

Children's interaction with ecosystem services in a mangrove forest: Perceptions of fisherfolks on the involvement of minors in fishing activities in the Gulf of Fonseca in Honduras

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ABSTRACT

This study examines the participation of minors in fishing activities in the communities settled in the mangroves of the Gulf of Fonseca, in Honduras. With a survey of 88 fishermen from San Lorenzo (in the province of Valle), we describe the perception of adults regarding the involvement of minors in fishing and we examine the threats to the mangrove ecosystem on the Pacific coast. To complete the case study, 11 qualitative interviews and 2 focus groups with key informants were conducted. The results revealed that children start to perform pre-work activities around the age of 11 or 12. The contact with nature in complementary shellfish harvesting and fishing activity is perceived as contributing to the improvement of their understanding of nature in general and about the ecosystem services of the mangrove in particular. This assessment of child labour practices when minors collaborate in family subsistence activities, highlights the need to ensure local traditional knowledge transmission that should be integrated as part of formal education, which may help reinforce the fishing community future implication in conservation bottom-up initiatives at the same time that prevent child labour malpractices.

1. Introduction

Children's interaction with nature develops their understanding of the surrounding ecosystem services, strengthens their ability to adapt and promotes a sense of attachment to the place (Lindahl, 2005; Louv, 2005, 2005b). However, this interaction also imbues "child labour" practices¹ (Maya-Jariego, 2021), such as the participation of minors in fishing, herding or agricultural activities. In this study we explore to what extent the collaboration with subsistence tasks carried out by parents is perceived by local communities as a problem or an opportunity for the personal development of children. To do this, we base our study on the case of fishing communities in the Gulf of Fonseca, in Honduras, and we examine the link of minors with the natural environment through their direct or indirect participation in fishing activities.

1.1. Minors, fishing communities and mangroves

Tropical coastal mangroves are highly productive ecosystems that have experienced significant biodiversity decline in recent years (Canty et al., 2018; Soanes et al., 2021). Together with the impact of climate change, they are subjected to strong pressures related to aquaculture, agriculture, logging and coastal urban development. This has led to a deforestation of over a third of the surface area of mangrove forests over a decade (Duke et al., 2007).

The local fishing communities are among the groups with the most direct interaction with the mangrove and that can be most strongly affected by this decline. Hence the need to find out the threats perceived by the group of fishermen, as well as their receptivity to accepting the measures to mitigate them (Owuor et al., 2019). Many families who live off fishing depend on the resources offered by the mangrove and are directly affected by the degradation of the ecosystem. The mangrove is a habitat that provides protection and food to a wide variety of marine

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¹ In other words, it has a negative impact on their health, psychological well-being or personal development.

species (Stone et al., 2008), therefore, in addition to serving as a breeding area, it allows them to catch fish, molluscs and crabs. It has also been used to obtain firewood or wood for construction.

The people who live near the mangroves know first-hand the ecosystem services they provide and directly perceive changes in the ecosystem. In different geographical contexts, it has been shown that these communities are aware of the decline in provisioning services and, more specifically, of the negative impact generated by both illegal logging and the progressive reduction of the mangrove surface area (Baremore et al., 2021; Caviedes et al., 2020; Nyangoko et al., 2022). The fishing activity is one of those that is directly affected by this whole process, reinforcing the subsistence economy.

In these communities, children start fishing and learn the characteristics of the ecosystem through their early experiences. Participation in the activities carried out by their elders offers them an opportunity to interact directly with nature and benefit from the intergenerational transmission of local ecological knowledge. The relationship with nature contributes positively to child development (Summers et al., 2012), as it not only promotes greater environmental awareness (Cohen and Horm-Wingerd, 1993), but it also improves the minor's cognitive abilities and degree of independence (Kahn and Kellert, 2002; Louv, 2005, 2005b, 2005; van Noy, 2008). For this reason, we have questioned whether the participation of minors in the family subsistence economy must be classified as "child labour" (Maya-Jariego, 2021), or whether the acquisition of popular knowledge about the natural environment is essentially incompatible with formal education (Reyes-García et al., 2010).

Next, we focus on the specific case of the Pacific coast of Honduras. In the next two sections, we successively review the characteristics of the fishing activity and ecosystem services in the Gulf of Fonseca. This allows us to describe the peculiarities of the socio-ecological environment faced by minors who collaborate in fishing activities.

1.2. Fishing in the gulf of fonseca

The expansion of small-scale fishing on the coasts of Honduras is a relatively recent phenomenon (MacKenzie and Stehlik, 1996). This type of fishing is key to the diet, economy and employment of coastal communities, mainly in remote areas or in areas with high levels of poverty, where there are no other alternative sources of income. In Honduras, there are clear differences between the country's two main fisheries: the Caribbean and the Pacific Ocean. Small-scale fishing is prevalent in the Gulf of Fonseca, where the lack of a consolidated infrastructure to process catches reduces the marketing of fish mainly to the domestic market or to the nearby bordering areas of El Salvador or Nicaragua (Box and Bonilla, 2009).

Fishing is carried out on foot in the seasonal swamps and lakes to catch mangrove cockles, clams, red mangrove crabs, shrimp larvae and shrimp. Small boats, with net and hook gear, are also used to catch fish and shrimp. The boats are made of wood and fibreglass, measure an average of 6 m in length, do not have a cabin and have 15-horsepower steam engines and a maximum capacity of one tonne. The product of small-scale fishing is intended mainly for self-consumption and local marketing. It is worth highlighting the lack of fish markets or organised collection spaces for the sale and marketing of catches. The most used system for the sale of fish is intermediation, which consists of marketing the catches through a middleman, who is generally not from the fishing area, and who travels from cities in the southern region, or even from the Central District, and sells the product at markets and other commercial premises in the country.

In the Gulf of Fonseca, three groups of fishermen have been identified based on the type of fishing, the degree of dedication and the usual places of capture (Corea Flores, 2007). Firstly, open sea fishermen tend to fish all year round, with intensive use of trammel nets and a great diversity of species caught. Secondly, fisherman of lakes, within the mangrove, tend to fish for half of the year, normally in winter (from May

to November), combining the use of hooks and cast nets with fishing on foot in the swamps. Thirdly, fishermen of the islands usually devote themselves to fishing in the open sea. Those two last groups occasionally combine their main fishing activities with farms, employment in aquaculture and construction or tourist activities.

In the most recent registry, there was a census of 1180 small-scale fishing vessels at 35 landing points on the Honduran coast of the Gulf of Fonseca. Of these, 80% were active, implying a capacity of approximately 2000 fishermen in the area. The daily departure involved some 330 boats, that is, 30% of the total number of boats registered. Total catches in 2008 amounted to 4200 tonnes, mainly from fish (3400 tonnes), and to a lesser extent shrimp (570 tonnes), mangrove cockles and crabs (230 tonnes) (Soto et al., 2012). In the last decade, species such as the catfish, grouper or shark have practically disappeared from catches, whereas wild shrimp are only found sporadically (Kurien, 2015).

Alongside the degradation of ecological spaces in the Gulf of Fonseca, a reduction in the volume of catches and in the profitability of the fishing activity has been observed. The depletion of some populations of fish species has resulted in the need to search for new catch areas, which has sometimes led to crossing the international borders of the three countries that share the Gulf.² The capture effort has also increased considerably in recent decades. Fishermen have to spend more time and more fuel to reach waters that are further and further away from landing areas. On the other hand, the incipient entry of commercial and industrial fishing boats and the increased use of driftnets in small-scale fishing areas has further reduced the catches available (Lemay et al., 2007).

1.3. The mangrove in the gulf of fonseca

Mangroves³ are forests of trees and shrubs that dominate the intertidal zone along coasts, estuaries and islands in tropical and subtropical regions (Macintosh and Ashton, 2002; Middleton and McKee, 2001). Mangroves provide various ecosystem services that contribute to the well-being of the communities directly linked thereto (Brander et al., 2012). Among others, they fulfil duties of provision, regulation, habitat maintenance and cultural services (Spaninks and van Beukering, 1997).

However, mangroves are among the most threatened ecosystems in the world (Stevens et al., 2006). Because of their location, they are vulnerable to natural agents such as hurricanes and storms. They are also exposed to anthropogenic factors such as road construction, pollution and tourism (Barbier and Cox, 2003). This disappearance of mangroves has a profound impact on the vulnerability of coastal populations, especially in developing countries (de Souza Queiroz et al., 2017).

This is the case with Honduras: some of the threats and pressures suffered by mangroves worldwide are clearly reproduced in the Gulf of Fonseca. In this inlet of the Pacific Ocean, overexploitation comes mainly from the extraction of wood for construction and firewood for fuel. At the same time, the transformation caused by the industrial exploitation of shrimp and tilapia has considerably reduced the size of the mangrove forest areas (Promangle, 2001). Children soon become aware of the threats to the mangrove through their participation in the daily activities of the fishing community, in direct interaction with adults. That is why the perception of the fisherfolks provides a valid approach to how intergenerational transfer occurs. Adults transfer to minors their vision of the ecosystem environment and of the fishing activity itself.

In the case of the Gulf of Fonseca, there is an evident tension between

² This has caused an increase in disputes and conflicts between fishermen, as well as the seizure of their product and fishing gear by the authorities on numerous occasions.

³ They are also known as "tidal forests", "coastal forests" and "mangrove forests" (FAO, 1994).

logging and aquaculture activities, small-scale fishing and mangrove conservation. Moreover, the State has shown little ability to regulate and control these activities. Hence why some international cooperation initiatives have started to demand environmental conservation actions, with the introduction of sustainable practices in aquaculture. For example, investments have been made to farm tilapia in the high seas and reduce pressure on the mangrove, avoiding its deforestation for the installation of farming pools. It is also worth mentioning the Community Advisory Councils on protected areas, promoted by local organisations, which have made it possible to channel part of the local and international aid, creating participation spaces around the protection and regeneration of the mangrove (Flores, 2013).

1.4. Research questions

The participation of minors in fishing activity is important in the domestic economy of families. Especially in a context in which the subsistence economy is threatened by commercial intermediaries, aquaculture companies and the over-exploitation of wood, among other factors. Consequently, intra-family dynamics are decisive in the functioning of the socio-ecosystem.

In this context, it is necessary to explore which activities carried out by minors can be considered child labour and which are a form of collaboration with livelihood activities with a recreational or educational dimension. Both the context of poverty and the value of local knowledge could help to better understand child labour in societies based on subsistence economies.

In this case study we examine community dynamics, fishing activity and mangrove exploitation in a community in the Gulf of Fonseca in Honduras. The objective of the research was to describe adult perception of the relationship of minors with the environment through their participation in work activities in the fishing sector. To do this, we combined the characterisation of the extractive activity in a fishing community with the assessment of the ecosystem services provided by the mangrove, paying particular attention to the fishing activity carried out by minors. With these two elements, we intend to answer the following research questions.

1. How do the economic, ecological and social changes to which Pacific coastal communities are exposed affect family life and, specifically, the early involvement of minors in work activities?
2. How is local ecological knowledge about the mangrove transmitted through the participation of minors in community life and small-scale fishing?

The answer to these two questions will serve to propose appropriate management strategies in relation to an issue that has historically been neglected in coastal fishing communities.

2. Methods

2.1. Study area

This study was carried out in a fishing community in the municipality of San Lorenzo, in the Gulf of Fonseca (represented in Fig. 1). San Lorenzo is the capital of the province of Valle, which forms the outlet of Honduras to the Pacific Ocean, together with the province of Choluteca. The coastal areas located in both provinces are characterised by a high population density, high levels of poverty and an accelerated deterioration of natural resources (ACI-Participa, 2018).

The Gulf of Fonseca is a bay shared by El Salvador, Honduras and Nicaragua. The region is formed by a system of water basins with coastal and aquatic habitats that constitute the basis for the socio-economic development of the area. The marine-coastal area occupies more than half of the stretch of the Gulf and is mainly made up of mangroves and salt forests, estuaries, marshes and swamps. In total it occupies 8245 km², including an aquatic area of 2015 km² and a coastline of 400 km.

The wetlands cover approximately 1000 km². The tropical dry forest creates a contact line with the humid mangrove forest, generating a key ecological space in the Gulf. The beaches on these limits are spawning and nesting areas for sea turtles and their estuaries serve as a habitat for a large number of species of high ecological and commercial value. Seasonal lakes are depressions below the mean high tide that connect with the sea through estuaries (Corea Flores, 2007). During the summer (from December to April), the beaches are usually dry and unproductive



Fig. 1. Satellite image of the gulf of fonseca (source: National oceanic and atmospheric administration, NOAA. Public domain). Coordinates: 13° 15'N 87° 45'O.

for fishing. In winter (from May to November), they capture rainwater, and this is added to the contributions from the estuaries. Finally, the group of islands in the Gulf of Fonseca is a landscape of volcanic origin. These islands are made up of dry forest, with a stretch of relatively accessible beaches along the coast, which constitute the area's main tourist attraction.

The 80,000 ha of protected spaces form part of the Natural Protected Areas Subsystem of the Southern Zone of Honduras. This subsystem is made up of seven habitat or species management areas, two multiple-use areas and a marine national park. Although the management of protected areas in Honduras is the direct responsibility of the State, through the National Institute of Forest Conservation and Development, agreements are also established with non-governmental organisations and local entities for the shared management of these spaces. The Honduran legislation defines management as a "shared management model, based on a dynamic and systematic process, between the State, local governments and organised civil society" (*Mesa de ONGs Comanejadoras de Áreas Protegidas de Honduras, 2018, p. 9*). This management is organised around four key elements: the guarantee of conservation, sustainable use, governance and community participation with gender equity. In the case of the Gulf of Fonseca, the private entity responsible for the shared management of these protected areas is the Committee for the Defence and Development of Flora and Fauna in the Gulf of Fonseca.

2.2. Participants

Interviewing adults provide instructive insights to children's interaction with nature because adults are part of children's everyday spaces and activities in the municipality of San Lorenzo. To this end, a total of 88 fishermen from the municipality of San Lorenzo participated in the study, with an average age of 42.3 years ($SD = 13.89$ years). Almost all interviewees are men (92.04%, $n = 81$). Most of them live in the neighbourhood of San José del Chaparral (79.5%, $n = 70$), whereas the rest came from other adjacent neighbourhoods such as Buenos Aires, Buenos Aires South and La Ceibita. It is a population that is deeply rooted locally, with little geographical mobility: 73% lived in the same district in which they were born, while the remaining 27% came mostly from other municipalities in the province of Valle or from other nearby provinces like Choluteca or Francisco Morazán. However, 20% of interviewees say they receive remittances from relatives living abroad, in most cases between 100 and 300 dollars per month.

The results of the interviews do not necessarily represent the actual perceptions of children themselves.

2.3. Procedure

The field work was carried out in two phases. Firstly, exploratory visits were made to the area over three consecutive months, and meetings were organised with fishermen and representatives of associations and public institutions. Specifically, members of the Mayor's Office, the General Directorate of Fisheries and Agriculture, educational centres in the area, fishermen's associations and various non-governmental organisations were contacted. Focus groups were also organised with children and teachers from educational centres in San Lorenzo, on the one hand, and with key informants linked to fishing, on the other. Over these three months, participant observation of fishing activities in the area was also carried out. The second phase took place two years later and consisted of applying the survey to the 88 fishermen included in this study.

In the first phase, the research combined (a) the intensive observation of the urban environment, community dynamics and the daily fishing activities of the inhabitants of the neighbourhood of San José del Chaparral in San Lorenzo with (b) an evaluation through individual interviews and focus groups on fishing practices, mangrove ecosystem services and the involvement of minors in work activities.

In the second phase, the respondents answered a semi-structured

questionnaire with questions on (a) socio-demographic, labour and economic characteristics of the family home, (b) social participation and sense of community, (c) ecological functions, situation and perceived problems of the mangrove, (d) fishing activity and ecological knowledge and (e) child labour linked to fishing. To evaluate the functions and the impact that child labour in fishing has on minors, a scale was applied that evaluated the degree of agreement with different results of this work on the child's development and learning, as well as the possible benefits for families and the community environment.

In the first phase, 11 individual interviews and 3 focus groups were conducted. The mangroves were visited, and the fishermen were accompanied in some of the activities of fishing and capturing mangrove cockles. The contacts with the informants were provided by a fish merchant in the area with close ties to public services, local associations and communities linked to the mangrove. Fishermen, mangrove cockle catchers, and representatives of the Committee for the Defence and Development of Flora and Fauna in the Gulf of Fonseca participated in the qualitative interviews, along with members of non-governmental organisations and local public administrations, both from the San Lorenzo Mayor's Office and the General Directorate of Fisheries and Aquaculture. In the focus groups, information was obtained on the educational context and the experience of children and teenagers in the local ecological context. Teachers, families, children, workers in the fishing sector, administration officials and members of environmental protection associations participated in the groups. The participants signed an informed consent, in which they were given a guarantee of confidentiality and aggregate treatment of the information. The children participated in the framework of an international cooperation project and had the signed authorization of their parents or guardians.

The interviews and focus groups were transcribed and analysed by two independent researchers who identified key issues related to fishing activity, community processes and child labour. This information was used to prepare the instruments and collect information in the second part of the study. It was also used to prepare a qualitative report that was independently reviewed by two anthropologists with international experience in marine socio-ecological contexts. The scales used in the survey are described in the next section.

2.4. Instruments

Goods and services of the mangrove. A list was used containing 25 possible functions related to (a) the provision of resources through fishing, agriculture and other human activities, (b) the regulation of the ecological space and protection against environmental phenomena, (c) the conservation of biodiversity and ecological wealth and (d) the promotion and maintenance of cultural and community processes. To prepare the list, the inventory of mangrove ecosystem functions created by Himes-Cornell et al. (2018) was used as a source. The list was completed with the information contained in the first exploratory phase of the study. The interviewees had to assess the importance, both for the community and for themselves, of each of these services on a scale of 1 ("low importance") to 3 ("high importance"). The scale presented a Cronbach's alpha of .814.

Threats to the mangrove. The interviewees were asked to rate the level of perceived threat from different activities in the mangrove: tourism, aquaculture, fishing, agriculture, wood or salt extraction and urban development. They also assessed the degree of environmental deterioration, water pollution and climate change. To do this, the catalogue of the most frequent activities listed by the key informants interviewed in the first phase of the study was used. The interviewees rated each of these activities on a scale from 1 ("It poses no threat") to 6 ("It poses a significant threat").

Regulations linked to the fishing activity. A 7-item scale was applied in which the interviewees were asked about different actions related to the regulation of fishing activity to improve its sustainability. The scale evaluated aspects such as the imposing of restrictions on the fishing

activity (e. g. “fishing should be restricted in certain areas to allow fish and the mangroves to grow”) or the control of fishing activity by the State or by fishermen’s associations (e. g. “the fishermen’s associations should lead the marketing of fishing”) or the control and imposing of sanctions on irregular fishing activities (“illegal fishing and sale of fish should be sanctioned”). The interviewees had to rate each item with a Likert-type scale from 1 (“completely disagree”) to 6 (“completely agree”).

Registration of fishing activity. On one hand, the frequency of use by the interviewees of different fishing gear (trammel net, cast net, beam, hook or fishing on foot) was evaluated and on the other, the catch volume of different fish species was evaluated. In this latter case, to facilitate identification, the interviewees were presented with a list of species, as well as a sheet with an image of a specimen of each one together with the scientific name and common name used in the area. Both for the identification of the fishing gear and the main species caught in the Gulf of Fonseca, the information provided by the interviewees in the first phase and previous studies was used (Soto et al., 2012; Promangle, 2001).

Child labour. The interviewees were asked about the frequency with which children engaged in different fishing activities, such as repairing and taking care of boats and gear, fishing by boat or on foot or helping to unload and sell fish. Secondly, a 10-item scale was applied to evaluate the degree of agreement with different benefits and harms of the involvement of minors in fishing activities. The scale evaluated aspects such as the importance of the economic contribution of the child’s activity (“it is important for the sustenance of the family economy”), the acquisition of knowledge and cultural values (“it educates and instructs them about nature, the mangroves and the sea”) or the benefits for child development (“it is beneficial for their physical and mental development”). The scale obtained a Cronbach’s alpha of .753.

Personal networks. The following name generator was used: “Please give me a list of 45 people with whom you have a regular relationship throughout the week. I am interested in you mentioning those with whom you have the most frequent and regular contact. [They may be work colleagues, neighbours, relatives, friends, or people with whom you share hobbies. They may be from your neighbourhood, from nearby neighbourhoods or even from more distant ones. It is important that they are the 45 people with whom you have the most frequent relationship]”. Information was obtained from each of the people mentioned about their gender, their relationship with Ego,⁴ their place of residence, the activity they were engaged in and the frequency of contact. Later, the interviewee was asked to indicate the type of relationship that each pair of alters mentioned had with each other at four levels of intensity, where 0 corresponded to “they do not know each other”, 1 “they know something of each other”, 2 “they have a good relationship” and 3 “they are friends”.

3. Results

3.1. Socio-economic characteristics of households

In total, 70% of respondents live in a home they own. The most common case consists of sharing the family home with a partner and children, with an average of 2 children per household. Most households have electricity and drinking water services (94.3% and 80.7%, respectively). Having a sewage system (61.4%) or access to the Internet (27.3%) is less common.

It is a group with a low socio-economic level. On the one hand, the participants have a low level of formal education: 61.4% have completed basic education, whereas 28.4% had no education at all. 42% do not know how to read or write. On the other hand, practically half of

fishermen declared a monthly income of less than 108 euros (3000 lempiras), while a fifth reported an income of over 180 euros per month (over 5000 lempiras). Over half consider that their income is not enough to cover the basic expenses of the family home (54.5%). Only 10% have some ability to generate savings. The majority are those who own the basic materials and goods to perform the fishing activity, such as nets (72.7%), lamps (70.5%), hooks (50%), a boat or canoe (48.9%) and an engine (51.1%).

The fishermen’s collective forms part of a highly cohesive community. The respondents report a high psychological sense of community with their neighbourhood of residence. They feel especially well integrated with their neighbours. However, participation in community-based organisations is sporadic.

3.2. Fishing activity and local ecological knowledge

At the time of the interview, the respondents had been linked to the fishing activity for an average of 27.72 years (SD = 14.81). Practically half have not had any other occupation throughout their lives.⁵ The most used fishing gear is the trammel net (66%), followed by the extraction of molluscs and crustaceans on foot (25%), the beam, fishing with hooks or traps (10%) and the cast net (5%). In Fig. 2, we document the coexistence of fishing on foot and fishing from a boat in the same setting of the mangrove.

“At night we fish and in the day there are mangrove cockles and, when there are any, also fish. Right now, there are no fish, so we have not gone out fishing, this is done at night and during the day we hunt for mangrove cockles”. [Fisherman and mangrove cockle catcher, San José del Chaparral]

“When we start the day here, there are times when like let’s say right now as the tide is rising, one comes home from work, let’s say when the tide is high, sometimes it drops back in the afternoon, so we sometimes come home from catching mangrove cockles, load the trammel nets and go fishing at night, for part of the night”. [Fisherman and mangrove cockle catcher, San José del Chaparral]

“The fishermen earn what is left over. Fuel costs are taken out first. And from there we distribute it into three parts, but first we have to take out the fuel cost and what is left over is what will be distributed. Sometimes they even owe fuel because they can’t pay. The mangrove cockle catchers play it safe because there are always mangrove cockles at the points where they already know they can get them. But the fishermen who may catch 45 or 50 pounds, at 25 pesos a pound of fish, and after an entire night of work ...”. [Fish seller, San Lorenzo]

Around half of the fishermen state that they catch species such as the white mullet (*Mugil curema*), the Pacific flag-fin mojarra (*Eucinostomus Currani*), the spotted head sargo (*Anisotremus Dovi*), the green jack/Pacific crevalle jack (*Caranx Caballus/Caninus*) and the Colorado snapper (*Lutjanus Colorado*) on a daily basis. The mangrove cockle (*Anadara Tuberculosa*) is the only bivalve mollusc caught by a significant proportion of fishermen on a regular basis, while others such as the salt-water clam (*Mytella Guyanensis*), the cortez oyster (*Crassostrea Cortezensis*) and the grand ark clam (*Anadara Grandis*) are caught less frequently. In this case, the type of specialised extraction, on foot and in specific areas of the mangrove, limits catches to those who are exclusively devoted to this activity.

The respondents made an estimate of the current average daily number of catches of each indicated species and the daily average 10 years ago. The results show an overall decline in the volume of catches in all species, especially in those with the highest volume of catches, with a

⁴ In personal network analysis we refer to the respondent as “Ego”, and the people mentioned by the respondent as “alters”.

⁵ Among those who have performed other work activities, these include caring for the lakes and packaging products in aquaculture, as well as construction, agriculture and wood extraction.



Fig. 2. Two types of fishing in the mangrove. Catches of fish from a boat (left) and catches of molluscs and crustaceans on foot (right).

decrease of between 30 and 70% depending on the species. However, the high standard deviation of all averages reported a high variability in the estimates made by the fishermen.

3.3. The perception of the mangrove ecosystem services

The fishermen are aware of the importance of the ecosystem services offered by the mangrove. Firstly, they consider it a key resource for maintaining ecological diversity. Secondly, it is a source of fishing resources, allowing the capture of fish, the rearing of young fish, food for animals and plants and the capture of molluscs and crustaceans. Thirdly, they recognise the role of the mangrove in the protection against meteorological phenomena or climate change. Finally, they believe that it is an ecosystem that also contributes to maintaining identity and traditions.

On a personal level, the respondents have a direct relationship with the mangrove through the fishing resources it provides them. Over 45% mention catching fish or molluscs as the main service offered to them by the mangrove. Obtaining firewood for burning (15.9%) or storing wood for construction (9.1%) are also notable uses. Moreover, an improvement in well-being and quality of life was mentioned by 8% of participants. Minors may eventually participate in all these activities.

The fishermen are divided between those who consider the current situation of the mangrove as good (45.6%) and those who rate it as bad (38%). However, the majority believe that the situation of the mangrove has worsened in the last 10 years (77.3%). Included among the biggest perceived threats to the survival of the mangrove are water pollution, climate change and wood extraction. Fig. 3 documents some of the pressures to which the mangrove is subject. In Table 1 we have compiled the ranking of problems perceived most important for the sustainability of the environment in which the respondents live. What is striking is the low perceived threat of activities that are widespread in the Gulf of

Table 1

Level of perceived threat to the survival of the mangrove and the community.

	M	SD
Water pollution	5.02	1.72
Climate change	4.16	2.11
Wood extraction	3.86	2.16
Illegal fishing	3.50	2.22
Real estate and construction activity	2.95	2.25
Industrial fishing	2.86	2.25
Aquaculture	2.00	1.75
Agriculture	1.86	1.61
Salt extraction	1.63	1.41
Tourism	1.61	1.43
Small-scale fishing	1.55	1.47
Total	2.82	0.80

Note. Scale from 1 “No threat” to 6 “Significant threat”.

Fonseca and that have caused political, social and environmental conflicts and problems in recent years, such as aquaculture (M = 2.00, SD = 1.75), agriculture (M = 1.86, SD = 1.61) and tourism (M = 1.61, SD = 1.43).

In the qualitative interviews, the fishermen insistently mentioned the problems derived from the felling and cutting of the mangrove, especially of plants that are still green. The intensive extraction of wood reduces the extent of the mangrove and its size, which ends up affecting tidal flows and the reproduction of fish and poultry species.

“The mangrove is a way of life for us. Although we do not really take care of it. People even cut trees for firewood, and even worse because they cut them when green ... so it no longer grows, and the mangrove becomes small!”. [Fisherman, San José del Chaparral]



Fig. 3. Benefits of and threats to the mangrove ecosystem services. From left to right: A) the mangrove is used as firewood and for building houses; B) aquaculture operations reduce the size of the mangrove and is associated with pollution levels; C) tourism on the islands of the Gulf of Fonseca is counted among the cultural services of the ecosystem.

“There was a big crisis in the mangrove ... The mangrove planting programme lasted until now, just one month ago there was a group that came to plant mangrove ... Because if you see, this house is made from mangrove, they cut the wood to make the house. Now it is prohibited. If they catch you with that, they fine you and take away the product, and if they catch you a second time, you go to jail. This wood is very resistant, it lasts for years if it doesn't get wet, but if rainwater falls on it, it quickly rots”. [Fisher, San José del Chaparral]

The pollution of the mangrove was highlighted as another serious problem for fishing activities. Pollution derives mainly from the discharge of wastewater from homes, from the deposit of solid waste on to the banks of the mangrove swamp and from chemical substances from agriculture and aquaculture. Likewise, climate change and its consequences (such as the heating up of water and long periods of drought) were also pointed out as problems affecting fishing.

The fishermen hold the aquaculture farms responsible for both the pollution of the waters and the progressive reduction in the size of the mangrove. Despite the fact that (as shown in Table 1) it was not reflected in the scale, the fishermen maintain a critical attitude towards the activity performed by these companies, which they blame for the difficulties in finding fishing areas (having to increasingly enter the Gulf) and the reduction in catches. The installation of dams for shrimp farming requires the felling of large areas of the mangrove, which has led to a considerable reduction in its size in recent decades. The state control of this activity is not always effective and the conflict of interests between the different parties involved makes it difficult to manage.

“Unfortunately, most of the shrimp farms are located in protected areas. Being able to control that is practically impossible and even if the State puts the brakes on or wants to apply regulations on people, it is almost impossible. Because the local governments receive income from these activities (in addition to salt production, shrimp production and small-scale fishing that serve their municipalities, to be able to move forward with the issue of the education and health of their people)”. [Worker for the Regional Directorate of Fishing and Agriculture]

On the other hand, the fishermen complained that the dumping of chemical products derived from shrimp farming affected many mangrove fish species, increasing their mortality and reducing their presence. This situation caused conflicts and direct confrontations between the fishermen and the owners and workers of these companies.

“There are places where there are no saltwater clams because there are shrimp prey and they throw poison and kill them. When a shrimp harvest ends and they are going to plant another, they throw in some chemicals to prepare the land and kill the sea scorpion that eats the shrimp. But if that escapes, it kills fish, mangrove cockles and saltwater clams”. [Mangrove cockle catcher, San José del Chaparral]

“There are fewer catches, partly because there has been a lot of product mortality, because now where a lot of product was taken, the shrimp farms release a poison that kills mangrove cockles and fish. They also have nowhere to grow, the mangrove where they reproduced in quantity is disappearing”. [Fisherman, San José del Chaparral]

Finally, the interviewees pointed out that competition between fishermen has increased in recent years. Increased unemployment and poverty have led many inhabitants of the area to devote themselves to fishing or extracting mangrove cockles, increasing the number of families who rely on this sector.

“We spend most of the time just doing this, because some mangrove cockle catchers and fishermen have worked as construction helpers, but it does not work for us because the salary is very low, because construction helpers earn between 200 and 250 lempiras a day [between 7 and 9 euros]. For master builders, it is different, as they

earn 400–500 lempiras [from 14 to 18 euros]. Us mangrove cockle catchers earn around 250 lempiras a day [9 euros], but we only work between 4 or 5 hours because we take advantage of the fact that the tide goes out for around 6 hours and the other 6 hours the tide is high and then we can no longer do it”. [Mangrove cockle catcher, San José del Chaparral]

The fishermen recognised that this competition and the not always controlled incorporation of other members of the community to the fishing activity has led, in some cases, to fishing in protected areas or using non-permitted fishing products or practices (such as explosives or hooks). Moreover, the conflicts derived from the triple border with El Salvador and Nicaragua aggravates the problem.

“For a Honduran, going out like this to sell mangrove cockles to another country is expensive, but if a fisherman from another country comes to Honduras to sell them, it is cheap. People from El Salvador and Nicaragua come here to fish and this cannot be done by a Honduran. In Honduras, anyone can enter to sell or do what they want. There are even fights and conflicts in some places”. [Fish seller, San Lorenzo]

Together with the factors mentioned above, all of this has contributed to the decline in catches, the depletion of some mangrove areas and increased difficulties in finding profitable fishing areas. The fishermen are in favour of the establishment of close seasons during the breeding season and recognise the need to restrict development to protect the mangrove. Some consider that the work of the Committee for the Defence and Development of Flora and Fauna in the Gulf of Fonseca indirectly supports the fishing sector, through surveillance actions to “prevent us from using explosives when fishing or from cutting green trees from the mangrove”.

“We no longer get the same number of mangrove cockles as we did before, now there are less. There is a lot of competition, that is, there are more mangrove cockle catchers and the need for work is greater each time. When there are not many mangrove cockles, then we grab the nets and go fishing. So, the mangrove rests, and when we return there is a little more production”. [Mangrove cockle catcher, San José del Chaparral]

Production has dropped quite a lot because, on a daily basis, there are more mangrove cockle catchers, more fishermen, and so the few cockles that come in are distributed among everyone now. It is not like before when we gathered more”. [Fisherman, San José del Chaparral]

3.4. The personal networks of fishermen in San Lorenzo

Fishermen have a highly cohesive interpersonal space. It is about dense personal networks, about strong ties. As well as having a high density ($M = 927$, $SD = 0.117$), the mentioned contacts maintain strong relationships with each other, with a mean value of the tie greater than 2. Sub-areas of high cohesion are also observed, with a large proportion of cliques with a size greater than 25 members. The respondents have daily contact with almost 40 of the 45 contacts evaluated ($M = 39.91$, $SD = 6.81$).

The composition is very homogeneous, as shown in Table 2. Most of the mentioned contacts were men. Over half of the people mentioned in the personal networks are friends, and around 10 are relatives. Over two thirds are fishermen ($M = 30.96$, $SD = 13.36$). The presence of players dedicated to aquaculture, agriculture or tourism was almost testimonial.

Next, we classified the personal networks into 3 clusters using the K-means procedure, with the professional categories most present in the personal networks and the time dedicated to the fishing activity by the interviewees being used as the criterion variables (Table 3). Clusters 1 and 2 have a high proportion of fishermen in their networks and a low presence of professionals not dedicated directly to fishing. They differ in

Table 2
Composition of the personal networks.

	M	SD
Men	35.81	8.42
Women	9.19	8.42
Close relatives	6.73	8.29
Other relatives	3.68	7.35
Friends	26.40	15.26
Work	3.21	9.68
Acquaintances	4.64	9.41
Fisherman	30.96	13.36
Aquaculture	.11	.36
Agriculture	.14	.85
Tourism	.04	.35
Merchant	2.12	2.77
Labourer	1.64	4.10
Student	.79	1.98

Table 3
Final cluster centres for the cluster analysis.

	Cluster 1 (n = 28)	Cluster 2 (n = 20)	Cluster 3 (n = 23)
Number of contacts with fishermen	40.96	35.20	15.35
Number of contacts with merchants	.89	1.60	3.87
Number of contacts with labourers	.29	.10	4.74
Fishing time (in years)	19	46	20

the length of fishing experience. While group 1 has been around 19 years, the second has been around for over 45 years. Cluster 3 is characterised by the most heterogeneous composition: less than half of the members in its networks are fishermen, therefore, they have the highest proportion of merchants and labourers. In terms of fishing time, they are similar to the first cluster.

To illustrate the two most differentiated types of networks, in Fig. 4 we have selected a representative case from cluster 2 and another representative case from cluster 3. On the one hand, Helder is 28 years old (Network 27: Fig. 4, Left). He has been fishing since he was 12 years old, when he started going out with his father to collect mangrove cockles. He currently lives with his parents and has no partner or children. He mainly performs fishing activities with trammel nets, hooks and traps, which he combines with catching mangrove cockles when the tide goes out. This means he normally catches a wide variety of fish (raucous grunt, mackerel, sea bass, grouper, mullet, pomfret, among others), but also molluscs and crustaceans (shrimp, mangrove cockles, crabs and saltwater clams). He also visits a wide variety of areas to find those in which he can get the most out of the fishing activity, depending on the tide and weather conditions. For Helder, the main problem with the mangrove is the reduction in catches, which reduces the profitability of the fishing activity and affects the family economy. Helder's personal network is comparatively heterogeneous. His contacts are divided equally into three groups: fishermen (n = 16, 35.5%), labourers (n = 14, 31.1%) and people who are devoted to housework or are unemployed (n = 14, 31.1%). However, it is a cohesive network with a high density (0.695) and an extensive number of cliques (322). Helder maintains daily contact with 62.2% of his contacts (n = 28), whereas contact with the rest is usually weekly. His relationships are divided between close family (n = 20, 44.4%) and friends (n = 25, 55.5%).

On the other hand, Marvin is 52 years old and started fishing when he was 7, also accompanying the family (Network 60: Fig. 4, Right). He only devoted himself to catching mangrove cockles in that initial period, an activity that he abandoned in adulthood. Except for a period when he worked as a shrimp packer at an aquaculture company, most of his life has been devoted to fishing. He currently mainly devotes himself to fishing with a trammel net, which he occasionally combines with the use

of beams, hooks and traps. His catches are mainly fish such as bass, horse mackerel, grouper or sea bream. He considers the main problem of the mangrove to be ecological, due to the cutting of it either to build shrimp farming companies or to use it as firewood or construction material. Marvin's network is more homogeneous in terms of its composition. Thus, 73.3% of his contacts are fishermen (n = 33), while a small proportion are merchants (n = 6) or are either unemployed or devoted to housework (n = 6). Marvin maintains daily contact with most of them (n = 40, 88.8%), despite the fact that the density in the network of strong ties is lower than in Helder's case.

3.5. The participation of minors in fishing activities

In the Gulf of Fonseca, child labour has been traditionally linked to small-scale fishing in the family environment. Children tend to participate from an early age in the extraction on foot of various species of molluscs and crustaceans (mainly mangrove cockles and crabs in the mangroves of the Gulf) before joining other fishing activities, such as fishing with hooks or working on boats with gill nets on the open sea. It is often dangerous work, with serious consequences for the health of the minors. They accompany their parents on boats and vessels and carry out part of the extraction work in the mangroves in groups of 2 or 3 for long days in the morning or in the afternoon, at low tide. Work in the mangrove involves going into the mud to look for clams, where the humidity conditions and high temperatures, presence of mosquitoes and parasites and rubbing against the roots and trunks of the mangrove cause wounds and skin and respiratory problems.

In our study, through the interviews with fishermen, we also documented early incorporation into performing extractive activities. The average age at which the participants started fishing was 11.67 years (SD = 4.81), mainly with their parents (69.3%). This age coincides with the estimated age at which minors start fishing today. Over half of respondents state that children now start helping the family with fishing before the age of 10. Children tend to participate quite frequently in most of the activities linked to fishing, from preparing the gear to selling the fishing products. It is especially worth highlighting the unloading and cleaning of fish and fishing from boats with adults, together with extracting mangrove cockles and selling the caught fish.⁶ Fig. 4 documents some of the activities performed by teenagers in the fishing communities of San Lorenzo.

Fishermen in the coastal communities analysed consider that the participation of minors in fishing can contribute to child development, with a positive impact on their families. Although they do not think that fishing is more important than a school education (M = 2.98, SD = 2.24), they do understand that it can improve the minors' understanding of nature (M = 5.34, SD = 1.31) and community traditions (M = 5.30, SD = 1.47). Moreover, in their opinion, it allows them to develop values of honesty and respect (M = 5.34, SD = 1.40) while contributing to family well-being (M = 5.07, SD = 1.48). Table 4 also mentions other perceived benefits of the participation of minors in work activities in the fishing sector.

In fishing communities, the belief is quite widespread that the early involvement of minors in extractive activities, in preparing gear and in the unloading of fish improves the transmission of local ecological knowledge, knowledge of fishing practices and reproduction of cultural traditions and customs. Incorporation into the fishing sector occurs naturally.

"Children start working from the age of 5 because when it comes to fishing, while their father is fixing the fishing net, they are there at the same time ... they stop going to school ... If the father is cleaning a net, the child is alongside him with the *carotillo* hitting the net to

⁶ They also mention, although with less relevance, looking after the boats and gear on land, preparing and repairing gear and fishing with hooks and traps.

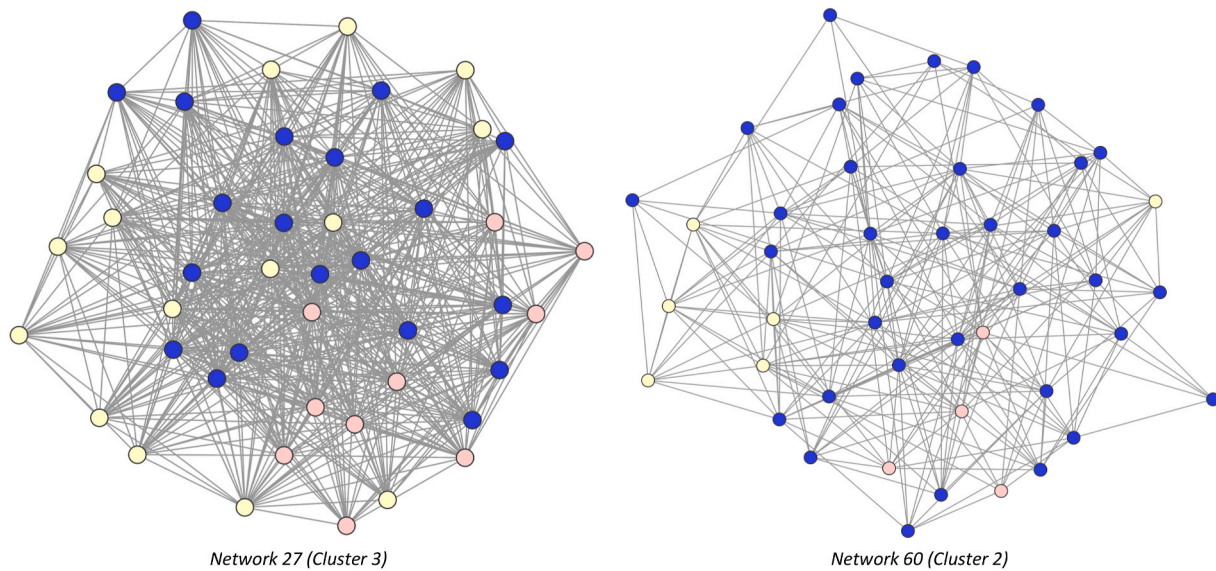


Fig. 4. Two personal networks of fishermen in San Antonio. An illustrative network from the third cluster is depicted on the left, and an illustrative network from the second cluster is depicted on the right. In both cases, only the “strong ties” have been represented, with an intensity value of 3. The colour indicates the professional sector of the personal contacts: Blue; fisherman; Yellow, labourer in other sectors; Pink, other (housework, unemployed, etc.).

Table 4
Impact and perceived benefits of the participation of minors in fishing activities.

	M	SD
Understanding of nature	5.34	1.31
Acquisition of values of honesty, commitment and respect	5.34	1.40
Knowledge of community traditions	5.30	1.47
Employment opportunities for the future	5.17	1.66
Improved family well-being	5.07	1.48
Physical and mental development	4.85	1.64
Supplement to school education	4.73	1.82
Important for family support	4.68	1.87
Pays for children’s education	4.36	2.07
More important than school education	2.98	2.24

Note. Scale of 1 “Completely disagree” to 6 “Completely agree”.

clean it. Clearly, they are already joining in with the jobs of their parents instead of going to school”. [Worker for the General Directorate of Fisheries and Agriculture]

They also believe that it has a positive impact on the acquisition of values such as honesty and commitment and that it contributes to the acquisition of skills for future employment. The lowest average is observed in the assessment of the relative importance of work compared to school. However, over a third of the fishermen surveyed (35.5%) agreed or strongly agreed that work in fishing is more important than a school education. This is reflected in a high tolerance for the involvement of children in fishing activities.

“We teach [children] when they start work, but most of the time they go with some adults because they want to start working instead of studying. Our eldest child is 16, but we do not send him to catch mangrove cockles that often, it’s better he takes advantage of going to school. Sometimes I take him on weekends, Saturday and Sunday, which is when he has free time”. [Fisherman, San José del Chaparral].

For the rest, dedication to work activities in fishing has a utilitarian function, based on the perceived benefit of the work’s contribution to the economy and to family well-being. The characteristics of minors make them especially suitable for certain fishing activities on foot in the mudflats.

“The work of children in mangrove cockle fishing is justified because they say that a child has a smaller hand to be able to enter inside the root and extract the mangrove cockle, clam or grand ark clam. Most children go because of their smaller hands and, besides that, they don’t sink, they look like they’re levitating, they don’t sink. An adult can sink up to their necks in mud, they can’t”. [Worker for the General Directorate of Fisheries and Agriculture]

According to our informants, the children seem to be aware of the changes that the mangrove is undergoing, as well as some of the risks that threaten ecosystem services. Occasional participation in the work activities of their families offers them a direct connection with that world. Children acquire skills to respond to day-to-day contingencies and learn about the socioeconomic relationships in their immediate environment. When labour participation is more intense, however, risks may appear that affect the children balanced development (see Fig. 5).

4. Discussion

In this study we document the involvement of minors in fishing activities in local communities in the Gulf of Fonseca. Children participate in the extraction of mangrove cockles, they accompany adults in fishing from a boat and they actively collaborate in preparing fishing gear. This start in work activities normally occurs between 11 and 12 years of age, frequently in the family unit. Early incorporation into fishing activities is a practice that has been maintained for generations and that contributes both to the socialization of minors in the world of work and to the transmission of situated knowledge about life in the mangrove. Sometimes it takes the form of *pre-work* activities, which facilitate learning about fishing gear or about the places and conditions in which the catch occurs. With early incorporation, children learn to combine fishing from a boat with shellfishing on foot, and they also acquire direct knowledge of the structure and functioning of the mangroves. They learn how to extract mangrove cockles and how to obtain firewood. They are also initiated into the belief system shared by their elders. They assimilate that the mangrove is deteriorating and that aquaculture exploitations together with the excessive extraction of wood put the survival of the mangrove and the fishing activity itself at risk, as the progressive reduction in catches seems to show.

Adult fishermen have a positive view of incorporating children into fishing activities. In their opinion, collaborating in the work performed



Fig. 5. Minors are involved in activities related to fishing from an early age. On the left, a teenager helps his father repair fishing nets. On the right, a teenager shows off some of the mangrove cockles he has caught in the mangrove.

by their parents provides a better understanding of nature. It is also a natural way of learning about the customs and traditions of the community, as well as an expression of respect for the elderly, with whom they collaborate through the shared assumption of responsibilities.

The results obtained in our research coincide with those from other studies, which show the importance of the mangroves and the pressures to which they are subjected. On the one hand, the mangroves play a significant role in the local economy and in the livelihood of the communities living in them (Mozumder, Shamsuzzaman, Rashed-Un-Nabi, & Karim, 2018). On the other hand, overexploitation and the spread of unsustainable practices (such as fishing with explosives, trawl fishing and small-mesh gill nets) have contributed significantly to the reduction in catches of shrimp and other populations of fish (Castellanos-Galindo et al., 2015). In the Gulf of Fonseca, it is an activity in which children have traditionally participated (Canales et al., 2006; Zelaya, 2004).

The case study also highlighted the coexistence of fishing and shellfishing on foot in the coastal communities of the Gulf of Fonseca. Some interviewees started by catching mangrove cockles, later they combined catching mangrove cockles with boat fishing and, finally, they have preferably devoted themselves to boat fishing. This trajectory seems to repeat itself with some frequency throughout the life cycle. As a result, the coastal communities are organised into subgroups with a variable structure in the fishing gear used and in their relationship with the mangrove. Shellfishing on foot seems to offer a better relationship between the time invested and the catch obtained, and is better adapted to the characteristics of minors. It is quite common for it to be used as a complement to fishing, or as an alternative when faced with economic difficulties, depending on the season or when it is close season for boat fishing. Shellfishing is, therefore, a complementary subsistence, in which the extractive activity forms part of the adaptation strategies of domestic groups in coastal areas. In other geographical contexts, the preferred participation of women and children has also been documented, in a type of activity fundamentally oriented towards local marketing and that in many cases provides a first socialization with the sea. This is the case, for example, of women shellfish catchers in Galicia, although over time their participation has evolved towards a greater professionalization⁷ (Frangoudes et al., 2008; Pita et al., 2019).

The combination of fishing and shellfishing on foot is also reflected in the diversification of the catch areas and the degree of exposure to the different ecosystem services, as well as in the heterogeneity in the composition of personal networks. This relationship between the distribution of fishing activity and the properties of personal networks has

also been observed in other contexts (Maya-Jariego et al., 2018; Maya-Jariego, Holgado, Florido & Martínez, 2016; Maya -Jariego, Querevalú, Varela & Ávila, 2017). The perception of the changes to which the ecosystem is exposed are also relevant with regard to the integration of children in fishing communities. Thus, it has been observed that the perception of changes in a fishing system affect sociocultural patterns, social networks, or the degree of community cohesion (Katikiro et al., 2015).

4.1. Practical implications and recommendations for management

The extraction of mangrove cockles has been a common subsistence practice for coastal communities linked to the mangrove in Central America for centuries. Recently, the increase in local and regional demand, and consequently in prices, has made their extraction a fundamental commercial activity for these communities, sometimes leading to situations of overexploitation. Added to this is the uncontrolled extraction of wood, as occurs in other places (Mozumder, Shamsuzzaman, Rashed-Un-Nabi & Karim, 2018). However, small-scale fishermen perceive that the greatest threats to mangrove sustainability come from aquaculture farms. Some even suggest the existence of possible bribes to public officials, and they generally declare themselves to be in favour of a greater regulation of the uses of the mangrove.

The fishermen's collective depends on intermediaries ("middlemen") for marketing. This system places fishermen in a position of extreme weakness given the ability of the claimants to set downward prices in a stable manner, thus encouraging the intensification of the extractive activity (Bjorndal et al., 2014; Jacinto and Pomeroy, 2011; Pollnac et al., 2001). Consequently, improving the governance of the value chain could have a significant impact on the quality of life of the population (Jentoft and Chuenpagdee, 2018). Thus, we had the opportunity to verify this through the precarious conditions in which fishing families live on the Pacific coast of Honduras.

In this study, we have examined the involvement of minors in work and *pre-work* activities in the fishing sector, therefore, it can be connected with the concept of "decent work" drawn up by the International Labour Organization (ILO) (Garcia-Lozano et al., 2021). Among other recommendations, the ILO has proposed the need to (a) generate adequate employment opportunities, (b) establish regulatory standards over labour rights, (c) improve workers' social protection mechanisms and (d) promote the tripartite social dialogue (between workers, employers and governments). For its part, the Food and Agriculture Organization of the United Nations (FAO) establishes a guide in which it recommends guaranteeing access to education for minors, promoting decent work and, at the same time, taking into account the peculiarities of small-scale fisheries and their livelihoods (Kurien, 2015). More

⁷ Active work has been done with this group, for example in Spain, on the social visibility of its activity, in an attempt to improve the management, marketing and political recognition of said activity.

broadly, article 32.1 of the Convention on the Rights of the Child "recognise the right of the child to be protected from economic exploitation and from performing any work that is likely to be hazardous or to interfere with the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral or social development" (United Nations General Assembly, 1989, p. 10).

In the Gulf of Fonseca, we were able to verify that children naturally take part in fishing activities, often under the supervision of adults in their family. In this case, the number of hours, the schedules and conditions under which this activity is performed could be determinants of its personal or educational impact and, ultimately, of its consideration as "child labour" (Holgado, Maya-Jariego, Palacio & Oviedo-Trespalacios, 2016; Holgado et al., 2014). The community itself conceives the participation of minors as a way of assuming responsibilities, developing skills and acquiring a better understanding of the natural environment. In many cases, it will have a positive impact. However, there may be activities that pose a health risk⁸ or a level of dedication that interferes with their continuation with compulsory education. For those cases, despite family beliefs and values, it may be necessary to implement community prevention actions for child labour (Maya-Jariego, 2017, 2021).

Compared to other sectors of activity, the fishing sector is often exposed to precarious working conditions (García-Lozano et al., 2021). With regard to minors, even extreme cases of forced labour, slavery and human trafficking have been documented (Agbenya, 2009; Hamenoo and Sottie, 2015; Jensen, 2013). Hence, despite the great variability of situations, the establishment of a minimum age for work and the ratification of international ILO agreements are generally recommended. Moreover, conditional cash transfers, psycho-educational interventions and tripartite coalitions have been shown to be particularly effective (Maya-Jariego, 2021). However, as we have documented in the case of Fonseca, when it comes to family subsistence activities, it is also necessary to adapt it to the local conditions and introduce improvements that increase the community fit of interventions. We believe that inter-generational transmission of local knowledge should be ensured and even integrated as part of formal education to empower coastal communities in the face of threats to mangrove ecosystems. This openness to local knowledge is also a tool to engage future fishing communities in bottom-up conservation activities, as well as to ensure fair access and use of mangrove ecosystem services, while sustaining livelihoods.

4.2. Child labour and the governance of small-scale fisheries

The term "child labour" is often used to refer to any participation of minors in the world of work (i.e., below the minimum legal working age). However, in practice, this label covers a great diversity of situations, ranging from collaboration with family subsistence activities to forced labour or slavery, passing through different forms of wage labour (Maya-Jariego, 2021). In the case of fishing, for example, port fish-sorting, deep-sea fishing, or high-risk dive fishing under harsh conditions would fall into that same category (Damcha-om, 2002; Hamenoo and Sottie, 2015), to name just a few. Understandably, the potential impact of each of these modalities on child development and well-being is clearly different. In turn, the intervention strategies that are relevant and effective would be also different in each case.

In those families that have a subsistence economy, all members usually play an active role in maintaining the household, so we need to consider the role of women and children in obtaining resources and generating income (Pomeroy, 1987). Otherwise, when the family base of small-scale fisheries is ignored, it becomes increasingly difficult to recruit new generations for the sector, and consequently the very

⁸ For example, mosquito bites, skin problems due to humidity and rubbing against mangrove roots, or nicotine addiction due to the tobacco used to drive away mosquitoes, among other problems, have been described.

continuity of the fishing activity can be put at risk. This seems to be the case when the emphasis is placed on reducing the size of fisheries through greater professionalization (Neis et al., 2013). Furthermore, this may be aggravated in a context of climate change, to the extent that the perception of greater uncertainty (such as an increased risk of storms) reduces parents' expectations for their children to be fishermen (Sereneonchai and Arunrat, 2019).

As far as effective governance practices are concerned, the prevention of early involvement in work activities usually entails the implementation of educational reinforcement programs, which guarantee the completion of compulsory schooling. At a higher severity level, reducing the risk associated with hazardous work typically requires rehabilitation, community reintegration, and tertiary prevention strategies. In the most extreme cases, the intervention focuses on ensuring compliance with the law, which often involves judges, labour inspectors, or the police (Maya-Jariego, 2021). In the coastal communities of Fonseca, we observe a certain predominance of light or episodic forms of labour participation, which contribute positively to socialization in the world of fishing and facilitate the direct relationship of minors with the natural environment. Nevertheless, this same incorporation by default of the children of fishermen in the fishing sector may also contribute to the reproduction of the social status of their parents, as well as it partially limits their opportunities for upward social mobility. In addition, there are activities, such as shellfishing on foot in the mangrove swamp, that test the physical resistance capacity of minors and that are classified by the ILO as dangerous work (ILO, 2018).

Therefore, although very often the collaboration of minors with the family's subsistence activities is not comparable to the worst forms of child labour, fishing in the mangroves also usually entails a series of potential risks that make it advisable the implementation of preventive actions or mitigation of its impact. In addition, sometimes early labour activities reduce minors' life opportunities along their life course, which is why it is necessary to enhance their educational experience and implement other compensatory measures that guarantee the completion of compulsory studies.⁹

5. Conclusion

In the coastal communities of the Gulf of Fonseca (Honduras), children begin to interact with the mangrove swamp at an early age and often carry out pre-work activities, collaborating in fishing with their parents. This facilitates the intergenerational transmission of both local ecological knowledge and effective fishing practices. In many cases, early work activity is punctual or episodic and does not interfere with compulsory schooling. However, shellfishing on foot in the mangrove carries health risks, while early involvement in the world of fishing reduces the diversity of job opportunities available to them during their adult lives. This implies that abolitionist approaches to child labour may not be sufficiently sensitive to the local reality of the fishing sector in certain geographical contexts. But at the same time, there is evidence of the need to prevent school dropout and strengthen social protection measures for children from low-income families. The early socialization of minors in the fishing sector facilitates the social reproduction and future sustainability of fishing. However, given the conditions in which this activity is normally carried out, it is advisable to be vigilant about the development and well-being of children in families that are

⁹ Another alternative consists of promoting entrepreneurship and innovation in the fishing sector. Both training and local development initiatives can be particularly relevant to boosting opportunities for young people in fishing communities. Training allows improvements to be made in fishing companies as well as in fishing modalities, in turn influencing the employment profile of the sector. This training can be especially relevant with the school-age population, as a way to maintain the link with traditional knowledge about the sea, the maintenance of fishing tools or knowledge about marine species.

dedicated to fishing. Primary and secondary prevention initiatives are a priority in this context.

This document contributes to the field of ocean and coastal management in terms of providing insight into the multiplicity of identities of youth in coastal communities. The consideration of the various modalities of labour and pre-labour participation of minors in the fishing sector helps to distinguish potentially positive or negative effects on their personal development. This would benefit both academics and practitioners in rethinking context-based interventions for youth in fishing communities.

Informed consent

The participants signed an informed consent in the following terms: "Mr./Mrs. ____ with identity document number ____ provides this information voluntarily and after being informed of the objectives of the research for which it is collected. The researchers agree to use the information only for research purposes and to respect anonymity and aggregate use in data processing and dissemination of results. You can withdraw from your participation in this research at any time you deem appropriate."

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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