


Coexistence between cetaceans and artisanal fisheries in southeastern Brazil

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ABSTRACT

Understanding of the coexistence of human communities and wildlife let to evaluate the impacts of conflict interactions and development of management strategies that mitigate anthropogenic pressures about species conservation. The present study aims to identify conflicts arising from the coexistence of artisanal fisheries, the Guiana dolphin (*Sotalia guianensis*), and the humpback whale (*Megaptera novaeangliae*) along the central coast of southeastern Brazil. Fieldwork was undertaken with artisanal fishers (n = 80) registered with the Z-2 Fisher's Colony, Espírito Santo State (ES), Brazil, through semistructured interviews, the use of photographic identification boards, and participatory mapping. Species identification in the fishers' accounts was verified by comparing descriptions of coloration, body size, distribution range, seasonality, and behavioral traits with the scientific literature, supplemented by photographic board confirmation. Thirty-one respondents described a dolphin ethno-species consistent with *S. guianensis*, expressing predominantly positive perceptions and employing human-like descriptors such as "calm," "peaceful," and "docile." No aggressive behaviors were reported. Nonetheless, eighteen fishers cited fishing interference by the species, and twenty-five identified areas of incidental capture and indicated that no effective solutions exist to mitigate gillnet-related bycatch. With respect to humpback whales, twelve fishers identified the animals observed as *M. novaeangliae* and reported negative interactions, including fish dispersal and the need to alter vessel routes to prevent collisions and entanglements. These findings contribute to the understanding of habitat use by *S. guianensis* and *M. novaeangliae* and their interactions with artisanal fisheries in the central coastal zone of southeastern Brazil. The results provide further insights to support human–cetacean coexistence frameworks and inform the development of participatory and adaptive management strategies aimed at reducing conflicts and promoting the sustainable management of coastal fisheries.

1. Introduction

Coexistence refers to the relationship between humans and nonhumans (human–wildlife), encompassing the capacity to coexist and interact in a sustainable manner; that is, no species should exhibit such a degree of conflict with another that simultaneous occupancy of the same space becomes unfeasible (Green et al., 2024). A nuanced understanding of the coexistence of human communities and wildlife is pivotal for evaluating the impacts of conflict interactions and for informing the

development of management strategies that mitigate anthropogenic pressures while fostering species conservation (Hallwass et al., 2024). Such conflicting interactions frequently occur when human and wildlife populations share spatial resources, potentially resulting in substantial consequences for biodiversity conservation and for the well-being of human populations (Peterson et al., 2010).

With the increasing number of cetacean sightings, such as whales and dolphins, along the coast, the dynamics of interactions with anthropogenic activities tend to intensify, potentially increasing the

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likelihood of conflicts. These animals are susceptible to anthropogenic interactions, including intentional or incidental capture, vessel traffic, tourism, and habitat degradation (Pratezi, Rollo, 2024). Conversely, humans may also be affected by such interactions and face health risks and economic losses, such as damage to fisheries, as well as psychological impacts that can influence the quality of life of coastal communities (Zappes et al., 2013a). Conflicts are also observed with freshwater dolphins. In the Ganges River, there is direct competition for the same food resource between dolphins and fishers. These dolphins, when exposed to fishing activity, alter their behavior compared to areas without fishing activity. These behavioral changes can affect the socialization and foraging habits of the animals (Paudel et al., 2020). In Peruvian Amazon, fishermen have associated dolphins with negative economic impacts, as they can damage nets and interfere with fishing. This reflects the occurrence of bycatch, with dolphin carcasses being used as bait in fishing (Campbell et al., 2020).

In Brazil, the coexistence of humans and cetaceans is characterized predominantly by interactions involving these animals and fishing communities, with conflicts related to accidental entanglement in fishing nets being the most frequently reported. Such conflicts can cause harm both to cetacean populations, by reducing the number of individuals through mortality, and to fishing communities, which may experience loss of fishing effort and gear (Zappes et al., 2024). According to members of fishing communities, these captures are unintentional and occur due to the spatial overlap between fishing grounds and cetacean habitats (Zappes et al., 2013b, 2016, 2024). For small cetaceans, the literature is more abundant (Araujo et al., 2023; Figueira et al., 2021; Manzan and Lopes, 2015; 2016; Peterson et al., 2008; Souza and Begossi, 2007; Zappes et al., 2009a, 2011, 2014, 2016, 2024), whereas studies on large whales remain incipient (Bueno et al., 2025; Martins et al., 2001; Zappes et al., 2013a, 2013b).

Identifying conflicts between humans and cetaceans is crucial for environmental management, as it enables the development of strategies that reconcile marine biodiversity conservation with the maintenance of traditional community livelihoods, such as small-scale fisheries. Once implemented, conflict resolution should be simple to address the problem in relation to the species involved, thus diminishing its impact. People's responses to conflict vary, and therefore it is necessary to assess the level perception of conflict, the individual's or group's response to that conflict, and whether management actions are directly linked to the reported conflict (Dickman, 2010). Therefore, it is important to have an interdisciplinary approach with an integrative perspective for coexistence. Unfortunately, this interdisciplinarity is still neglected or little known in the field of conservation (Gao and Clark, 2023).

Studies grounded in traditional knowledge can provide complementary information to the literature on cetaceans along the Brazilian coast (Zappes et al., 2014). This knowledge is empirically developed, acquired orally, transmitted through intergenerational traditions and deeply rooted in practical fishing experience and environmental observation (Johannes et al., 2000). This traditional knowledge is not merely a collection of observations, but an integrated system encompassing information about traditional practices of resource management, social institutions, and ethical and spiritual beliefs regarding a people's relationship with the environment (Berkes, 1999). Through the practice of small-scale fishing, fishers maintain direct and constant contact with the environment, which allows them to observe marine fauna, such as coastal dolphins and migratory whales (Mymri et al., 1999; Zappes et al., 2013b, 2024).

Along the coast of the state of Espírito Santo (ES), in southeastern Brazil, occurrences of the Guiana dolphin (*Sotalia guianensis van Bénédén 1864*) and individuals from the South Atlantic population of the humpback whale (*Megaptera novaeangliae* Borowski, 1781) have been recorded (Andriolo et al., 2010; Mayorga et al., 2020). In ES, coexistence relationships marked by conflicts between these species and small-scale fisheries have been documented, involving incidents such as vessel collisions and incidental entanglement in fishing nets (Zappes et al.,

2009a, 2013a). Nevertheless, information on the coexistence of cetaceans and small-scale fisheries remains incipient for the state. In this context, the present study aims to identify coexistence conflicts between small-scale fisheries and cetaceans along the central coast of ES, southeastern Brazil. These findings may contribute to discussions on the potential impacts of fishing on the Guiana dolphin population and the South Atlantic humpback whale population in ES based on the perceptions of local stakeholders. Furthermore, the results may enhance the understanding of small-scale fishing as both a cultural and economic activity and provide insights into fishing territories.

2. Materials and methods

2.1. Study area

The coastal municipality of Vila Velha, in the state of Espírito Santo (Fig. 1), comprises a 40 km stretch of coastline extending from Praia do Ribeiro to the Ponta da Fruta resort area (Proater, 2011). Within this municipality are the small-scale fishing communities of Prainha, Praia do Ribeiro, Praia da Costa, São Pedro Pescador/Itapoã, and Itaparica, which are all registered under the Z-2 Fisher's Colony. These communities are composed of families whose primary economic activity has been small-scale fishing since the mid-19th century, from which they derive their livelihoods. In these localities, artisanal fishers operate small vessels equipped with simple gear and traditional tools to harvest aquatic species for either subsistence or small-scale commercial purposes.

In this region, the climate is classified as pseudo-equatorial, characterized by tropical summer rainfall occurring from October to March and a dry season extending from April to September (autumn and winter) (Albino, 1996). The beaches are dissipative, sheltered from wave action originating from the northeast, and function as sediment sinks by receiving and retaining materials transported by longshore currents from the southwest. This coastal stretch undergoes significant morphosedimentary alterations as a result of intense urban occupation (Albino, 1996).

2.2. Procedures

This study was approved by the Ethics Committee and is registered under protocol number CAAE 62511922.2.0000.5542. Data were collected between September 2022 and February 2024 through direct and participant observation methods (Malinowski, 1992), which enabled the authors' immersion in the activities and daily routines related to small-scale fishing within the communities.

Eighty individual interviews with artisanal fishers operating along the central coast of Espírito Santo ($n = 40$ for *S. guianensis* and $n = 40$ for *M. novaeangliae*) were conducted through in-person dialogs using a semistructured questionnaire comprising both open- and closed-ended questions (Schensul et al., 1999). The questionnaire was organized into the following categories (Table 1). The number of interviews was deemed adequate, as a consistent pattern of responses without the emergence of new information was observed after approximately 30 interviews, thereby reaching the so-called "saturation point" (Mason, 2010). The criteria for the selection of interviewees included: (1) being an artisanal fisher; (2) having fishing as the primary source of income; and (3) engaging in fishing activities along the central coast of Espírito Santo. Potential participants were identified through: (1) referrals by the president of the Z-2 Fishers' Colony for the first interviewee; (2) the snowball sampling method from the second interviewee onward (Bailey, 1982); and (3) opportunistic encounters with new fishers within the communities.

During the interviews, an illustrated board displaying photographs of cetaceans occurring along the coast of Espírito Santo was presented to the participants. The images used for the identification of *S. guianensis* included the killer whale (*Orcinus orca*), bottlenose dolphin (*Tursiops*

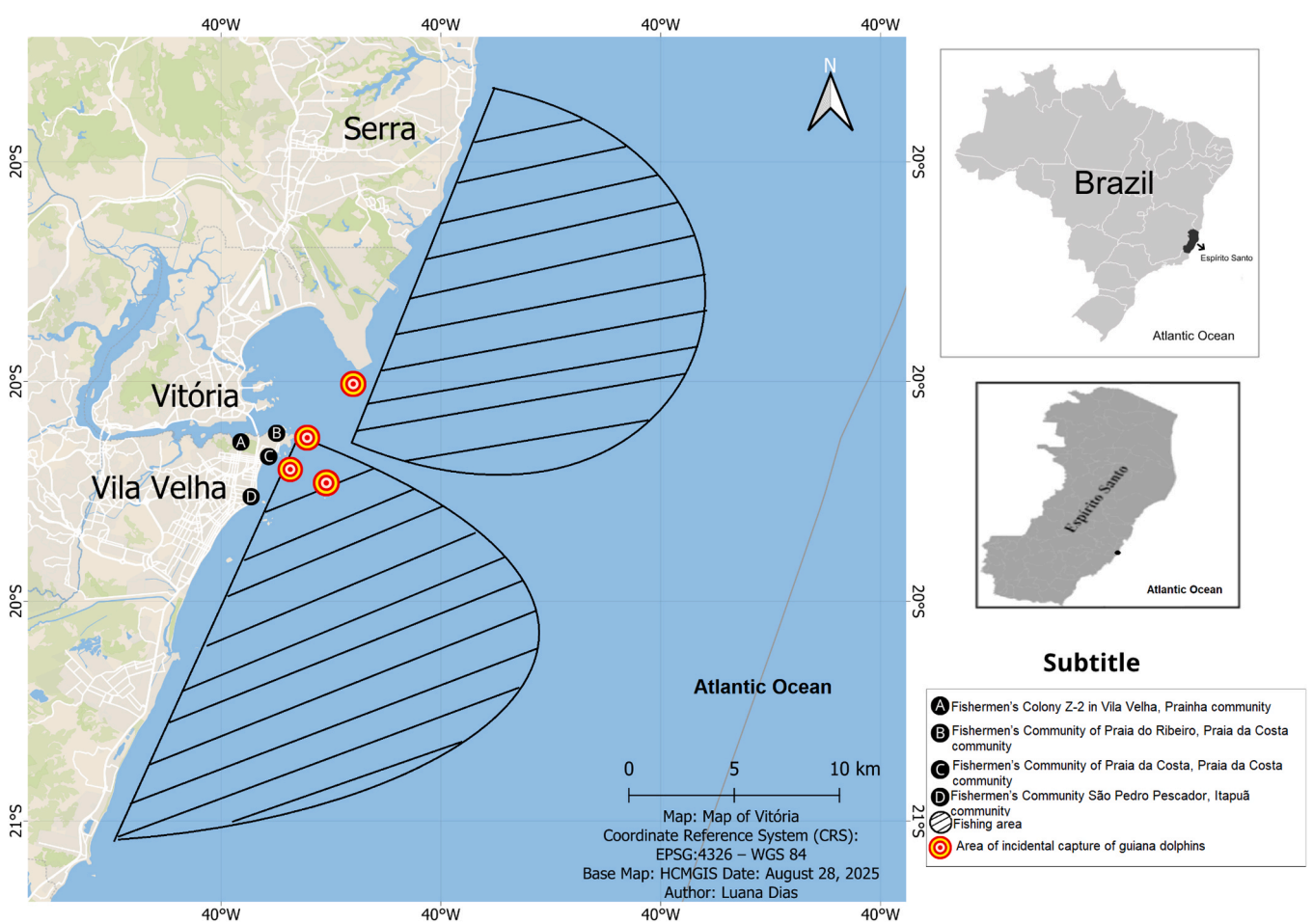


Fig. 1. Spatial overlap between fishing grounds and incidental capture zones of *Sotalia guianensis*, as reported by artisanal fishers from the central coast of Espírito Santo State, southeastern Brazil. Source: authors.

Table 1
Topics addressed in the semistructured questionnaire. Source: authors' own elaboration.

Topics	Questions
1. Socioeconomic aspects	Age Years of fishing experience Period of fishing activity in the study region
2. Description of fishing activities	Types of fishing gear employed Vessel specifications (length, engine type/power) Target fish species
3. Cetacean characteristics	Body size Coloration Behavioral patterns Feeding habits Distribution range Group size
4. Interactions with fishing activities	Fisheries–cetacean interactions Occurrence of incidental (bycatch) events Location of incidental capture Fate of carcasses: use as bait, human consumption, sale, or disposal
5. Proposed solutions for conflict mitigation	

truncatus), Guiana dolphin (*S. guianensis*), and franciscana dolphin (*Pontoporia blainvillei*). For the identification of *M. novaeangliae*, the images comprised the killer whale (*O. orca*), southern right whale (*Eubalaena australis*), Bryde's whale (*Balaenoptera edeni*), and humpback whale (*M. novaeangliae*). The selected images were chosen to depict

angles and perspectives similar to those artisanal fishers might encounter when they were sighting cetaceans during fishing activities, thereby aligning the participants' visual perception with their typical at-sea experience. Each interviewee was subsequently provided with a simplified map containing minimal symbols and technical elements to facilitate the identification of sighting locations and conflict hotspots. This tool was developed using participatory mapping techniques to enhance map readability, enabling fishers to make annotations based on their traditional ecological knowledge (Abreu et al., 2022).

2.3. Data analysis

The interview records were organized into a spreadsheet and classified into categories corresponding to the questionnaire items, thereby grouping information by thematic domain and facilitating the interpretation of responses (Ryan and Bernard, 2000). To enable comparative analysis across interview accounts, the synchronous repeated-information technique was employed, in which the same questionnaire was administered to all respondents (Opdenakker, 2006). To validate the respondents' identification of *S. guianensis* and *M. novaeangliae*, criteria were established based on the literature (Table 2). Following this screening, analyses were conducted exclusively with fishers whose identifications of *S. guianensis* and *M. novaeangliae* were consistent with established descriptions in the scientific literature.

Spatial data derived from participatory mapping were analyzed based on the locations indicated by the fishers on the provided maps. This interpretation accounted for both the areas in which they customarily operate and the regions where they report frequent sightings of

Table 2

Criteria used to identify fishers who recognize the guiana dolphin (*Sotalia guianensis*) and the humpback whale (*Megaptera novaeangliae*) along the central coast of the state of Espírito Santo, southeastern Brazil. Source: authors.

Ethnospecies	Group of variables	Popular linguistic terms	Literature
<i>Sotalia guianensis</i>	Body size	Between 1.0 and 2.5 m	Di Benedetto and Ramos, (2004); Flores and Da Silva, (2009). Jefferson et al. (2015).
	Coloration	Light gray, gray, dark gray, gray on the back and light on the belly	
	Distribution pattern	Edge, beach, bay, shallow, low-depth regions, coast	
<i>Megaptera novaeangliae</i>	Body size	Between 11 and 16 m	Woodward et al. (2006); Jefferson et al. (2015) Borobia, (1991); Rossi-Santos et al. (2007); Santos et al. (2010). Chixaro et al. (2024).
	Coloration	Dark gray and black with a white belly with folds	
	Distribution pattern	Near the coast, near the coast of Vitória	

cetaceans. The triangulation method was subsequently employed to compare responses through the intersection of data obtained from direct and indirect observations, as well as interviews (Yeasmin and Rahman, 2014).

3. Results

3.1. Profile of respondents and description of artisanal fishing

Among the 80 respondents, 79 were male, ranging in age from 28 to 79 years, with low formal education levels and up to 60 years of fishing experience. The vessels employed were primarily (1) small open boats (bateira or dinghy) measuring from 4 to 6 m in length, with a carrying capacity ranging from 20 to 500 kg, powered either by low-horsepower engines or oars, and (2) decked boats measuring from 6 to 12 m in length, with a carrying capacity of 300–2500 kg and engines of up to 90 HP (horse power) (Fig. 2). Fishing activities were typically initiated

between 04:00 and 05:00 a.m., with return times between 5:00 and 6:00 p.m. However, some fishers (n = 23) reported remaining at sea for more than 24 h. The primary fishing gear employed included handlines, trawl nets, and gillnets (either bottom-set or surface-set) (Table 3). The

Table 3

Primary fishing gear employed by fishers from the central coast of Espírito Santo State, southeastern Brazil. Source: authors.

Fishing gear	Handline (n = 64)	Gillnet (n = 14)	Trawling Net (n = 9)
Characteristics	Constructed from nylon (polyamide) filament and monofilament nylon, with a thickness ranging from 60 to 200 mm. Equipped with one to six hooks distributed along the mainline. Employed at depths ranging from 8 to 180 m.	Manufactured from nylon filament, with a twine thickness ranging from 40 to 70 mm, a total length ranging from 280 to 2000 m, and a height from 1 to 10 m. Deployed at depths of 10–55 m. The mesh size varies from 30 to 80 mm. Each net is fitted with approximately 30–150 polystyrene floats and 2–20 kg of lead weights distributed along its length, in addition to a large marker buoy positioned at each extremity to indicate its location.	Constructed from nylon, silk, or synthetic silk twine, with a thread thickness ranging from 40 to 60 mm. The net measures from 300 to 1000 m in length and 4–10 m in height and is deployed at depths ranging from 6 to 20 m. Mesh size between adjacent knots ranges from 18 to 60 mm. The gear is equipped with 100–400 buoys made of expanded polystyrene or polyethylene and 25–50 kg of lead weights—distributed in 100 g segments—uniformly along the net.
Vessel	Rowboats and dinghies; decked fishing vessels and motorboats.	Rowboat, dinghy, and decked fishing vessel.	Utilized with small open-hull boats (bateiras) and dinghies.



Fig. 2. Vessels employed along the central coast of Espírito Santo state, southeastern Brazil. A – Prainha Community; B – Praia do Ribeiro Community; C – São Pedro Pescador/Itapuã Community; D – Praia da Costa Community. Images: authors.

most commonly fished species belong to the following families: Sciaenidae, Engraulidae, Mugilidae, Carangidae, Sparidae, Centropomidae, Scombridae, Balistidae and Paralichthyidae.

3.2. Coexistence of cetaceans and artisanal fisheries

Among the respondents (n = 80), 43 individuals (53%) provided descriptions of cetacean characteristics consistent with the scientific literature, with 31 fishers identifying the dolphin as *S. guianensis* and 12 identifying the whale as *M. novaeangliae*. For *S. guianensis*, the period of highest reported occurrence was either during the spring–summer months, from September to March (n = 11), or year-round (n = 13). For *M. novaeangliae*, the peak sighting period was reported to occur between June and November, with the highest frequency occurring between August and September. Calves of both species were also reported in the central coastal waters of Espírito Santo (n = 37).

The Guiana dolphin was observed in groups ranging from 2 to 5 individuals (n = 36), with gillnet entanglements reported in 25 cases. Carcasses resulting from these incidental captures were occasionally repurposed as bait (n = 2), sold (n = 2), or discarded (n = 16). Fishers reported that the distribution range of *S. guianensis* overlaps with those of fishing grounds, leading to occasional incidental capture, particularly in the vicinity of the Port of Tubarão (lat 20° 19' 05" S, long 040° 17' 04" W), which was identified as the area with the highest frequency of interactions (Fig. 1). Nonetheless, gillnet entanglement was not perceived by the respondents as a negative impact of fishing on *S. guianensis*. For a portion of fishers (n = 18), the presence of this species interferes with fishing activities, as the dolphins “scare the fish away,” forcing them to

seek alternative fishing sites and thereby increasing operational costs and fishing effort. Despite this perception, the fishers did not classify such interference as negative but rather as an indication of the species’ presence within fishing areas.

For humpback whales, sightings included solitary individuals (n = 2) and groups of up to 10 animals (n = 10), with reports of interference from this species in fishing operations (n = 10). Observations occurred as far as 20 nautical miles from the coast (Fig. 3). Such interference arises because fishers (1) must change fishing locations, as the whales, owing to their large size, displace target fish species; and (2) are required to alter navigation routes to avoid vessel–whale collisions or entanglement of fishing gear. Additionally, fishers expressed apprehension when humpback whales approached their vessels, suggesting that (1) accidents, such as finger loss, may occur if the animal becomes entangled in fishing lines, an event that has previously been reported; (2) there is a risk of vessel capsizing or sinking if the whale becomes ensnared in anchor lines or other fishing gear; and (3) hull damage may result from collisions, leading to increased operational costs. To prevent such incidents, fishers reported employing deterrent strategies, including (1) pouring diesel oil into the water and (2) starting the vessel’s engine. However, these measures are largely ineffective, as whales have become habituated to them.

4. Discussion

4.1. Profile of respondents and characterization of small-scale fisheries

The data obtained delineate a demographic profile consistent with

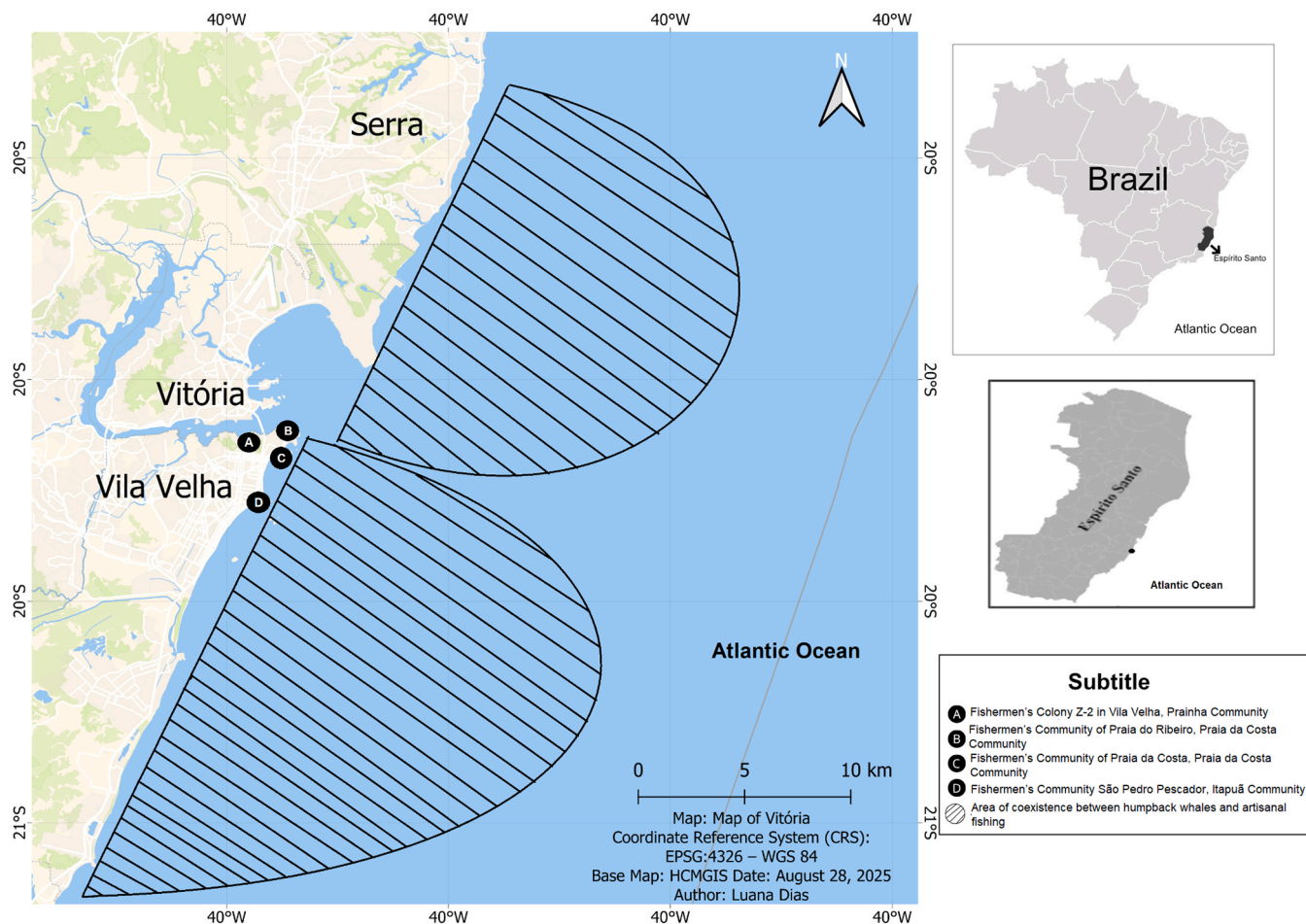


Fig. 3. Areas of spatial coexistence of artisanal fisheries and *Megaptera novaeangliae*, as reported by artisanal fishers along the central coast of Espírito Santo State, southeastern Brazil. Source: authors.

traditional communities inhabiting the central coastal region of Espírito Santo State (ES), where small-scale fishing constitutes the primary economic and cultural activity (Abreu et al., 2022). The age distribution and duration of engagement in artisanal fishing suggest that, in previous decades, lifelong involvement in the activity was commonplace. This reality, marked by early entry into fishing and consequent school dropout, has contributed to the persistently low levels of formal education. The early incorporation of young people into fishing routines hinders educational progression and, in turn, limits access to employment opportunities that do not require specialized technical skills (Abreu et al., 2022). However, at present, fishers themselves generally discourage their children from pursuing fishing as an occupation, citing occupational health risks, low income, social prejudice, and the broader societal undervaluation of the artisanal fishing profession (Oliveira et al., 2016).

With respect to fishing vessels, the predominance of open skiffs and small boats without cabins is directly associated with economic accessibility and their adaptability to coastal and estuarine environments (Abreu et al., 2022). However, the limited cargo capacity and operational range of these vessels constrain the fishing grounds accessible to fishers, reflect the low autonomy of the activity, and necessitate operations in nearshore areas to ensure safe return to land. This reduced autonomy is also linked to the smaller storage capacity, as catch preservation relies primarily on Styrofoam boxes due to the absence of on-board cold storage facilities. Handlines are the most frequently employed fishing gear in the study area owing to their selectivity, ease of handling in small vessels, and design suitability for use in nearshore zones with rocky seabeds (Abreu et al., 2022). The use of fishing nets is a widespread practice in small-scale fisheries, yet it poses a significant threat to marine fauna, particularly because of the high incidence of entanglement events (Filgueira et al., 2021). According to fishers' accounts, many animals are unable to detect the nets and consequently become accidentally ensnared in them.

Given this context, it is imperative to pursue strategies that reconcile fishing activities with marine life conservation. Measures such as the modification of gillnets and the deployment of acoustic deterrent devices (pingers), which increase the ability of marine fauna to detect and avoid fishing gear, have shown considerable promise (Cotter et al., 2019). Pingers may induce an initial moderate avoidance response; however, this response may diminish or change over time, possibly due to habituation to the acoustic stimuli. Such behavioral dynamics may compromise the effectiveness of these devices as a mitigation measure to reduce interactions between dolphins and fishing nets (Cox et al., 2003). However, the possibility of decreased effectiveness due to habituation remains an open question in the scientific literature, especially in scenarios of prolonged use (Waples et al., 2013). Through the integration of information regarding areas of cetacean occurrence, derived from the local ecological knowledge of the stakeholders involved, the establishment of participatory partnerships is proposed, in which stakeholders contribute to identifying the most appropriate locations and fishing gear for the strategic deployment of pingers (Zappes et al., 2013a).

Studies on traditional knowledge can help in obtaining quick data such as range and coexistence interactions between cetaceans and communities, especially for areas where cetacean field surveys are rare. When coupled with the valorization of local ecological knowledge and the sensitization of fishing communities, these initiatives foster a more harmonious coexistence of humans and the marine environment, thereby advancing the practice of more sustainable and responsible fisheries (Lin et al., 2019). Local ecological knowledge can guide recommendations for cetacean conservation, such as suggesting awareness levels and mitigation strategies involving fishing communities that coexist with these animals (Zappes et al., 2024). Studies on co-management demonstrate that the use of traditional knowledge improves environmental governance and legitimizes management plans that benefit species such as cetaceans that share the same habitat as local human activities (Stori et al., 2019). This partnership can help in the

participatory management of fisheries, with the involvement of stakeholders throughout the process, allowing for the maintenance of the cetacean population off the Brazilian coast (Abreu et al., 2017; Filgueira et al., 2021).

4.2. Coexistence of small-scale fisheries with the Guiana dolphin and the humpback whale

Artisanal fishers possess empirical knowledge of *S. guianensis* and *M. novaeangliae* occurring along the central coast of southeastern Brazil, reflecting the long-standing coexistence of these cetaceans and fishing communities. Moreover, the role of traditional knowledge is underscored in the identification and understanding of the patterns of occurrence, seasonality, and behavior of these species, which are consistent with the scientific literature. This alignment suggests careful and sustained observation of cetaceans by fishers, in accordance with studies that emphasize the value of traditional ecological knowledge for the monitoring and conservation of marine species (Zappes et al., 2013a).

In addition to reports concerning cetacean characteristics, species identification conducted with the aid of photoidentification plates has proven to be a valuable tool for confirming the taxa observed. Nevertheless, the use of such plates may present limitations owing to the reduced scale of the images and the influence of light on the animals' coloration, which can hinder accurate recognition (Zappes et al., 2024). The limited recognition of *M. novaeangliae* by fishers may be linked to their lower degree of interaction with the species, as the areas utilized by humpback whales may be located at a considerable distance from fishing grounds. Furthermore, the operational demands of fishing activities, which require sustained attention, may preclude detailed observations of cetaceans (Zappes et al., 2014).

The seasonal occurrence patterns of the Guiana dolphin described by the interviewees are consistent with findings from ecological and ethnoecological studies. Filgueira et al. (2021) and Manzan and Lopes (2016) reported the seasonal presence of *S. guianensis* groups during the summer months. Such variation in group size may be associated with factors such as the availability of trophic resources, reproductive strategies, or the social dynamics of the species (Flach et al., 2008).

The presence of the humpback whale is typically associated with the period between the winter months (June to August) and spring (September to November), during which the coastline of Espírito Santo becomes part of the migration route for reproduction (Zerbini et al., 2006; Andriolo et al., 2010). This migratory pattern is critical for the conservation of the species, as the protection of migratory routes and breeding grounds is essential for the maintenance of South Atlantic populations (Andriolo et al., 2010). Sightings of pairs or groups of species near the coast may be associated with the presence of calves, which are strongly linked to shallow waters (Pack et al., 2017).

Studies conducted since 2006 on humpback whale stocks in the Southern Hemisphere have indicated that the population in the western South Atlantic has recovered only about 30% of its abundance compared to the pre-exploitation period (Andriolo et al., 2006; Zerbini et al., 2011). These abundance estimates for humpback whales were calculated for feeding and breeding areas based on observation, genetic, and photo-identification data (Ward et al., 2011). Since then, new research has generated information on the abundance of this population in wintering areas and has indicated a larger population than estimated in the early 2000s (Bortolotto et al., 2016). This increase in the number of whales also increases the possibility of encounters, overlapping area use, and interactions between artisanal fishing and the animals. Consequently, the coexistence between the activity and humpback whales can be described by accidents such as collisions and entanglements, which consequently increase conflicts (Zappes et al., 2013a).

The presence of *M. novaeangliae* is often associated with a sense of fear among fishers, who attempt to drive the whale away using vessel fuel or engine noise. However, these methods have not proven effective.

The lack of response from these animals may be related to studies indicating that large cetaceans are becoming habituated to the presence of vessels (Dunlop, 2024), which may result in an increase in collisions between whales and boats. This fear has been reported along the coast of Espírito Santo and highlights the need to understand the relationship between fishers and whales to prevent accidents, as well as to foster a protective sensibility toward these animals among the fishing communities involved (Zappes et al., 2013a).

With the increase in incidental catches of cetaceans in gillnets, it is worth highlighting the use of carcasses as bait in fishing activities and, less frequently reported, for human consumption (Zappes et al., 2009; Seminara et al., 2019; Filgueira et al., 2021). Federal Law No. 7643/87 prohibits the capture of cetaceans in Brazilian jurisdictional waters. In the long term, catches, even when incidental, may compromise the ecological viability and population size of these species (Rossi-Santos et al., 2007). In this context, it is crucial to develop strategies and implement conservation actions that involve fishing communities and make them participants in decision-making processes (Abreu et al., 2017).

The surrounding area of Tubarão Port, which is located in Vitória Bay, has been identified as the site with the highest level of interaction between the Guiana dolphin and fishing activities. This phenomenon can be attributed to the high concentration of food resources and the spatial overlap between the habitats used by the species and the fishing grounds. Fisher's reports indicate that incidental capture occurs more frequently in this area, which is characterized by a high occupancy rate by *S. guianensis*. Unfortunately, there are no abundance estimates for Guiana dolphins in this region, which prevents us from stating evidence of an increase in the species population size in the area.

Law No. 186/2023 authorizes the use of assisted gillnets in Vitória Bay, with an emphasis on environmental protection, the preservation of local traditions, and the livelihoods of fishing communities. In this fishing modality, fishers remain alongside their gear to prevent accidents related to the incidental capture of marine animals. Port terminal regulations, as stipulated in Item 3.0, Article 31, establish that the facility operates 24 h a day, which may increase the risk of accidents between large vessels and artisanal fishing boats. In this context, the risk to fishers is substantial, as the constant proximity to large ships in the area heightens the likelihood of collisions and other incidents that compromise both vessel safety and the physical integrity of workers.

The positive perception of the interviewees regarding the Guiana dolphin can be attributed to a combination of ecological, cultural, and socioeconomic factors (D'Lima et al., 2014). In many accounts, the Guiana dolphin is anthropomorphized, often described as "calm" or "peaceful," which contributes to strengthening emotional bonds and fostering respect for this animal. Thus, a positive view of this dolphin suggests a sensitivity on the part of artisanal fishers, indicating that its capture is unintentional and considered accidental (Zappes et al., 2009). In contrast, the humpback whale elicits a sense of fear, reinforcing the need to dedicate partnership efforts to bridge scientific and traditional knowledge about these animals through ocean literacy initiatives and by promoting awareness of the ecosystemic importance of *M. novaeangliae*.

Fishers emphasize that the use of gillnets is essential for their household livelihoods and underscore the incidental nature of cetacean captures. In this context, although bycatch is frequent, it was not reported by fishers as constituting a negative impact of fishing activities on these species. This perception may be related to the fact that fishers do not attribute intentionality to such captures. Other fishers indicate that reducing and/or prohibiting the use of gillnets, in addition to strengthening enforcement measures, would decrease cetacean bycatch in the region, given that both illegal and abandoned nets also increase the likelihood of incidental captures (Seminara et al., 2019). Nevertheless, the reluctance of fishers to describe such captures as a negative impact may be associated with fear of reprisals, even within an academic context, as the capture and harassment of cetaceans are prohibited by Brazilian law (Zappes et al., 2009, 2013a, 2024). Laist et al. (2001) and

Reeves et al. (2003) reported that whales and dolphins inhabiting areas with high vessel traffic are more susceptible to interactions with small watercraft, which may result in injury and/or mortality.

Traditional ecological knowledge is indispensable for complementing scientific understanding and for providing critical insights that can inform the development of fisheries management strategies (Abreu et al., 2017). In the present study, the fishers themselves acknowledged that the incidental capture of the Guiana dolphin and the humpback whale resulted from the fishing gear they employed. This acknowledgment represents a meaningful step toward fostering comanagement initiatives and collaborative conservation efforts. Furthermore, these findings underscore the significance of integrating local knowledge to ensure that traditional communities are engaged as active partners in the design and implementation of conservation measures.

5. Final considerations

This study provides a comprehensive understanding of artisanal fisheries along the central coast of Espírito Santo, as well as the coexistence of this activity with the Guiana dolphins and the humpback whales occurring in the region. This research presents novel insights, as it constitutes the first documentation derived from the traditional ecological knowledge of local fishers in this area. The findings offer a nuanced understanding of the interactions between fishers and these species, elucidating both the modes of species identification employed by the fishing community and the nature of the conflicts arising from these interactions.

The knowledge regarding the coexistence of cetaceans and artisanal fisheries, as conveyed by the interviewees, provides valuable insights for understanding the socioenvironmental conflicts currently present in the region. In light of the increasing populations of these marine mammals, particularly *M. novaeangliae*, and the challenges faced by fishers, the implementation of measures such as modifications to gillnet designs and the adoption of acoustic deterrent devices (pingers) may constitute effective strategies for mitigating adverse impacts. Nonetheless, the establishment of an ongoing and collaborative dialog among researchers, public authorities, and fishing communities is essential to develop mitigation strategies through genuine partnerships.

CRediT authorship contribution statement

Luana Francisca de Oliveira Dias: Writing – original draft, Validation, Methodology, Investigation, Formal analysis, Data curation. **Pilsen Ca'líia da Costa Peterle:** Writing – review & editing, Validation, Investigation. **Maria Luiza Furtado Cardoso:** Writing – review & editing, Validation, Methodology, Investigation, Formal analysis. **Camilah Antunes Zappes:** Writing – review & editing, Validation, Resources, Project administration, Methodology, Funding acquisition, Formal analysis, Conceptualization.

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Declaration of Competing Interest

The authors declare that they have no known competing financial

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Data availability

The data that has been used is confidential.

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