtle eggs and for the essential economic benefits it
515 provides.

516 Despite their conservation successes and important ecological insights, AMBAS
517 members still suffer prejudice today. We echo the various calls to action to better incorporate
518 women at the decision-making table of environmental efforts, whether that be equal access to
519 land, management authority over natural resources, or increased access to education and
520 finances. We hope that highlighting AMBAS as a case study contributes to the growing body of
521 evidence of the essential role women play in conservation and other environmental efforts, and
522 believe that AMBAS’ success story can serve as an example of the value women’s ecological
523 knowledge and perspectives bring to both science and natural resources management. When we
524 asked the AMBAS founder why she pressed forward in the organisation’s earlier years despite
525 social pushback, she told us,

526

527 “We as women, we understand our situation and we saw that when we join forces, we can
528 work together to conserve the area. We’ve accomplished a lot for women, for tour guides,
529 for ecotourism. We’ve built the capacity to improve our quality of life and conserve the
530 environment.”

531

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766 **Table 1.** Representative Quotes from AMBAS and *Tortuguero* Respondents

