

# Critical Points Concerning Artisanal Fishing: an Analysis from the Perspective of Artisanal Fishers in Southeastern Brazil

*Juliana Silva de Abreu*<sup>1</sup> 

*Laura Helena de Oliveira Côrtes*<sup>2</sup> 

*Camilah Antunes Zappes*<sup>3</sup> 

## **Keywords**

Comanagement  
Fishing  
Fishing Communities  
Traditional Knowledge  
Coastal Mesoregion of  
Brazil

## **Abstract**

In Southeastern Brazil, artisanal fishing communities reside, operate and suffer from interference originating from various economic branches. Thus, this study is aimed at identifying the critical points concerning the practice of artisanal fishing from the traditional knowledge of artisanal fishers in the coastal mesoregion of ES. 102 ethnographic interviews were conducted in 2022 with artisanal fishers through a semistructured questionnaire containing both open and closed questions. The critical points of fishing were identified through a SWOT analysis (strengths, weaknesses, opportunities, and threats). All the participants were men (n=102; 100%), and they reported that negative critical points (weaknesses and threats) exert the greatest influence on fishing. From the perspective of these fishers, the main problems that interfere with artisanal fishing are the lack of adequate fish storage, the precariousness of the vessels, the reduction in fish stocks, the high perishability of fish, the devaluation of traditional knowledge, and the presence of middlemen that prevent the commercialization of fish production from moving directly from the fisher to the final consumer. The identification of these critical points enables the recognition of flaws in the production chain and the realization that they can be minimized through public policies and comanagement strategies related to the economic, ecological, and social development of the sector.

<sup>1</sup> Universidade Federal do Espírito Santo - UFES, Vitória, ES, Brazil. [juliana.silva.abreu.br@gmail.com](mailto:juliana.silva.abreu.br@gmail.com)

<sup>2</sup> Universidade Federal do Espírito Santo - UFES, Vitória, ES, Brazil. [laurahocortes@gmail.com](mailto:laurahocortes@gmail.com)

<sup>3</sup> Universidade Federal do Espírito Santo - UFES, Vitória, ES, Brazil. [camilahaz@yahoo.com.br](mailto:camilahaz@yahoo.com.br)

## INTRODUCTION

Artisanal fishery is an activity involving family labor that guarantees the income and subsistence of the members of traditional coastal communities, and fish stocks are important natural resources supporting this activity (Alves *et al.*, 2019). Artisanal production is performed on small and medium scales and relies on diverse technologies and low autonomy vessels that operate close to the coast (Oliveira *et al.*, 2016). In Brazil, this is an economic activity performed by fishers either “autonomously or as a family economy, with its own means of production or by means of a partnership contract, landed, and may use small vessels” (Brasil, 2009, art. 8, inc. I).

On the world stage, artisanal fishery has been facing problems related to predatory fishing, a drop in the number of active fishers, degradation of coastal environments, port activities, real estate speculation, low education and income of those involved in the activity, scientific data and management lack (Tidd *et al.*, 2022). Such factors reflect on the quality of fishing resources and the sustainability of artisanal fishery. Despite these negative points, the sector generates more than 2.8 million direct and indirect jobs mainly in Latin America and the Caribbean and produces around 70 million tons of fish, which contributes to food security for thousands of families and the eradication of poverty (FAO, 2020).

Studies in the South Atlantic Ocean, specifically those on the Brazilian coast, show a decrease in marine fish stocks that is mainly due to overfishing, noncompliance with the closed season, conflicts over fishing territories, food insecurity, pollution, lack of inspection, and governmental and traditional regulatory measures (Fogliarini *et al.*, 2021). However, the Brazilian coast is extensive, where there is intense artisanal fishery activity, diversity of fishing resources and coastal ecosystems, such as estuaries and mangroves (Oliveira *et al.*, 2020). These are considered critical points that exert socioenvironmental and socioeconomic influences on fishing communities (Fogliarini *et al.*, 2021). In this sense, analyzing the potential and limitations of artisanal fishery can contribute to the development of measures to reduce negative points, and consequently, contribute to the sustainability of fishing.

Comanagement actions consist of integrating stakeholders into decision-making processes

ranging from the local to the governmental level to develop more democratic public policies (Côrtes *et al.*, 2019). Public policies aimed at artisanal fishery do not always involve social, environmental, and economic criteria that are aligned with the local reality due to the devaluation of the traditional community knowledge that depends on this activity (Abreu *et al.*, 2017). The traditional knowledge of marine fishers is considered to comprise detailed information about the environment; moreover, local actors from fishing communities are fundamental stakeholders in the safeguarding of environmental and fish stock health due to their economic and cultural dependence on this environment (Abreu *et al.*, 2020).

In some countries, such as Turkey, Greece, Canada, and the Caribbean islands, the comanagement of fisheries takes place between public authorities and fishing communities through the ongoing participation of both parties (Cadman *et al.*, 2022; Ertör-akyazi, 2019). This comanagement enables the reduction of negative interferences and strengthens the dialog among stakeholders in the process of creating public policies aimed at managing fishery resources (Ertör-akyazi, 2019). In Brazilian artisanal fishery, socioenvironmental conflicts do occur, which highlights the absence of efficient comanagement of this activity (Edwards *et al.*, 2019). Stakeholders show interest in participating in decision-making processes, but their lack of dialog with managers hinders their participation (Abreu *et al.*, 2017).

In southeastern Brazil, specifically in the state of Espírito Santo (ES), artisanal fishery both supplies the regional market and serves as the financial and cultural support of local communities (Abreu *et al.*, 2020). The annual fish production in ES is approximately 21,000 t, which shows the importance of food and economic security for fishing communities (UFES, 2013). According to the artisanal fishers in the region, fish production is decreasing due to the absence of comanagement and the devaluation of traditional knowledge in decision-making processes (Abreu *et al.*, 2020). Thus, to promote the efficient comanagement of fishery resources, this study is aimed at identifying the critical points related to the practice of artisanal fishery from the perspective of the traditional knowledge of the artisanal fishers operating in the region.

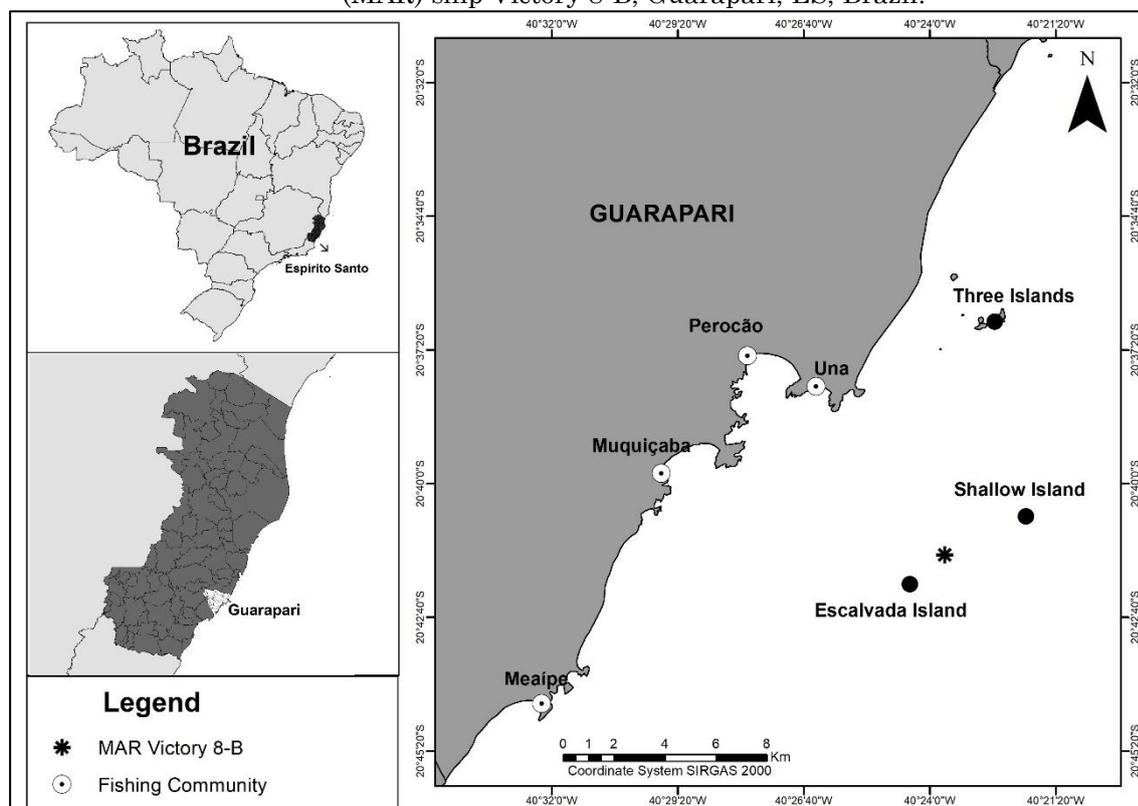
## MATERIALS AND METHODS

### Study area

In southeastern Brazil, the municipality of Guarapari (20°38'S 40°27'W) is located in the state of ES (IBGE, 2023). Artisanal fishery is part of the local culture, and there are more than 1,400 fishers registered in the Z-3 Fishing Colony. The main fishing areas are located around the Rasas and Escalvada Islands and the Three Island Archipelago, in addition to the

marine artificial reef (MAR) ship Victory 8-B, which serves as an important habitat for the target species of artisanal fishery (Figure 1) (Abreu *et al.*, 2020). Moreover, the region hosts different conflicts involving the competition for fishing territory that occurs among the fishers themselves and between these and uncontrolled sport fishing and diving tourism (Abreu *et al.*, 2021). These conflicts are most intense during the summer (December to March), when the local population, estimated at 120,000, receives more than 500,000 tourists and excursionists.

Figure 1 - Location of the studied fishing communities, coastal islands, and the artificial marine reef (MAR) ship Victory 8-B, Guarapari, ES, Brazil.



Source: The authors (2023).

### Procedures

The research project to which this study is linked is registered on the platform of the National System for the Management of Genetic Heritage and Associated Traditional Knowledge (Sistema Nacional de Gestão do Patrimônio Genético - SISGEN), under the number AF42FD7, and approved by the Brazil Platform/Research Ethics Committee (CAAE: 03219018.0.0000.5243) in compliance with Brazilian legislation (Brasil, 2015). The proposal for this study was also approved by the communities studied, and the president of the Z-3 Fishing Colony, who is the legal representative

of this category, signed a prior consent form (Brasil, 2015)

In 2022, 102 ethnographic interviews were conducted using a semistructured questionnaire with both open and closed questions, but these interviews were kept flexible in case clarifications were needed (Adams, 2015). The sample number (n=102) was deemed sufficient since the data acquired began to become repetitive and lacking in new information, thus indicating that the saturation point had been reached (Mason, 2010). Participants were selected according to the following criteria: 1) participants must be over 18 years of age, 2) an artisanal fisher registered in the Z-3 Fishing Colony, and 3) work in the coastal mesoregion of

the state of ES, Southeastern Brazil. In the region studied, women are responsible for domestic tasks, cleaning and marketing.

The interviews began after trust had been established between the researcher and these communities through participation and direct observation (Lopez-Dicastillo; Belintxon, 2014). At the end of each day of data collection, direct observations made in these communities were recorded in a field diary (Wolfinger, 2002). The first interviewee was selected via opportunistic encounters within the communities, while the snowball method was applied to select the rest of the participants (Naderifar *et al.*, 2017). This method works through the method of interviewees suggesting other potential participants (Naderifar *et al.*, 2017). The interviews were conducted individually in the form of a dialog according to the availability of each participant.

### *Data analysis*

The questionnaire information was organized by themes and divided into the following categories: 1) the socioeconomic profile of the fishers and 2) the critical points of artisanal fishery. Based on the triangulation method, data obtained from participants and direct observations and in the field diary were cross-checked against the information obtained from the questionnaires to identify any similarities and differences in the answers. This triangulation technique enabled the most accurate results (Heale; Forbes, 2013). The basic descriptive statistics, average (MED) and standard deviation (SD) were applied to participant responses to social (Kaur *et al.*, 2018).

The participants' perceptions of the critical points of artisanal fishery were assessed through a SWOT analysis (strengths, weaknesses, opportunities, and threats) (Helms; Nixon, 2010). "Weaknesses" correspond to internal failures, and refer to the weak points identified by the respondents that originate in the communities themselves. "Threats" are events in the external environment that affect critical points and prevent the growth of fishing activity in terms of stock use, income, fishing technologies, the valorization of traditional knowledge, and the promotion of dialog among stakeholders. "Strengths" refer to the positive characteristics of artisanal fishery that serve to reduce threats and weaknesses. "Opportunities" are positive events in communities that should be seized, as they contribute to improving the

practice of fishing (Viegas *et al.*, 2014; Glass *et al.*, 2015; Abreu *et al.*, 2017).

The fishers' reports were categorized in four quadrants and divided into internal and external environments as follows: the internal environment (the variables controlled by the community) includes 1) strengths and 2) weaknesses; and the external environment (the variables not controlled by the community) include 3) opportunities and 4) threats. Although the environment is not controlled by the community, in some cases, it can still be influenced by it (Figure 2) (Helms; Nixon, 2010). SWOT analysis enables the development of strategies for maintaining strengths, expanding opportunities, and reducing threats and for enhancing decision-making, strategic planning, and the comanagement of fishery resources (Helms; Nixon, 2010; Abreu *et al.*, 2017).

## RESULTS

### *Socioeconomic profile of artisanal fishers*

All participants were men (n=102;100%), aged 28 to 75 years (n=99; 97%) (MED = 52 years; SD = 12 to 14), with prior experience in local fisheries ranging from 14 to 60 years (MED = 30 years; SD = 13 to 17). Regarding schooling, 78% (n=80) did not complete primary education, 12% (n=12) did not complete secondary education, and 10% (n=10) had never studied (no formal schooling). 92% of the participants (n=93) reported a monthly income of higher than US\$ 252.77 (R\$ 1,200.00, in Brazilian real values from 2020 to 2022) and entirely derived from fishing activity.

### *Perception of strengths, weaknesses, opportunities, and threats*

According to the interviewed fishers, fresh fish (n=32; 32%), the use of new technologies (n=19;19%), and traditional knowledge of the marine environment (n=17;17%) were the main strengths of artisanal fishery (Table 1). On the other hand, the most reported weaknesses were Improper storage (21.5 %), reduction of fish stocks (19.5%), devaluation of traditional knowledge (14.7%), precarious transportation (13.7%), presence of illegal fishers (13%), low educational level of fishers (9.8%), high cost of catching fish (9.8%), lack of public regulations on fisheries (9.8%), lack of technical assistance (7.8%), absence of traditional management (6.8%) and lack of unity among fishers (4.9%).

**Table 1** - Strengths interfering with artisanal fishery in Southeastern Brazil.

<b>Strengths</b>	<b>N*</b>	<b>%</b>
Fresh fish	32	32
Use of new technologies	19	19
Traditional knowledge of the marine environment	17	17
Diversity of fish	14	13.5
Does not know	8	7.5
Recognition of interference with fishing activity	6	5.5
No answer	6	5.5
<b>Total</b>	<b>102</b>	<b>100</b>

Legend: N: number of reports. Source: The authors (2023).

In terms of opportunities, fishers pointed to the valorization of the artisanal fishery (n=32;32%), the growing consumer market (n=15;15%) and products for their own consumption (n=12;12%) (Table 2). However, the reduction of fishery resources (19.6%), high perishability (15.6%), low income from fishing activity (15.6%), overexploitation of fish stocks (14.7%), increase in input prices (13,7%), competition with the regional market (11.7%), devaluation of traditional knowledge (11.7%), presence of middlemen (9.8%), difficulty of creating dialog between stakeholders (8.8%), environmental barriers (8.8%), fish stocks

affected by reduced public inspection (7.8%), lack of incentive for fisheries research (4.9%) and disinterest of young people in maintaining the tradition of artisanal fishery (3.9%). Fishers reported more than one threat, which explains the higher number of answers (n=150) than participants (n=102). SWOT analysis showed that the negative factors (weaknesses and threats) were the most perceived by the participants and that they directly interfered with the positive factors (strengths and opportunities) of artisanal fishery in Guarapari (Table 3).

**Table 2** - Opportunities in artisanal fishery in Southeastern Brazil.

<b>Opportunities</b>	<b>N*</b>	<b>%</b>
Valorization of artisanal fishery	32	32
Growing consumer market	15	15
Product for self-consumption	12	12
Contribution of traditional knowledge of the marine environment to sustainable practices	11	10.5
Contribution of stakeholder dialog to comanagement	11	10.5
Introduction of new fishing technologies	9	8.5
Assistance from research institutions for new equipment	7	6.5
Does not know	5	5
<b>Total</b>	<b>102</b>	<b>100</b>

Legend: N: number of reports. Source: The authors (2023).

**Table 3** - SWOT analysis scheme: analysis of the critical points related to the practice of artisanal fishery in Southeastern Brazil from the perspective of.

	<b>Strengths</b>	<b>Weaknesses</b>
<b>INTERNAL ENVIRONMENT</b>	<ul style="list-style-type: none"> <li>• Fresh fish</li> <li>• Diversity of fish</li> <li>• Use of new catching technologies</li> <li>• Traditional knowledge of the marine environment</li> <li>• Recognition of interference with fishing activity</li> </ul>	<ul style="list-style-type: none"> <li>• Improper storage</li> <li>• Precarious transportation</li> <li>• Reduction of fish stocks</li> <li>• Presence of illegal fishers</li> <li>• Lack of technical assistance</li> <li>• Low educational level of fishers</li> <li>• High cost of catching fish</li> <li>• Disunity among fishermen</li> <li>• Devaluation of traditional knowledge</li> <li>• Absence of traditional management</li> <li>• Lack of unity among fishers</li> <li>• Reduction of fish stocks</li> </ul>
	<b>Opportunities</b>	<b>Threats</b>
<b>EXTERNAL ENVIRONMENT</b>	<ul style="list-style-type: none"> <li>• Product for self-consumption</li> <li>• Growing consumer market</li> <li>• Valorization of artisanal fishing</li> <li>• Assistance from research institutions for new equipment</li> <li>• Introduction of new fishing technologies</li> <li>• Contribution of traditional knowledge of the marine environment to sustainable practices</li> <li>• Contribution of stakeholder dialog to comanagement</li> </ul>	<ul style="list-style-type: none"> <li>• High perishability</li> <li>• Competition with the regional market</li> <li>• Presence of middlemen</li> <li>• Low income from fishing activity</li> <li>• Increase in input prices</li> <li>• Environmental barriers</li> <li>• Overexploitation of fish stocks</li> <li>• Reduction of fishery resources</li> <li>• Lack of incentive for fisheries research</li> <li>• Disinterest of young people in maintaining the tradition of artisanal fishing</li> <li>• Low income from fishing activity</li> <li>• Devaluation of traditional knowledge</li> <li>• Difficulty of creating dialog between stakeholders</li> <li>• Fish stocks affected by reduced public inspection</li> </ul>

Source: The authors (2023).

## DISCUSSION

### *Socioeconomic profile of artisanal fishers*

In the coastal mesoregion of ES, southeastern Brazil, fishing is a traditional activity that is primarily performed by men with low levels of

education. Despite the predominance of men during data collection in this study, other studies conducted in the region show that women participate in the management of the activity (Abreu *et al.*, 2020). Women are responsible for cleaning the fish, a task that facilitates marketing and raises the final value

of the product. However, public policies fail to consider this benefit (Gissi *et al.*, 2018).

In recent decades, women fishers have achieved improvements in health and education through their participation in the sector, but the importance of their activities in the fishing production chain is still not recognized, which directly interferes with their socioeconomic condition (Harper *et al.*, 2013). This invisibility reaches educational and research institutions and fishery statistics in Brazil and other countries, such as Mexico, England, Finland, and South Africa (Harper *et al.*, 2013; Salmi; Sonck, 2018). Studies highlighting the importance of the role of women in fisheries management should be encouraged through funding, as cultural values tend to overvalue the work of men and underestimate that of women (Andrade *et al.*, 2021). Studies related to gender in fishing activities are still scarce, which may influence the absence of public policies aimed at the division of labor (Gissi *et al.*, 2018; Andrade *et al.*, 2021). Therefore, understanding gender inequality within the fishing production chain may contribute to achieving Sustainable Development Goal (SDG) 5 (Gender equality) of the United Nations 2030 Agenda.

The age range of fishers is similar to those found in other studies in the same state (Abreu *et al.*, 2020; Musiello-Fernandes *et al.*, 2020). This shows that individuals of different generations engage in artisanal fishery and that traditional knowledge is locally passed on across generations, since fishers of diverse ages are common (Abreu *et al.*, 2020). The low educational level is a result of the lack of opportunity and encouragement regarding formal education. Since their youth, members of fishing communities have been involved in fishing to generate household income. Generally, other members of the household also have low levels of education (Musiello-Fernandes *et al.*, 2020). This lack of technical training hinders the performance of local household members in other types of economic activity, as well as hindering their participation in decision-making (Oliveira *et al.*, 2016).

In the studied communities, fishing is the main source of income for fishers, which highlights the economic dependence of families (Abreu *et al.*, 2020). The amount received is considered low (about U\$ 252.00, which is lower than the minimum wage in Brazil of R\$ 1,200.00) and does not allow for the adequate provision of basic family needs. Moreover, financial insecurity motivates young fishers to seek other economic activities (Abreu *et al.*, 2021). This financial insecurity is directly related to the increase in poverty and food

insecurity, which is an important discussion in regard to the 2030 Agenda, specifically regarding SDG 1 (No poverty), 2 (Zero hunger), and 3 (Good health and well-being). Measures to minimize the problems that arise from the professional and financial constraints on fishing communities are important for ensuring the quality of life of those families dependent on artisanal fishery and for Brazil's contribution to achieving the SDGs of the 2030 Agenda.

Understanding the socioeconomic profile of fishing communities is indispensable for their economic development, their social organization, and the implementation of conservation measures for fish stocks. However, this type of study is neglected by educational and research institutions, which causes community helplessness (García-de-la-Fuente *et al.*, 2013). Thus, further socioeconomic studies of these communities are necessary to understand their context and support the creation of incentives and development measures for fishing activity.

### *Perception of strengths, weaknesses, opportunities, and threats*

The SWOT analysis showed that weaknesses and threats were the critical points most mentioned by fishers. This indicates that these points pose greater interference with the practice of artisanal fishery. In contrast, traditional knowledge can be an important tool for contributing to sustainable practices by minimizing these critical points (Renck *et al.*, 2023). Local knowledge increases and adapts over generations through the experiences and perceptions of artisanal fishers concerning the changes that occur in the environment. Anticipating interference and creating local and regional public policies (Renck *et al.*, 2023) are crucial activities. However, traditional knowledge is not considered in public policies and the participation of local actors is little encouraged (Renck *et al.*, 2023).

In Brazil, public policies are developed by politicians, researchers, and technicians who, in some situations, disregard popular knowledge (Renck *et al.*, 2023). Decisions are made top-down, and they originate in political centers whose members are unaware of the specific scenarios within fishing communities. Thus, these communities are affected by the implementation of public policies that do not include local and/or regional realities, thus increasing the inefficiency of fisheries management. Therefore, planning and actions aimed at artisanal fishery should occur in conjunction with fishing communities,

educational and research institutions, and public management. Moreover, information provided by science and traditional knowledge should be considered in the creation of strategies for improving strengths, seizing opportunities and reducing weaknesses and threats (Abreu *et al.*, 2017).

The studied coastal mesoregion has a complex reef with natural and artificial corals, which allows the development of a diversity of species and, consequently, a variety of fish. Due to this characteristic, the area attracts the attention of artisanal fishers, divers, tourists, and visitors who practice sport fishing and who use the area daily (Abreu *et al.*, 2021). However, there are no planning measures to regulate the use and catch of fish in informal fishing and diving, which increases the uncontrolled informal exploitation of fishing in the region and intensifies the conflicts among stakeholders over disputed fishing grounds (Abreu *et al.*, 2021).

The overexploitation of local stocks is even more intense during the summer (holiday season in Brazil) and on holidays. On these occasions, the number of people consuming fish in the studied region triples, thus increasing the consumer market for artisanal fishery (Abreu *et al.*, 2021). The absence of suitable marketing venues means that fishers have little access to the final consumer. This forces them to pass on fishing production to middlemen for reduced values, which serves to reduce the household income of fishers (Côrtes *et al.*, 2019).

Middlemen represent a link between fishers and the consumer market. They have better transport, storage, and marketing structures, which increases the value of the product for the final consumer (Côrtes *et al.*, 2019). However, this work structure does not increase the sale value of production at the stage when the fisher sells to the middleman. The presence of middlemen hinders the improvement of communities and contributes to social exclusion and the expansion of informal fishers (Côrtes *et al.*, 2019). Thus, the artisanal fishery chain itself contributes to the devaluation of fishing, but it also displays critical points, such as the need for suitable marketing to reduce costs for the final consumer and increase the income of fishing households.

As a strength of this study, artisanal fishers have vested interest in the use of new technologies that favor the catch of fish and the sustainability of fishing. However, the vessels and artifacts used by Brazilian artisanal fishers are still simple and precarious (Alves *et al.*, 2019). The fishers interviewed used sonar to locate fishing grounds as a way of increasing

their fishing efficiency, but their low education level hinders the use of new technologies and, combined with their low income, limits investment in new equipment (Alves *et al.*, 2019).

In Brazil, artisanal fishery is managed by the government, which is responsible for implementing any planning measure (Begossi, 2014). This model does not always consider the interests of artisanal fishers in pursuing new forms of management and catching technologies, since traditional knowledge is neglected by the absence of a scientific basis in this model (Begossi, 2014). The lack of dialog between the fishing communities and the government results from the top-down management style, which hampers the definition and implementation of sustainable measures (Côrtes *et al.*, 2019). Thus, educational and research institutions can partner with communities to assist in the development and use of new sustainable technologies (Abreu *et al.*, 2017).

Fishing represents the connection between fishers and their cultural identity, which is a key element in maintain the tradition underlying artisanal fishery (Côrtes *et al.*, 2019). The dangers involved in sea fishing and the low financial return discourage young people from remaining in this profession, which is a dynamic that can exclude the sector and traditional knowledge from the decision-making processes (Oliveira *et al.*, 2020). The marine ecosystem has always been linked to the way of life of fishers, and therefore, they are able to perceive any changes and/or interferences in this environment (Alves *et al.*, 2019). This perception allows the recognition of fundamental peculiarities that lead to the identification of negative impacts on artisanal fishery (Oliveira *et al.*, 2020). Thus, the establishment of dialog between managers and the fishing community can contribute to the development of comanagement measures for the sustainable use of fishing and, consequently, the maintenance of the tradition of fishing (Abreu *et al.*, 2017).

The social, economic, cultural, and environmental demands of fishing communities must be integrated into the management of the ecosystem in which they are situated since the traditional knowledge of this category holds information that can contribute to the development of conservation and activity management measures (Begossi, 2014). SWOT analysis provides information for identifying the strengths, weaknesses, opportunities, and threats that are considered critical points for artisanal fishery (Benzaghta *et al.*, 2021). The

identification of negative points (weaknesses and threats) allows the determination of comanagement strategies for improving the use of the positive points (strengths and opportunities) of fishing. The following tables describe the actions taken to increase strengths

(Table 4), reduce weaknesses (Table 5), seize opportunities (Table 6), and mitigate threats (Table 7) that can be applied both in the coastal mesoregion in southeastern Brazil and in other fishing communities with similar characteristics.

**Table 4 - Actions for increasing the strengths of artisanal fishery in Southeastern Brazil.**

<b>Actions to increase strengths</b>	<b>Managers</b>
1) In Periodic inspection of fish stocks for identification and conservation of target species for artisanal fishery.	Educational and research institutions Fishing communities Public managers Institutions that encourage artisanal fishery
2) Creation of new fisheries technologies that are less invasive to the environment and that benefit the physical health of artisanal fishers.	Educational and research institutions Nongovernmental organizations Institutions that encourage artisanal fishery
3) Conversation circles formed in community educational institutions to share experiences and valorize the local culture.	Educational and research institutions Fishing communities Nongovernmental organizations Public managers Funding agencies for education
4) Production of data and reports aimed at identifying conflicts involving fishing.	Educational and research institutions Fishing communities

Source: The authors (2023).

**Table 5** – Actions for reducing the weaknesses that interfere with artisanal fishery as practiced in Southeastern Brazil.

<b>Actions to reduce weaknesses</b>	<b>Managers</b>
1) Creation of a public policy for the purchase of materials for the storing and preserving of fish during fishing.	Educational and research institutions Nongovernmental organizations Public managers Institutions to encourage artisanal fishery
2) Elaboration of public policies designed to encourage the restoration of vessels operating in precarious situations.	Educational and research institutions Nongovernmental organizations Public managers Institutions to encourage artisanal fishery
3) Creation of university extension programs involving artisanal fishery.	Educational and research institutions Public managers Research funding agencies
4) Increased inspections to reduce the presence of illegal fishers.	Educational and research institutions Fishing communities Public managers Institutions to encourage artisanal fishery
5) Valorization of the traditional knowledge of fishers in schools by public and private educational institutions.	Educational and research institutions Fishing communities Public managers
6) Projects undertaken in partnership with communities to identify alternatives to the traditional management of fishing resources.	Educational and research institutions Fishing communities Public managers Research funding agencies

Source: The authors (2023).

**Table 6** - Actions for seizing the opportunities facing artisanal fishery as practiced in Southeastern Brazil.

<b>Actions to seize opportunities</b>	<b>Managers</b>
1) Establishment of suitable markets to sell fish to encourage the local consumer market.	Educational and research institutions Fishing communities Public managers Institutions to encourage artisanal fishery
2) Educational activities coordinated by local leaders to disseminate information about artisanal fishery.	Educational and research institutions Nongovernmental organizations Fishing communities Public managers
3) Meetings in the communities focused on providing technical assistance to facilitate the use of new technologies in fishing activities.	Educational and research institutions Nongovernmental organizations Fishing communities Public managers Institutions to encourage artisanal fishery
4) Preparation of materials on environmental sustainability that combine scientific and traditional knowledge.	Educational and research institutions Nongovernmental organizations Fishing communities Public managers Institutions to encourage artisanal fishery
5) Promotion of dialog among stakeholders to create effective and democratic coastal comanagement.	Educational and research institutions Nongovernmental organizations Fishing communities Public managers

Source: The authors (2023).

**Table 7** - Actions for reducing the threats that interfere with artisanal fishery as practiced in Southeastern Brazil.

<b>Actions to reduce threats</b>	<b>Managers</b>
1) Training of fishers in fish conservation practices in order to reduce the perishability of fish.	Educational and research institutions Nongovernmental organizations Public managers
2) Business management training for fishers, taught in local vocabulary, aimed at reducing the presence of middlemen.	Educational and research institutions Fishing communities Public managers
3) Development of partnerships between local fishing supply associations and communities in order to reduce the cost of catching fish.	Nongovernmental organizations Public managers Institutions to encourage artisanal fishery Private local input companies
4) Identification of local environmental problems based on the perspective of fishers to guarantee the participation of local actors and the valorization of traditional knowledge.	Educational and research institutions Fishing communities Public managers
5) Incentivizing compliance with fishing regulations and legislation in order to maintain the sustainability of the activity.	Educational and research institutions Fishing communities Nongovernmental organizations Public managers
6) Incentivizing the funding of research projects related to fishing culture.	Educational and research institutions Public managers Research funding agencies
7) Creation of social programs to attract young people to artisanal fishery to encourage the local fishing culture.	Educational and research institutions Nongovernmental organizations Fishing communities Public managers

Source: The authors (2023).

## FINAL CONSIDERATIONS

SWOT analysis enables the identification of the strengths, weaknesses, threats, and opportunities that interfere positively and negatively with artisanal fishery. The main strengths identified by the fishers were fresh fish, the use of new technologies, and traditional knowledge of the marine ecosystem. However, to enhance these points, improvements are needed to address the weaknesses of the activity, such as improper storage, the reduction of fish stocks, and the devaluation of traditional knowledge. Opportunities, on the other hand, can arise from

the valorization of artisanal fishery and the growing consumer market but can be compromised by threats such as the reduction of fishery resources, the high perishability of fish, and low income from fishing activity. Thus, identifying these critical points allows suggestions to be made for comanagement strategies aimed at the sustainable use of resources and, consequently, increases the maintenance of the activity and the quality of life of sea workers.

Measures such as those presented in this study could enable the development and implementation of comanagement actions that consider both local and regional specificities. In

the coastal mesoregion of Espírito Santo, southeastern Brazil, no management or monitoring strategy is in force to maintain the resources targeted by fisheries. In fishers' perception, the negative points hinder the development of the activity, which lacks effective public policies and strategies for comanagement. Moreover, valuing traditional knowledge and creating public policies are necessary for maintaining the resilience of the activity and the quality of life of the families that depend on fishing.

## ACKNOWLEDGMENTS

The authors thank the president of the Z-3 Fishing Colony and the fishers of Guarapari for their cooperation; researcher Natália Figurelli Maia for her support during the fieldwork; Coordenação de Aperfeiçoamento Pessoal de Nível Superior (CAPES) – Brazil, Financial Code 001, for granting the first author a PhD scholarship; Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) (Process No. 304.179/2022-1); Fundação de Amparo à Pesquisa e Inovação do Espírito Santo (FAPES) (T.O. 319/2023; Process No. 2023-H3457); and Programa de Pós-Graduação em Oceanografia Ambiental of the Universidade Federal do Espírito Santo (UFES) for their support.

## FUNDING SOURCE

Coordenação de Aperfeiçoamento Pessoal de Nível Superior (CAPES) - Brazil, financial code 001.

Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) (process no. 304.179/2022-1).

Fundação de Amparo à Pesquisa e Inovação do Espírito Santo (FAPES) (T.O. 319/2023/process n° 2023-H3457).

## REFERENCES

ABREU, J.S.; DI BENEDITTO, A.P.M.; MARTINS, A.S.; ZAPPES, C.A. Pesca artesanal no município de Guarapari, estado do Espírito Santo: Uma abordagem sobre a percepção de pescadores que atuam na pesca de pequena escala. **Sociedade & Natureza**.

- v. 32, p. 59-74, 2020. <https://doi.org/10.14393/SN-v32-2020-46923>.
- ABREU, J.S.; DOMIT, C.; ZAPPES, C.A. Is there dialogue between researchers and traditional community members? The importance of integration between traditional knowledge and scientific knowledge to coastal management. **Ocean & Coast Management**. v. 141, p. 10–19, 2017. <https://doi.org/10.1016/j.ocecoaman.2017.03.003>.
- ABREU, J.S.; OLIVEIRA, R.G.; ZAPPES, C.A. Interferência do turismo na pesca artesanal: uma abordagem da oceanografia socioambiental no sudeste do Brasil. **Revista de Geografia (Recife)**, p. 330-356, 2021. <https://doi.org/10.51359/2238-6211.2021.246190>
- ADAMS, W.C. Conducting Semi-Structured Interviews. In: Newcomer, K.E.; Hatry, H.P.; Wholey, J.S. (Eds.). **Handbook of Practical Program Evaluation**, San Francisco: Jossey Bass A Wiley Imprint, p. 492 – 505, 2015. <https://doi.org/10.1002/9781119171386.ch19>
- ALVES, L.D.; DI BENEDITTO, A.P.M.; ZAPPES, C. A. Ethnooceanography of tides in the artisanal fishery in Southeastern Brazil: Use of traditional knowledge on the elaboration of the strategies for artisanal fishery. **Applied Geography**. v. 110, p. 102044, 2019. <https://doi.org/10.1016/j.apgeog.2019.102044>
- ANDRADE, M.M.; XAVIER, L.Y.; GRILLI, N.M.; OLIVEIRA, C.C.; ANDRADE, D.A.; BARRETO, G.C.; HELLEBRANDT, L.; GALVÃO, C.; SILVA, S.T.; MONT'ALVERNE, T.C.F.; GONÇALVES, L.R. Gender and small-scale fisheries in Brazil: insights for a sustainable development agenda. **Ocean and Coastal Research**, v. 69, p. e21033, 2021. <http://doi.org/10.1590/2675-2824069.21033mmda>
- BEGOSSI, A., 2014. Ecological, cultural, and economic approaches to managing artisanal fisheries. **Environment, Development and Sustainability**. p. 5-34, 2014. <https://doi.org/10.1007/s10668-013-9471-z>.
- BENZAGHTA, M.A.; ELWALDA, A., MOUSA, M.M., ERKAN, I., RAHMAN, M. SWOT analysis applications: An integrative literature review. **Journal of Global Business Insights**. v. 6, p. 55-73, 2021. <https://doi.org/10.5038/2640-6489.6.1.1148>.
- BRASIL. **Lei N° 11.959, de 29 de Junho de 2009**. Dispõe sobre a Política Nacional de Desenvolvimento Sustentável da Aquicultura e da Pesca, regula as atividades pesqueiras, revoga a Lei no 7.679, de 23 de novembro de 1988, e dispositivos do Decreto-Lei no 221, de

- 28 de fevereiro de 1967, e dá outras providências. Diário Oficial União, Brasília, 2009. Available: [https://www.planalto.gov.br/ccivil\\_03/\\_ato2007-2010/2009/lei/l11959.htm](https://www.planalto.gov.br/ccivil_03/_ato2007-2010/2009/lei/l11959.htm) Accessed on: oct. 11, 2023.
- BRASIL, 2015. **Lei nº 13.123, de 20 de Maio de 2015**. Regulamenta o inciso II do § 1º e o § 4º do art. 225 da Constituição Federal, o Artigo 1, a alínea j do Artigo 8, a alínea c do Artigo 10, o Artigo 15 e os §§ 3º e 4º do Artigo 16 da Convenção sobre Diversidade Biológica, promulgada pelo Decreto nº 2.519, de 16 de março de 1998; dispõe sobre o acesso ao patrimônio genético, sobre a proteção e o acesso ao conhecimento tradicional associado e sobre a repartição de benefícios para conservação e uso sustentável da biodiversidade; revoga a Medida Provisória nº 2.186-16, de 23 de agosto de 2001; e dá outras providências. Diário Oficial da União, Brasília, 2015. Available: [https://www.planalto.gov.br/ccivil\\_03/\\_ato2015-2018/2015/lei/l13123.htm](https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2015/lei/l13123.htm) Accessed on: oct. 11, 2023.
- CADMAN, R.; SNOOK, J.; BAILEY, M. Ten years of Inuit co-management: advancing research, resilience, and capacity in Nunatsiavut through fishery governance. **Regional Environmental Change**. v. 22, p. 1-14, 2022. <https://doi.org/10.1007/s10113-022-01983-3>
- CÓRTEZ, L.H.O.; ZAPPES, C.A.; DI BENEDITTO, A.P.M. Sustainability of mangrove crab (*Ucides cordatus*) gathering in the southeast Brazil: A MESMIS-based assessment. **Ocean & Coastal Management**. v. 179, p. 1-10, 2019. <https://doi.org/10.1016/j.ocecoaman.2019.104862>.
- EDWARDS, P.; PENA, M.; MEDEIROS, R.P.; MCCONNEY, P. Socioeconomic Monitoring for Sustainable Small-Scale Fisheries: Lessons from Brazil, Jamaica, and St. Vincent and the Grenadines. **Viability and Sustainability of Small-Scale Fisheries in Latin America and The Caribbean**. p. 267-293, 2019. [https://doi.org/10.1007/978-3-319-76078-0\\_12](https://doi.org/10.1007/978-3-319-76078-0_12)
- ERTÖR-AKYAZI, P. Formal versus informal institutions: Extraction and earnings in framed field experiments with small-scale fishing communities in Turkey. **Marine Policy**. v. 109, p. 103673, 2019. <https://doi.org/10.1016/j.marpol.2019.103673>.
- FAO - Food and Agricultural Organization of the United Nations. **The State of World Fisheries and Aquaculture – Sustainability in Action**. 224p. 2020 Available: <https://www.fao.org/3/ca9229en/ca9229en.pdf>. Accessed on: oct. 11, 2023.
- FOGLIARINI, C.O.; FERREIRA, C.E.; BORNHOLDT, J.; BARBOSA, M.C.; GIGLIO, V.J.; BENDER, M. G. Telling the same story: Fishers and landing data reveal changes in fisheries on the Southeastern Brazilian Coast. **PloS one**. v. 16, p. e0252391, 2021. <https://doi.org/10.1371/journal.pone.0252391>
- GARCÍA-DE-LA-FUENTE, L.; GONZÁLEZ-ÁLVAREZ, J.; GARCÍA-FLÓREZ, L.; FERNÁNDEZ-RUEDA, P.; ALCÁZAR-ÁLVAREZ, J. Relevance of socioeconomic information for the sustainable management of artisanal fisheries in South Europe. A characterization study of the Asturian artisanal fleet (northern Spain). **Ocean & Coastal Management**. v. 86, p. 61-71, 2013. <https://doi.org/10.1016/j.ocecoaman.2013.05.007>.
- GISSI, E.; PORTMAN, M.E.; HORIDGE, A.K. Un-gendering the ocean: Why women matter in ocean governance for sustainability. **Marine Policy**. p. 215-219, 2018. <https://doi.org/10.1016/j.marpol.2018.05.020>.
- GLASS, J.R.; KRUSE, G.H.; MILLER, S.A. Socioeconomic considerations of the commercial weathervane scallop fishery off Alaska using SWOT analysis. **Ocean & Coastal Management**. v. 105, p. 154-165, 2015. <https://doi.org/10.1016/j.ocecoaman.2015.01.005>.
- HARPER, S.; ZELLER, D.; HAUZER, M.; PAULY, D.; SUMAILA, U.R. Women and fisheries: Contribution to food security and local economies. **Marine Policy**. v. 39, p. 56–63, 2013. <https://doi.org/10.1016/j.marpol.2012.10.018>.
- HEALE, R.; FORBES, D. Understanding triangulation in research. **Evidence-Based Nursing**. v. 16, p. 98-98, 2013. <http://dx.doi.org/10.1136/eb-2013-101494>.
- HELMS, M.M.; NIXON, J. Exploring SWOT analysis – where are we now? A review of academic research from the last decade. **Journal of Strategy and Management**. v. 3, p. 215–251, 2010. <http://dx.doi.org/10.1108/17554251011064837>.
- IBGE - Instituto Brasileiro de Geografia e Estatística, 2023 Available: <https://www.ibge.gov.br/cidades-e-estados/es/guarapari.html>. Accessed oct. 11, 2023.
- KAUR, P.; STOLTZFUS, J.; YELLAPU, V. Descriptive statistics. **International Journal of Academic Medicine**, v. 4, p. 60, 2018. [https://doi.org/10.4103/IJAM.IJAM\\_7\\_18](https://doi.org/10.4103/IJAM.IJAM_7_18).

- LARA, D. R. M.; CORRAL, S. Local community-based approach for sustainable management of artisanal fisheries on small islands. **Ocean & Coastal Management**, v. 142, p. 150-162, 2017.  
<https://doi.org/10.1016/j.ocecoaman.2017.03.031>
- LOPEZ-DICASTILLO, O.; BELINTXON, M. The challenges of participant observations of cultural encounters within an ethnographic study. **Procedia-Social and Behavioral Sciences**. v. 132, p. 522-526, 2014.  
<https://doi.org/10.1016/j.sbspro.2014.04.347>.
- MASON, M. Sample size and Saturation in PhD studies using qualitative interviews. **Forum for Qualitative Social Research**, p. 11, 2010.
- MUSIELLO-FERNANDES, J.; OLIVEIRA, P.C.; ARAÚJO, S.C.; ABREU, S.J.; DI BENEDITTO, A.P.; BRAGA, A.A.; HOSTIM-SILVA, M.; ZAPPES, C.A. Artisanal fishing on the coast of Espírito Santo state, southeastern Brazil: an approach to socioenvironmental oceanography\*. **Boletim do Instituto de Pesca**. v. 46, p. e610,2020, 2020.  
<https://doi.org/10.20950/1678-2305.2020.46.4.610>.
- NADERIFAR, M.; GOLI, H.; GHALJAIE, F. Snowball sampling: A purposeful method of sampling in qualitative research. **Strides in Development of Medical Education**. v. 14, p. 1-6, 2017.  
<https://doi.org/10.5812/sdme.67670>.
- OLIVEIRA, P.C.; DI BENEDITTO, A.P.M.; BULHÕES, E.R.; ZAPPES, C.A. Artisanal fishery versus port activity in southern Brazil. **Ocean & Coastal Management**, v. 129, p. 49-57, 2016.  
<https://doi.org/10.1016/j.ocecoaman.2016.05.005>.
- OLIVEIRA, P.C.; DI BENEDITTO, A.P.M.; QUARESMA, V.S.; BASTOS, A.C.; ZAPPES, C.A. Traditional knowledge of Fishers versus an environmental disaster from mining waste in Central Brazil. **Marine Policy**, v. 120, p. 104129, 2020.  
<https://doi.org/10.1016/j.marpol.2020.104129>.
- RENCK, V.; LUDWIG, D.; BOLLETTING, P.; REIS-FILHO, J.A.; POLISELI, L.; EL-HANI, C.N. Taking fishers' knowledge and its implications to fisheries policy seriously. **Ecology and Society**. v. 28, p. 1-13, 2023.  
<https://doi.org/10.5751/ES-14104-280207>.
- SALMI, P.; SONCK, K.,R. Invisible work, ignored knowledge? Changing gender roles, division of labor, and household strategies in Finnish small-scale fisheries. **Maritime Studies**. v. 17, p. 213-221, 2018.  
<https://doi.org/10.1007/s40152-018-0104-x>.
- TIDD, A. N.; ROUSSEAU, Y.; OJEA, E.; WATSON, R.A.; BLANCHARD, J.L. Food security challenged by declining efficiencies of artisanal fishing fleets: A global country-level analysis. **Global Food Security**, v. 32, p. 100598, 2022.  
<https://doi.org/10.1016/j.gfs.2021.100598>
- UFES – Universidade Federal do Espírito Santo. 2013. Boletim estatístico da pesca do Espírito Santo. **Programa de estatística pesqueira do Espírito Santo**. 1ª ed. Vitória:UFES, 108p. 2013.
- VIEGAS, M.D.C.; MONIZ, A.B.; SANTOS, P.T. Artisanal fishermen contribution for the integrated and sustainable coastal management–application of strategic SWOT analysis. **Procedia-Social and Behavioral Sciences**, v. 120, p. 257-267, 2014.  
<https://doi.org/10.1016/j.sbspro.2014.02.103>
- WOLFINGER, N.H. On writing fieldnotes: collection strategies and background expectancies. **Qualitative research**. v. 2, p. 85-93, 2002.  
<https://doi.org/10.1177/1468794102002001640>

## AUTHOR CONTRIBUTION

Juliana Silva de Abreu conceptualized the article, collected the data, carried out a formal analysis, investigated, developed the methodology and validated the work. In addition, the author wrote the original draft, reviewed and edited the article.

Laura Helena de Oliveira Côrtes investigated, validated, wrote the original draft, reviewed and edited the article.

Camilah Antunes Zappes Conceptualization collected data, performed formal analysis and acquired financing. Furthermore, the author carried out the investigation, developed the methodology, supervised project administration, validated, wrote the original draft, reviewed and edited the article.



This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited