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Interactions between cetaceans (suborder Odontoceti) and artisanal fishing in Brazil: an ethnoecological approach

Breno Carvalho da Silva[1,2*], Antonio da Silva Souto[3,4], Evaldo de Lira Azevêdo[2,5]

ABSTRACT

Studies examining the relationship between humans and the natural environment are important to understand the influences, knowledge, and perceptions associated with the interactions between humans, species, and ecosystems. This study focused on the interactions between cetaceans and artisanal fishing, aiming to: a) compile studies on artisanal fishing and its interactions with small cetaceans in Brazil; b) analyse research trends over time; c) examine the geographical distribution of studies by Brazilian region; d) assess authorship and publication records; e) classify the interactions between cetaceans and artisanal fishing, as reported by researchers; and f) identify the dolphin species registered in these studies. We reviewed current national publications on the interactions between cetaceans (suborder Odontoceti) and artisanal fishing in Brazil, emphasising ethnoecological studies. Seven databases were surveyed for this study. Interactions were classified using the categorisation proposed by Freitas-Netto and adapted by Di Beneditto. Our data analysis identified 12 types of interactions, with seven conforming to Di Beneditto's descriptions and five novel categories based on the results of this study. The reviewed studies documented interactions for 43.2% (n=16) of the 37 odontocete species reported in Brazil, with particular emphasis on *Sotalia guianensis*, *Tursiops truncatus*, *Pontoporia blainvillei*, *Inia geoffrensis,* and *Sotalia fluviatilis*. Our findings demonstrate that ethnoecological research can provide important insights into species occurrence and fishing dynamics. Furthermore, we advocate the advancement of research exploring the interrelations between cetaceans and traditional fishing methodologies, as such studies can generate critical data to devise mitigation strategies and manage species and ecosystems.

Keywords: Delphinidae; Operational interactions; Fishing community.

1 Universidade Estadual da Paraíba, Rua Baraúnas, 351, Bairro Universitário, 58429-500, Campina Grande (PB), Brasil.
2 Programa de Pós-Graduação em Ecologia e Conservação (UEPB), Centro de Ciências Biológicas e da Saúde, Rua Baraúnas, 351, Bairro Universitário, Campina Grande (PB), 58429-500, Brasil.
3 Universidade Federal de Pernambuco, Av. Prof. Moraes Rego, 1235, Cidade Universitária, Recife (PE), 50670-901.
4 Programa de Pós-Graduação em Etnobiologia e Conservação (UFRPE), Av. Prof. Moraes Rego, 1235, Cidade Universitária, Recife (PE), 50670-901.
5 Instituto Federal de Educação, Ciência e Tecnologia da Paraíba, Rodovia-426, S/N, Zona Rural, BR-426, Princesa Isabel (PB), 58755-000, Brasil.
* Corresponding author ✉. E-mail address: BCS (breno.carvalho.silva@aluno.uepb.edu.br)

SIGNIFICANCE STATEMENT

Although dolphins are highly diverse in different aquatic environments, 10 species found along the Brazilian coast are listed in the Official List of Brazilian Fauna Threatened with Extinction. Notably, the Porpoise (*Pontoporia blainvillei*) is emphasised because it is the country's most frequently captured dolphin during incidental fishing activities. However, assessments of the potential impact of these activities are lacking. This study documented 12 types of interactions between cetaceans and fishing activities along the Brazilian coast and introduced five new categories: Removal, Depredation, Disposal, Scaring, and Signaling. *Sotalia guianensis*, *Tursiops truncatus*, *Pontoporia blainvillei*, *Inia geoffrensis,* and *Sotalia fluviatilis* were identified as having the most interactive fishing activities. Studies focusing on the ethnoecological knowledge of fishing communities can provide crucial data for establishing guidelines for management plans and the conservation of species and ecosystems.

INTRODUCTION

Dolphins are a group of mammals uniquely adapted to aquatic life. They belong to the order Cetacea and the suborder Odontoceti or "toothed" cetaceans (Zerbini et al. 2006; Perrin et al. 2009). Cetaceans comprise approximately 2% of the 4,600 living mammal species worldwide (Dudzinski and Frohoff 2008). The suborder Odontoceti currently encompasses 74 species across ten families, which are grouped into three "superfamilies": Delphinoidea, Ziphoidea, and Physeteroidea (Cranford et al. 1996). These animals inhabit diverse aquatic habitats, such as coastal zones, deep-water pelagic oceans, and marine environments (Syme et al. 2023), as well as inland freshwater rivers (Vidal et al. 2022). Dolphins are highly sociable mammals with complex cognitive abilities similar to those of humans, and are notably communicative and predatory (Morton et al. 2021).

A total of 44 cetacean species have been recorded within Brazilian jurisdictional limits, including dolphins and true whales, representing approximately half of the species present globally. Some exhibit migratory behaviours, while others display resident tendencies (Lodi and Borobia, 2013). Many cetaceans have extensive home ranges; consequently, their protection ensures the conservation of numerous other species within their habitats, earning them the status of "umbrella species" in Conservation Biology (Yang et al. 2023). Furthermore, these animals are pivotal ecosystem indicators and sentinels because of their sensitivity to anthropogenic impacts (Lima et al. 2023).

Despite their considerable diversity across different aquatic environments, 10 cetacean species found along the Brazilian coast are listed in the "Lista Oficial da Fauna Brasileira Ameaçada de Extinção" (Official List of Brazilian Fauna Threatened to Extinction) (MMA 2022). This list includes four species from the suborder Mysticeti: the southern right whale *Eubalaena australis* (Desmoulins, 1822), sei whales *Balaenoptera borealis* (Lexxon, 1828), blue whales *Baleanoptera musculus* (Linnaeus, 1758), and fin whale *Balaenoptera physalus* (Linnaeus, 1758). Additionally, six species from the suborder Odontoceti include the Guiana dolphin *Sotalia guianensis* (Van Bénéden, 1864), Atlantic bottlenose dolphin *Tursiops gephyreus* (Montagu, 1821), Araguian river dolphin *Inia araguaiaensis* (Hrbek; Farias; Dutra and Silva, 2014), Amazonian River dolphin *Inia geoffrensis* (Blainville, 1817), sperm whale *Physeter macrocephalus* (Linnaeus, 1758), and La Plata dolphin *Pontoporia blainvillei* (Gervais and d'Orbigny, 1844).

Since the seventeenth century, the exploitation of cetaceans and the commercialisation of their derivatives have been significant human practices in mystical, religious, medicinal, and economic contexts (Castellucci 2021). In North America, cetaceans and other marine resources gained commercial importance as they were utilized for food, petroleum product production, and various manufacturing purposes (Davis et al. 2007; Parsons and Rose 2022). In Brazil, these products were crucial during the colonial period and essential for the survival of the population (Siciliano et al. 2023). Specifically, cetacean fat was used in lighting and lubricating sugar mill equipment and heating vessels (Tripathy et al. 2024). This exploitation, combined with the expansion of commercial activities, has contributed to the decline in cetacean populations over time (Ellis 1973; Alden 1964; Junior 2022).

Among the 44 cetacean species recorded in Brazil, *Pontoporia blainvillei* is currently the most threatened. This is primarily because dolphins are most frequently incidentally caught during fishing activities along the Brazilian coast, and assessments of the impact of these activities remain inadequate (Gariboldi et al. 2016). Artisanal fishing, recognised as the oldest and most important fishing practice, provides a substantial food resource for human civilisations (Diegues 1999). By 2015, Brazil had approximately 1.084 million registered artisanal fishermen operating over 8,000 km of the coastline (MPA 2015). These fishermen, who often work independently or employ family or self-employed labour, rely on this activity for their livelihood (Cezar and Theis 2021). They use various nets, lines, and traps, and their vessels and

equipment generally have limited navigational autonomy, suitable only for coastal areas (Shrestha et al. 2022).

Since the 1970s, accidental captures, deaths, and injuries caused by fishing gear have been recognised as significant factors that limit small cetacean populations (Dolman et al. 2022). However, detailed investigations of the interactions between cetaceans and artisanal fishing began to be recognised only in the 1990s (Nóbrega et al. 2021), demonstrating that fishermen possess vast knowledge accumulated through their observations and experiences, where humans and dolphins share the same space and food resources (Diegues 2000). Studies focusing on the relationship between humans and nature are essential for understanding the influences and perceptions associated with these complex relationships, bridging the gap between people and the environment (Nascimento et al. 2023; Nardin and Franzen 2023).

Perception is defined as the representation of reality by individuals based on their interactions with the environment (Ribeiro et al. 2009; Azevêdo et al. 2020). Human-cetacean interactions can be perceived positively or negatively; for example, entanglement in fishing gear is considered a detrimental interaction between fishermen and cetaceans (Fader et al. 2021; Carzon et al. 2023). Moreover, perceptions of interactions, such as theft and harpooning, vary depending on the methods, fishing gear, and vessel and propulsion employed by fishermen (Cram et al. 2022). It is important to emphasise cooperative fishing as a phenomenon reflecting long-standing relationships between humans and cetaceans, potentially benefitting both species (Connor et al. 2022). The sociability, territoriality, and memory of artisanal fishermen suggest that these cooperative relationships are prevalent, emphasising the importance of understanding these complex interactions (Diegues 2000). Therefore, ethnoecological studies of fishing communities are vital for evaluating these interactions, as the daily contact between fishermen and cetaceans allows for monitoring the impacts of human interference during artisanal fishing activities on both parties (Loch and Riechers 2021).

Ethnoecological studies have been conducted globally, focusing on the knowledge of artisanal fishermen, their relationships with small cetaceans, and how these perceptions can contribute to the establishment of guidelines for natural resource management plans in legally protected areas (Agardy et al. 2011; Abreu et al. 2017; Santos et al. 2022; Escobar et al. 2023). This demonstrates the interest of the scientific community in this topic as well as the recognition of traditional knowledge, defined by Diegues (2000) as the expertise acquired by a community through sustained, direct interaction with nature across generations. However, in Brazil, literature on traditional artisanal fishing knowledge and interactions with small cetaceans remains limited, despite the proven importance of data obtained through scientific methods for the conservation of these mammals (Molnár and Babai 2021).

Local Ecological Knowledge (LEK) is prevalent within the scope of ethnoecological studies involving fishermen and small cetaceans. LEK is defined as the comprehensive knowledge a community holds about the ecological conditions of their environment and the various practical implications of living within it (Sturtevant 1964; Johnson 1974). Moreover, research adopting the perspective of fishermen has been conducted since the 1990s (Leopold et al. 2013) to understand the interrelationships between humans and the environment as perceived or interpreted by those who experience them (Brandalise et al. 2009; Galvão and Tedesco 2022; Rai et al. 2024).

Thus, recognising the need to assess interactions between small cetaceans and artisanal fishing activities along the Brazilian coast, this study aimed to: a) compile studies involving artisanal fishing and its interactions with small cetaceans in Brazil; b) understand the trend in the number of publications over the years; c) analyse the distribution of studies by region of the country; d) classify the interactions between cetaceans and artisanal fishing recorded in the studies; e) identify the dolphin species recorded in the studies, seeking information on the level of extinction threats for the most frequently recorded species; and f) categorise the uses of captured animals. To achieve these objectives, we reviewed publications on the interactions of artisanal fishing with small cetaceans along the Brazilian coast and its inland rivers, focusing on ethnoecological studies using available databases.

MATERIAL AND METHODS

Methodological considerations

This study was conducted as a national bibliometric analysis of a predominantly exploratory-descriptive nature, aiming to identify the types of interactions between odontocete cetaceans and artisanal fishing along the Brazilian coast and its inland rivers, incorporating quantitative and qualitative aspects of the literature (Khan et al. 2022).

Databases and inclusion and exclusion criteria

The literature survey employed several databases: Google Scholar, Scielo, Pubmed, Science Direct, Directory of Open Access Journals (DOAJ), Web of Science (WoS) and SCOPUS (Elsevier). These platforms

provide excellent information coverage and access to a list of high-quality peer-reviewed articles that are frequently cited in the literature (Khan et al. 2020, 2022). Inclusion criteria included: a) research in ethnobiology focusing on interactions of cetaceans with artisanal fishing activities in Brazil and b) articles published in English or Portuguese up to 30 November 2022. The following studies were excluded: a) grey literature (dissertation, thesis, abstracts in annals), and b) books.

Study selection process and data analysis

The first step involved searching the databases using descriptors and analysing titles and abstracts to select relevant literature based on the inclusion criteria. A specific search formula was developed using keywords related to the topic, such as a) Cetacean or Cetáceo, b) Dolphin or Golfinho, c) Fishing or Pesca, d) Bycatch or Captura acidental, e) Interactions or Interações, and f) Brazil or Brasil. Terms commonly correlated with unrelated topics, such as a) Sirenia or Sirênia, b) Pinnipedia or Pinípedes, and c) Shark or Tubarão, were excluded to focus the search effectively.

In the second phase, the selected articles were further filtered by applying the exclusion criteria, which involved reading the texts and analysing the aims and results of each study (Figure 1). The number of studies identified facilitated the creation of a graph and map using Microsoft Excel and ArcGIS to visualise the distribution and trends of research over the years. The types of interaction between cetaceans and fishing activities were classified according to the categories proposed by Freitas-Netto (2003) and adapted by Di Beneditto (2004).

RESULTS

Studies on cetacean ethnoecology over time

Based on the inclusion criteria, 36 publications were identified (Additional File 1). The earliest study was published in 1988, with few publications per year until 2006. A noticeable increase in publications on the ethnoecology of small cetaceans began in 2007 (Figure 2), possibly due to enhanced funding for research and postgraduate studies from sources such as the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), the Financiadora de Estudos e Projetos (FINEP), and State Research Support Foundations (FAPs), which contributed to the restoration of research infrastructure and expansion of postgraduate programs (Moura and Camargo Junior 2017; Celeste et al. 2021).

On the other hand, the pandemic caused by Sars Cov 2 (COVID-19) in 2020 and subsequent cuts in research funding significantly impacted research momentum, with a notable 92% budget reduction for the Ministry of Science and Technology in 2021 (Santos et al. 2022). Additionally, recent cutbacks in research incentives and training in ethnobiology likely influenced the observed decrease in publications involving interactions between fishermen and cetaceans ($n = 36$).

Indeed, scientific efforts are pivotal in recognising the culture, perceptions, and knowledge of these communities, contributing to increased information on fauna and flora. This is essential for developing conservation policies for ecosystems and threatened species and for providing valuable data for future scientific research (Azevêdo et al. 2022). Additionally, studies addressing the LEK of communities have been significant factors in ethnoscientific research from various perspectives, fostering interactions among different types of knowledge (Albuquerque et al. 2013).

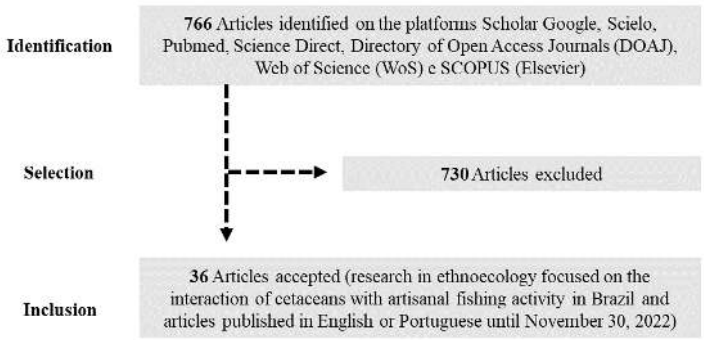

Figure 1. Steps in article selection process.

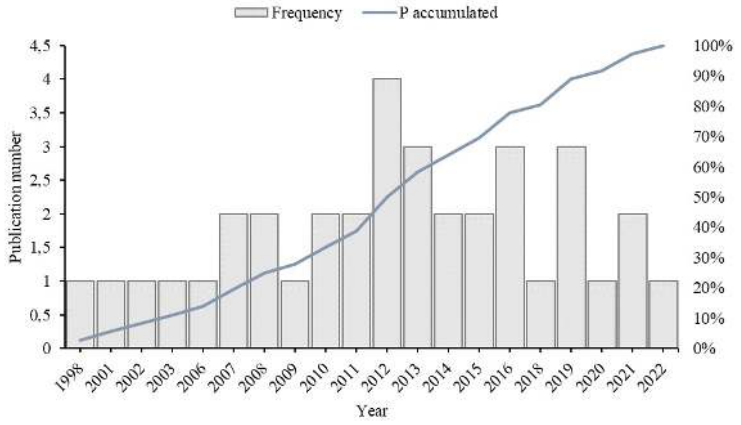

Figure 2. The annual number of publications on the interactions between artisanal fisheries and small cetaceans in Brazil published between 1998 and 2022 ($n = 36$).

Consequently, Ethnobiology assists in understanding and interpreting human interactions with nature (Sousa et al. 2022), thereby enabling the development of sustainable conservation strategies.

Therefore, it is essential to study and systematise the knowledge and perceptions of traditional fishermen, taking into account their daily actions and relationship with the natural and cultural environment (Barbosa Filho et al. 2021). As such, the efforts made in the last two decades to understand how LEK is connected to the community practices of traditional populations and the perceptions people have of species and ecosystems are valid (Davis and Wagner 2003).

Distribution of studies by Brazilian region

All other Brazilian regions were represented in the published studies, except for the Midwest region. The southeastern region had the highest percentage of publications at 47.4% ($n = 27$), followed by the northern and southern regions, each accounting for 19.3% ($n = 11$), and the northeastern region accounted for 14.0% ($n = 8$). A total of 58 cities were surveyed during the study period (1998-2022). The distribution of research by state included 25.0% ($n = 22$) in Espírito Santo, 13.6% ($n = 12$) in Bahia and Rio de Janeiro, 12.5% ($n = 11$) in São Paulo, 10.2% ($n = 9$) in Rio Grande do Sul, 6.8% ($n = 6$) in Santa Catarina, 4.5% ($n = 4$) in Pará, 3.4% ($n = 3$) in Rio Grande do Norte, and 1.1% ($n = 1$) in Maranhão and Paraná (Figure 3). Some publications covered more than one region, state, and municipality, totalling 58 cities included in the studies (Additional File 2).

The absence of studies in the Midwest region is directly related to the lack of oceanic and river cetaceans, as these species predominantly inhabit the continental shelf's edge or shallow coastal waters, which are crucial for their distribution (Würsig 1989). These areas (mouths of rivers, estuaries, bays, and fjords) offer high productivity and prey availability, provide habitats where dolphins and toninhas become residents, avoid predators, and benefit from more predictable food resources (Ingram and Rogan 2002).

Conversely, the southeastern coast corresponds to a very well-represented area in research because of the large number of odontocete species listed on the southeastern Brazilian continental shelf (PCSE) ($n = 27$) (Santos et al. 2010; Santos and Figueiredo 2016), and approximately 19 species have been recorded on the southern coast (Cherem et al. 2004). Among the five states with the most publications – Espírito Santo, Bahia, Rio de Janeiro, São Paulo, and Rio Grande do Sul – except for Bahia is not located in the South and Southeast. These regions also historically receive the highest federal research funding (CAPES, 2021) and are home to the two oldest Brazilian universities (UFRJ and USP) and pioneering oceanography courses (FURG and UERJ) (Schwartzman 2006).

Furthermore, financial support and incentives to strengthen Research Groups (RG) in the southern and southeastern regions of Brazil (Figure 4) likely contributed to increased scientific production. These institutions' privileged biodiversity hotspots for cetaceans (Tittensor et al. 2010) further enhance this effect. Although the number of studies considering fishermen's knowledge has grown significantly worldwide, becoming an important research area (Lima et al. 2017), there remains a notable lack of information on cetaceans and their interactions with Brazilian artisanal fishing, particularly in the Northern and Northeastern regions. Our results emphasise the need

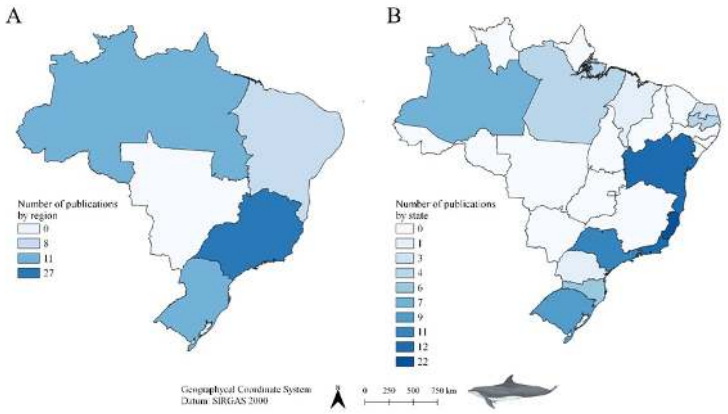

Figure 3. Map of the number of publications in Brazil from 1998 to 2022. A. Number of publications by region. B. Number of publications by state.

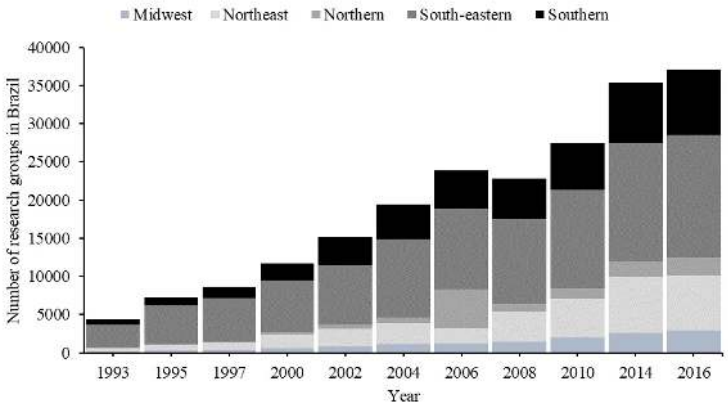

Figure 4. Temporal evolution of the number of research groups inventoried by the Directory of Research Groups (DGP) by region of Brazil.

for increased research efforts and initiatives in these areas, which together comprise one of the most significant coastal regions in Brazil (Martins et al. 2004).

Insights into the knowledge of traditional fishermen are crucial for understanding and interpreting the lifestyles of various fishing communities in different regions. This understanding is essential for enriching scientific expertise and developing effective measures to maintain biodiversity in ecosystems and biomes (Albuquerque et al. 2013). However, the lack of information regarding actual fishing efforts complicates the estimation of species mortality caused by these activities (Ott et al. 2002). In a study conducted in the eastern estuary of Guangdong, China, focusing on the Indo-Pacific humpback dolphin *Sousa chinensis* (Osbeck 1765), the authors integrated the LEK of fishermen in the region using scientific methods. This integration aimed to monitor the ecological information about this species, which has previously been neglected in scientific investigations. The data revealed that this species is prone to geographic isolation and faces constant threats, requiring substantial conservation efforts (Wang et al. 2016).

The scientific records from Wang et al. (2016) and Roda et al. (2012) suggest that efficient fisheries management requires the appreciation and recognition of traditional knowledge as a fundamental element of scientific research in this field, given that fishermen's LEK is highly specialised (Pita et al. 2016; Vásquez-Carrilo and Peláez-Ossa 2021). According to Pita et al. (2016) and Vásquez-Carrilo and Peláez-Ossa (2021), a deep understanding of fishermen's personal experiences can aid in developing proposals for effective community interventions together with communities. Nonetheless, despite its relevance, the development of local programs and policies to mitigate adverse impacts on ecosystems and lifestyles of traditional communities remains significantly undervalued

(Li 1996; Moura and Marques 2007).

The global increase in publications on the unification of academic and traditional knowledge of fishermen and other traditional communities has highlighted the emergence of a new paradigm within the scientific community (Purcell et al. 2020). This new outlook fosters interdisciplinary understanding and the recognition and alliance of knowledge, cultures, and perceptions as pathways to developing efficient government programs and balancing ecosystem research (Salazar-Peréz et al. 2020). Therefore, we reinforce the need for more scientific studies that consider LEK and fishermen's perspectives as strategic propositions for the conservation of coastal dolphin species in Brazil.

Interactions between dolphins and artisanal fishing in Brazil

Interactions between cetaceans and fishing are common worldwide. They can be categorised as ecological interference (associated with competition for the same food resources) or operational interference (associated with fishing equipment) (Lodi and Borobia 2013). These interactions are described as either positive, such as when cetaceans indicate the location of fish to fishermen (Zappes et al. 2011; Machado et al. 2019), or negative, such as when cetaceans collide with fishing nets, damage them, or become entangled (Ott et al. 2002; Di Beneditto 2003; Freitas-Netto and Di Beneditto 2008; Zappes et al. 2009). These interactions threaten dolphin populations and negatively affect fishing activities (Zappes et al. 2013).

In this study, we recorded 12 types of interactions between cetaceans and fishing activities (Table 1), of which only seven (Trapped, Collision, Entanglement, Harpooning, Theft, Ambush, and Cooperation) followed the descriptions adapted by Di Beneditto (2004). The remaining types were included based on an analysis of the reports obtained in the reviewed studies. Notably, with the exception of Souza and Begossi (2007), Zappes et al. (2013), Silva et al. (2014), Zappes et al. (2018), Machado et al. (2019), Vidal et al. (2019), Barbosa Filho et al. (2020), and Cook et al. (2022), all the other studies reported at least one type of interaction (Additional File 3). The category 'Trapped' was the most cited interaction, with 24.7% ($n = 18$) of reports documenting this type, followed by 'Cooperation' at 13.7% ($n = 10$), and 'Collision', 'Entanglement' and 'Theft' each at 12.3% ($n = 9$), among others.

According to Siciliano (1994), Simões-Lopes et al. (1998), Di Beneditto (2003), Freitas-Netto and Di Beneditto (2008), and Zappes et al. (2009), gillnets were identified as the leading cause of small coastal and oceanic cetacean captures in Brazil. Trapping in gillnets and longlines occurs across almost all regions of the country, including the north (Brito 2012; Marmontel 2013), northeast (Meirelles et al. 2009, Meirelles and Barros 2007), southeast (Moura 2009; Di Beneditto 2003), and south (Przbylski and Monteiro-Filho 2001). Additionally, an ethnoecological study by Pinheiro and Cremer (2003) in Babitonga Bay, Santa Catarina, highlighted that gillnets, especially those used for black drum, gray snapper, and hagfish, are highly lethal to cetaceans, causing death by drowning. The study also noted that the toninha, *Pontoporia blainvillei*, does not survive long once entangled in a gillnet, and that *Sotalia guianensis* tends to be caught more frequently in these nets (Pinheiro and Cremer 2003). Fishermen on the coast of Pará reported higher incidences of *S. guianensis* captures compared to *Inia geoffrensis*, attributing this to the slower behaviour of the Guiana dolphin compared to the Amazonian River dolphin (Brito 2012). Tregenza et al. (1997) also found that dolphins' failure to detect net strands through echolocation might contribute to entanglement during fishing in the Celtic Sea, United Kingdom.

Gillnets, cast nets, and longlines have been shown to have the most operational interactions with cetaceans during fishing. These interactions also help fishermen recognise the species interacting with the gear based on their daily observations (Monteiro-Neto et al. 2000; Siciliano 1994; Monteiro-Filho et al. 1999; Di Beneditto 2003; Zappes et al. 2009). One measure that could mitigate the number of accidental dolphin captures is the adoption of sound pulse beacons in nets, which makes the gear detectable to animals (Hamilton and Baker 2019). A preliminary study by Zollet and Read (2006) demonstrated that using beacons decreased bottlenose dolphin mortality due to entanglement, proving to be an effective strategy for mitigating the impacts of bycatch on fishing gear.

Ethnoecological studies have also played an important role in informing fishery management systems and conserving the species involved in fishing activities in Brazil (Diegues 2008; Gerhardinger et al. 2009; Silvano and Begossi 2012). Historically, fishery management was based on analyses that disregarded the knowledge systems of traditional communities, often leading to ineffective management models that artisanal fishermen felt excluded from or harmed (Smith et al. 2005; Andrew et al. 2007; Fernández-Vidal and Muiño 2014; El-Hani et al. 2022).

The inclusion of fishermen in decision-making processes is crucial, as it adds knowledge, values tradition, and fosters a social identity within these processes (Silva 2004; Urquhart et al. 2014; Linke and Bruckmeier 2015; De la Torre-Castro et al. 2017; Stephenson et al. 2019). Government organisations must collaborate with communities to manage activ-

Table 1. Interactions between small cetaceans and artisanal fishing. (n) = number of reports per study. (*) New types of interaction.

Interação (n)	Type of interaction		Interference	
	Ecological	Operational	Dolphin	Fisherman
Trapped (18)	Competition for resource	x	-	- or neutral
Cooperation (10)	Commensalism		neutral	+
Collision (9)	Competition for resource	x	-	-
Entanglement (9)	Competition for resource	x	-	- or neutral
Theft (9)	Competition for resource	x	+	-
Scaring away* (7)	Competition for resource		+ or neutral	-
Signalling* (4)	Commensalism		neutral	+
Harpooning (3)	Predation	x	-	+
Ambush (1)	Commensalism		+	neutral
Drive away* (1)	Commensalism		neutral	+
Depredation* (1)	Competition for resource	x	+	-
Disposal* (1)	Commensalism		+	neutral

ities and provide financial aid for acquiring beacons, ensuring aligned, shared, and community-based management (co-management or participatory management) (Berkes 2006; Diegues 2008). Therefore, involving fishermen in decision-making and collecting information on target stocks through interviews, observations, and monitoring is essential for efficient and collaborative management (Ota and Just 2008).

Description of new interactions in Brazil

This review included new interactions with those adapted by Di Beneditto (2004). These interactions included Drive away, Depredation, Disposal, Scaring away, and Signalling (Table 2).

Based on the data gathered from the literature, new reports were analysed and categorised based on the interactions described by the interviewed fishermen in the studies. Based on the complementarity of the categories provided by Di Beneditto (2004), a broader framework emerges for identifying the types of interactions, taking into account the particularities of the species and their distribution areas, whether marine or riverine. Consequently, 'drive away' (Figure 5) was the first type of interaction in the reports, considered a positive relationship for fishermen and a neutral one for cetaceans. In a study by Brito (2012) on artisanal fishing interactions with dolphins along the coast of Pará, it was reported, based on information from fishermen, that river dolphin species contributed to fishing activities by driving away other predators from the vessels. Similar reports have been documented in several ethnoecological studies conducted on artisanal fishermen (Monteiro-Filho et al. 1999; Przbylski and Monteiro-Filho 2001; Freitas Netto 2003; Di Beneditto 2003, 2004; Zappes 2007).

Another type of interaction identified in this study was depredation (Figure 6), which is considered negative for fishermen as their traps are damaged due to animal interference. Rosa and Secchi (2007) reported that the depredation of fishing traps by killer whales, *Orcinus orca*, in Southern and Southeastern Brazil was significantly greater than depredation caused by sharks, based on the proportion of fish damaged by the interaction. Furthermore, they noted that aggregations of many individuals can spread over large areas, utilising their group size to enhance their search for traps and maximise feeding efficiency.

Regarding disposal interactions (Figure 7), a study in the Central Amazon by Alves et al. (2012) found that 69.2% of interviewed fishermen reported that dolphins feed on voluntarily and involuntarily discarded fish during fishing. Similarly, Zappes et al. (2010), in their study on the behaviour, diet and occurrence area of the Guiana dolphin, *Sotalia guianensis*, noted that the tendency of dolphins to accompany vessels could be explained by the noise produced by the engine (which attracts the animals), the flow of

Table 2. Interactions between small cetaceans and artisanal fishing. (n) = number of reports per study. (*) new types of interactions.

Interaction	Description
Drive away*	Animal or group of animals keeps other predators away from the surroundings of the vessel.
Harpooning	An animal or group of animals is harpooned when approaching the vessel to be used as bait in fishing practices or for other purposes.
Collision	Animal or group of animals collides with the fishing net and manages to break it, freeing itself.
Cooperation	Animal or group of animals directs or corners the fish near the fishing device.
Depredation*	Animal or group of animals destroys the trap type "covo", "manzuá" or another, capturing the fish from inside.
Disposal*	Animal or group of animals feeds on fish, target or non-target species of the activity, discarded by the fisherman.
Trapped	Animal or group of animals collides with the fishing net and is trapped in the meshes of the artifact.
Entanglement	Animal or group of animals becomes entangled in the main or secondary lines of the longline or another type of fishing line.
Scaring away*	Animal or group of animals approaches the boat, moving the school to another area.
Theft	Animal or group of animals approaches the fishing device, removing the entangled or hooked fish.
Signalling*	Animal or group of animals signals where the shoal is, inducing the fisherman to choose that area.
Ambush	Animal or group of animals accompanies the fishing operation, chasing and capturing (or trying to capture) the fish that escapes from the artifact.

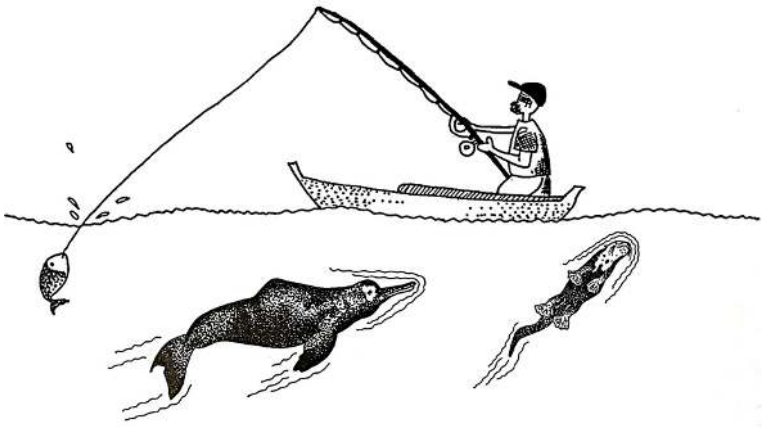

Figure 5. Illustration of withdrawal-type interaction.

water generated by vessel propulsion, and the opportunity to feed on fish discarded by fishermen during their activities.

Furthermore, the 'scaring away' interaction (Figure 8) can be identified by cetaceans moving towards vessels, which scares the catch away from the area, leading to reduced fishing success. Many fishermen have reported this type of interaction; for ex-

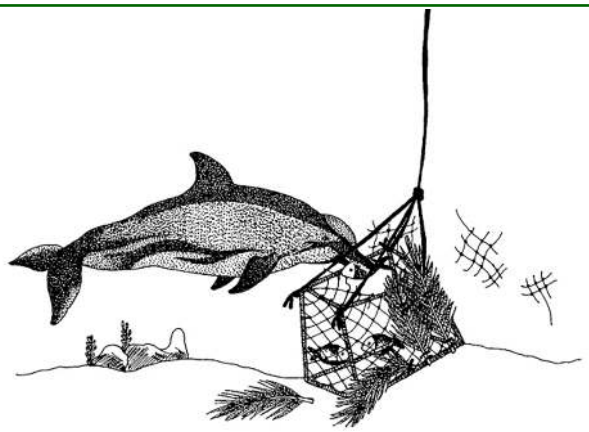

Figure 6. Illustration of predation-type interaction.

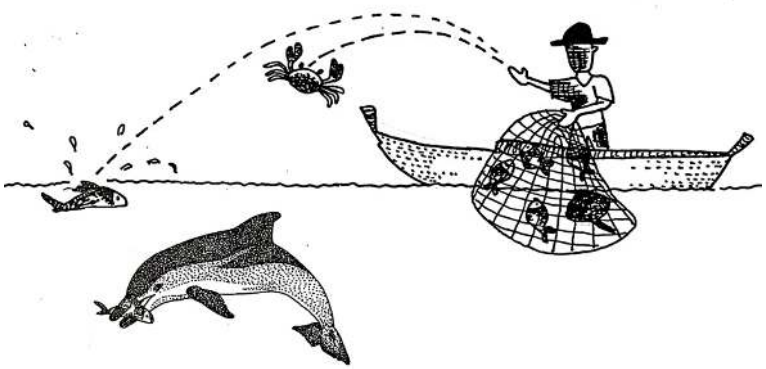

Figure 7. Illustration of discard-type interaction.

ample, in a study by Silva et al. (2014) in the municipality of Cabo Frio, east coast of Rio de Janeiro, where 2% of interviewed fishermen reported that the behaviour was detrimental to fishing activity, as dolphins scared the fish every time they approached the vessels. Furthermore, a study on the interaction of the Guiana dolphin *Sotalia guianensis* with fishing activity along the Pernambuco coast by Araújo (2008) found that 15% of interviewed fishermen stated that cetaceans could scare away the target fish due to their proximity. This was also corroborated by Brito (2012) on the LEK of fishermen and their interactions with river dolphins along the coast of Pará, where fishermen from the municipalities of Colares and Maracanã reported similar negative interactions with animals scaring off shoals every time they approached the fishing area.

The 'signalling' interaction (Figure 9) can be understood as a type of positive interaction for fishermen and neutral for dolphins, as the presence of the cetacean signals the presence of shoals to fishermen. This type of interaction has been reported by Pinheiro and Cremer (2003), Brito (2012), Zappes et al. (2014), Mintzer et al. (2015), Manzan and Lopes (2015), and Catão and Barbosa (2018). Furthermore, a study by Catão (2021) on collaborative fishing in Laguna, Santa Catarina, emphasised that signalling gestures performed by dolphins did not encompass the total behavioural repertoire of these animals but had established meanings based on different contexts and magnitudes.

Identified species and threat category

The compiled studies included 43.2% (n = 16) of the 37 odontocete species reported in Brazil (Additional File 4). The number of species identified in publications varied, where of the total number of studies analysed, 5.6% (n = 2) identified eight species, 2.8% (n = 1) identified six species, 2.8% (n = 1) identified four species, 8.4% (n = 3) identified three species, 19.4% (n = 4) identified two species, 50.0% (n = 184) identified one species, and 11.1% (n = 4) did not specify the species reported by the fishermen

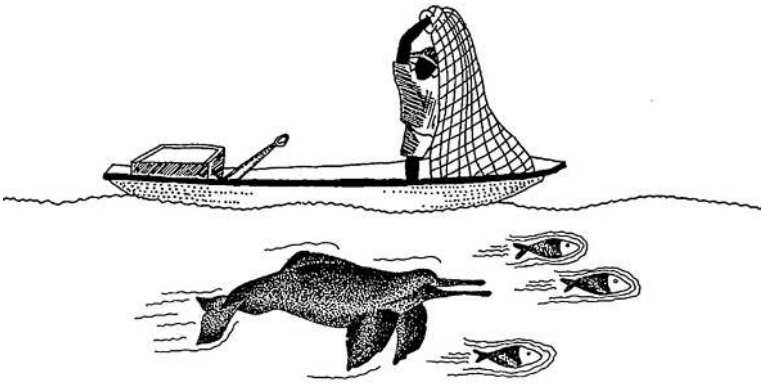

Figure 8. Illustration of the scare-type interaction.

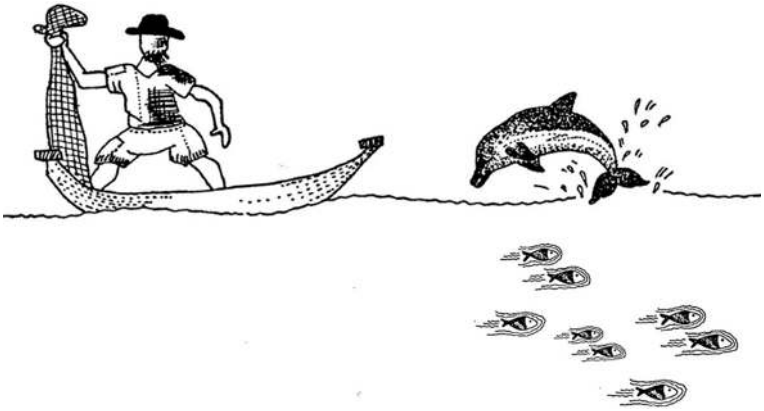

Figure 9. Illustration of signalling type interaction.

in interviews. The most frequently mentioned dolphin species by fishermen were *Sotalia guianensis* ($n = 14$, 21.2%), *Tursiops truncatus* ($n = 12$, 18.2%), *Pontoporia blainvillei* ($n = 8$, 12.1%), *Inia geoffrensis* ($n = 7$, 10.6%), and *Sotalia fluviatilis* ($n = 5$, 7.6%) (Figure 10). This resulted in 46 records, exceeding the total number of articles found ($n = 36$), which can be explained by some studies including more than one species based on interviews.

Additionally, according to interview reports, the northeastern region was the richest in terms of the number of species that interacted with fishermen ($n = 9$; 56.3%), followed by the southeastern ($n = 5$; 31.3%), southern ($n = 3$; 18.8%), and northern regions ($n = 2$; 18.8%) (Figure 11). These data underscore the need for increased research in the northeastern region. Despite the low number of publications highlighted in this study, the species richness reported for this region suggests the necessity for more robust conservation measures and actions based on dialogue between humans and nature. According to Lodi et al. (2013), in a study conducted with artisanal fishermen in the Archipelago das Cagarras, Rio de Janeiro, artisanal fishermen were able to identify potential anthropogenic impacts as well as the need to implement conservation and management measures for fauna. In particular, the authors concluded that this combination of data obtained using traditional scientific methods allows for understanding unanswered questions, such as seasonality, behaviour, habitat use, population size, anthropic pressures, and threats, when both parties provide complementary information.

Sotalia guianensis (Van Bénéden 1864)

As the most cited species in the reviewed studies, the Guiana dolphin (*Sotalia guianensis*) is the most common in shallow Brazilian waters, widely recognised from the coast of Pará to Santa Catarina (Filgeuira et al. 2021). It holds a global conservation status of "Near Threatened (NT)" as classified by the IUCN Red List (Secchi et al. 2018), and nationally, it is listed as "Vulnerable (VU)" by the Lista Oficial da Fauna Brasileira Ameaçada de Extinção (MMA

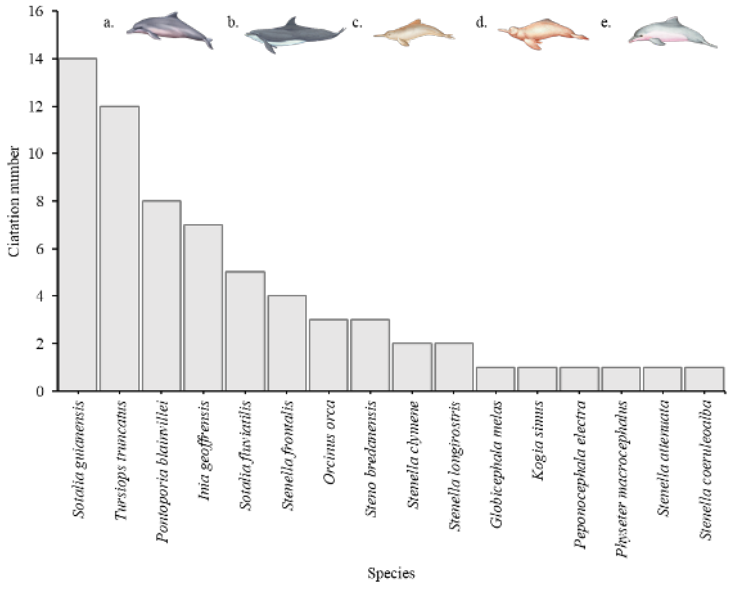

Figure 10. The number of records by species identified in the analysed studies, highlighting the most cited: a. *Sotalia guianensis*. b. *Tursiops truncatus*. c. *Pontoporia blainvillei*. d. *Inia geoffrensis*. e. *Sotalia fluviatilis*.

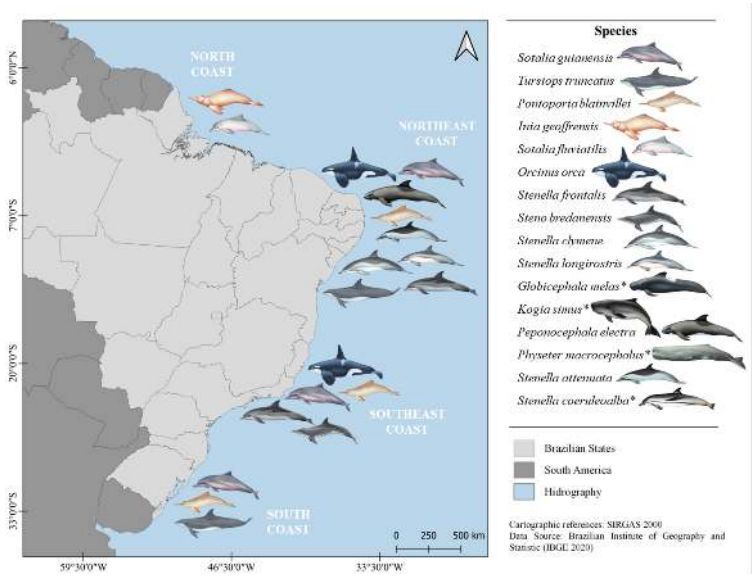

Figure 11. Number of species identified per region in Brazil.

2022) (Table 3). Despite the recent distinction between the marine and river ecotypes of *Sotalia fluviatilis*, Guiana dolphins remain the most well-studied aquatic mammals in Brazil in terms of population diversity (Cunha et al. 2005; Fettuccia et al. 2009), patterns of movement and distribution (Daura-Jorge et al. 2004, 2005), habitat use (Lodi 2003; Bazzalo et al. 2008), social parameters (Santos and Rosso 2008; Cantor et al. 2012a), and their relationship with ecotourism (Albuquerque and Souto 2013; Souza et al. 2022).

Although considerable efforts have focused on this species, there remains a significant gap in in-depth studies on its threat factors (Santos 2010; Manzan and Lopes 2015). Owing to its strong association with estuarine environments, this species is vulnerable to anthropogenic impacts, such as pollution, incidental capture, noise from boat traffic, and habitat changes (Cantor et al. 2012b; Albuquerque and Souto 2013; Bisi et al. 2013). For example, a study conducted

Table 3. The conservation status of species mentioned in previous studies. Threat categories followed the Red List of the International Union for Conservation of Nature (IUCN) and the Official List of Brazilian Fauna Threatened with Extinction by the Ministry of the Environment (MMA).

Species	Threat category (IUCN)	Threat category (MMA)
Sotalia guianensis	Near Threatened (NT)	Vulnerable (VU)
Tursiops truncatus	Least Concern (LC)	Endangered (EN)
Pontoporia blainvillei	Vulnerable (VU)	Critically Endangered (CR)
Inia geoffrensis	Endangered (EN)	Endangered (EN)
Sotalia fluviatilis	Endangered (EN)	Not Evaluated (NE)
Orcinus orca	Data Deficient (DD)	Not Evaluated (NE)
Stenella frontalis	Least Concern (LC)	Not Evaluated (NE)
Steno bredanensis	Least Concern (LC)	Not Evaluated (NE)
Stenella clymene	Least Concern (LC)	Not Evaluated (NE)
Stenella longirostris	Least Concern (LC)	Not Evaluated (NE)
Globicephala melas	Least Concern (LC)	Not Evaluated (NE)
Kogia simus	Least Concern (LC)	Not Evaluated (NE)
Peponocephala electra	Least Concern (LC)	Not Evaluated (NE)
Physeter macrocephalus	Vulnerable (VU)	Vulnerable (VU)
Stenella attenuata	Least Concern (LC)	Not Evaluated (NE)
Stenella coeruleoalba	Least Concern (LC)	Not Evaluated (NE)

in the Cananéia estuary (Southeastern Brazil) by Deconto et al. (2021) found that individuals of *S. guianensis* altered the frequency and intensity of their vocalisations in response to the presence of boats. Similarly, in the Northern Bay of Santa Catarina, Pereira et al. (2007) observed that the reactions of this species shifted from negative to neutral over 10 years due to vessel traffic. Furthermore, research has demonstrated that dolphin-watching tours in Tibau do Sul (Northeastern Brazil) employing motorboats can significantly diminish the foraging activity of the Guiana dolphin (Carrera et al. 2008).

Tursiops truncatus (Montagu 1821)

The bottlenose dolphin (*Tursiops truncatus*), common in Southern Brazil, is widely distributed in temperate and tropical waters and uses a broad range of habitats, such as bays, lagoons, estuaries, and river mouths (Tullio et al. 2015; Laporta et al. 2016; Paschoalini and Santos 2020). Its global conservation status is classified as "Least Concern (LC)" by the IUCN Red List (Wells et al. 2019), yet it is considered "Endangered (EN)" nationally by the Lista Oficial da Fauna Brasileira Ameaçada de Extinção (MMA 2022) (Table 3). This species is known for exploiting food resources from human activities, such as waste from fishing boats (Noke and Odell 2002; Piwetz 2019), and is noted for participating in cooperative fishing in Southern Brazil (Simões-Lopes et al. 1998, 2016).

Cooperative fishing not only benefits fishermen but also aids dolphins by increasing survival (Bezamat et al. 2021), reducing the risk of bycatch (Cantor et al. 2018), and reinforcing behaviours that generate physical, social, and emotional benefits for individuals (Clegg et al. 2017; Serres and Delfour 2017). Additionally, Simões-Lopes et al. (1998), Zappes (2011), and Santos et al. (2018) in Southern Brazil reported that the presence of common bottlenose dolphins increased fishing efficiency, changed dynamics by reducing activity effort, and increased the number of fish catches.

Consequently, these animals have been the focus of several long-term studies worldwide. Despite their well-documented behavioural plasticity, significant gaps remain in our understanding of how their interactions affect population dynamics (Mann et al. 2000; Fruet et al. 2015; Civil et al. 2019). Addition-

ally, many populations in coastal waters are declining (Currey et al. 2009; Féliz et al. 2017), rendering them particularly vulnerable. This vulnerability is exacerbated by their tendency to occupy more restricted distributions that frequently overlap with human activities (Bearzi et al. 2009).

Pontoporia blainvillei (Gervais and d'Orbigny 1844)

Commonly known as Franciscana, *Pontoporia blainvillei* inhabits estuarine and coastal zones and prefers depths of up to 30m (Danilewicz et al. 2009), which indicates its propensity for shallow and productive waters (Danilewicz et al. 2009; Amaral et al. 2018). The selection of their home range is influenced by both the depth and the extent of the continental shelf (Siciliano 1994; Amaral et al. 2018). Currently, incidental capture in fishing nets, especially gillnets, is considered to be the main threat to its conservation (Secchi et al. 2004; Moreno et al. 2009; Ferreira et al. 2010), which is corroborated by the global conservation status of "Vulnerable (VU)" on the IUCN Red List (Zerbini et al. 2017) and nationally as "Critically Endangered (CR)" on the Lista Oficial da Fauna Brasileira Ameaçada de Extinção (MMA 2022) (Table 3).

Due to its coastal habits, franciscana is especially susceptible to human activities (Gariboldi et al. 2015; Domiciano et al. 2016). In a study performed by Secchi et al. (2004), who monitored coastal gillnet fleets in the Port of Rio Grande (southern Rio Grande do Sul) between 1999-2000, the authors reported that the highest levels of *Pontoporia blainvillei* bycatch occurred along the southern coast of Brazil, Uruguay, and Argentina. Estimates indicate that the annual mortality of "franciscana" due to bycatch can vary from hundreds to thousands throughout their range (Ott et al. 2002; Danilewicz et al. 2009). Therefore, their accidental capture was observed throughout their entire geographic distribution (Bordino et al. 2002; Prado et al. 2013; Cunha et al. 2014; Gomez and Cassini 2015; Gariboldi et al. 2016; Amaral et al. 2018; Berninsone et al. 2020), which is believed to be unsustainable, thereby highlighting the immediate need for conservation and management measures for this species (Ott et al. 2002; Secchi et al. 2003).

Inia geoffrensis (Blaiville 1817)

The Amazonian River dolphin (*Inia geoffrensis*), also known as the pink river dolphin, is one of the largest freshwater dolphins, reaching up to 2.5m in length and weighing 200 kg (Silva et al. 2018). This species is endemic to the continental waters of South America and inhabits lakes and rivers of the Amazon, Araguaia-Tocantins, and Orinoco basins (Carolsfeld and Bank 2003). According to Silva et al. (2023), the Amazonian River dolphin consumes more than 40 fish species, with additional reports of small turtles and crabs in its diets. Males prefer larger river habitats, while females and calves are more commonly observed in floodplain areas (Marti and Silva 2006). The conservation status of *I. geoffrensis*, according to the IUCN Red List and the Lista Oficial da Fauna Brasileira Ameaçada de Extinção, is classified both globally and nationally as "Endangered (EN)" (Silva et al. 2018; MMA 2022) (Table 3).

This species is naturally curious and sociable (Vidal et al. 2022), often leading it to approach vessels during foraging. This behaviour frequently destroys fishing nets as dolphins search for food, creating a conflicted relationship with fishermen (Zappes et al. 2013; Tixier et al. 2021). In the Amazon region, accidental and intentional capture is common, where dolphins are captured to use their meat as bait for fishing (Rodrigues et al. 2018). Such interactions have led to a decline in river dolphin populations (Loch et al. 2009; Marmontel 2013).

Death caused by interactions with fishing activities has emerged as a major threat to the distribution of this species, although this issue has not been systematically studied (Tixier et al. 2021). Like other odontocetes, the Amazonian River dolphin is vulnerable to entanglement in various types of nets, and accidental deaths from fishing gear have been reported throughout the Amazonian region (Mintzer et al. 2013; Trujillo-González et al. 2019; Iriarte and Marmontel 2023). This poses problems for animals and fishermen who face gear damage (Jimenez et al. 2019). In a study by Kelkar et al. (2010) on the Ganges River in India, the authors discussed the biological interactions between artisanal fishermen and river dolphins, noting a strong spatial overlap between fishing areas and areas frequented by dolphins, confirming high competition for resources. Read (2008), in a review of the anthropogenic threats faced by marine mammals globally, argued that fishing activities can lead to significant alterations in ecosystem structure and function, with severe consequences for these populations (DeMaster et al. 2001).

Sotalia fluviatilis (Gervais and Deville 1853)

Sotalia fluviatilis, commonly known as "tucuxi", is endemic to the Amazonian Basin. This delphinid is generally found in small groups of up to six individuals, reaching approximately 1.52m in length and weighing approximately 50 kg (Gravena et al. 2021; Shostell and Ruiz-García 2010). Individuals of this species have robust and hydrodynamic bodies, which

enhance their water agility (Gillet et al. 2019). The "tucuxi" has recently been classified as "Endangered (EN)" on the global ICUN Red List (Silva et al. 2018), yet it is notably absent from the national Lista Oficial da Fauna Brasileira Ameaçada de Extinção (MMA 2022) (Table 3).

Similar to many other cetacean species worldwide, environmental pollution leads to the contamination of fish, which is a crucial food resource for these animals (Bossart 2011). Additionally, the increasing number of fishing vessels reduces food availability, resulting in competition for resources and a consequent increase in dolphin and "tucuxi" deaths in fishing nets (Loch et al. 2009). The absence of a national conservation status classification for "tucuxi" highlights the limited knowledge about this species across its distribution range and confirms that the existing information is insufficient to classify this species using the IUCN's established criteria. This situation calls for urgent conservation measures to preserve the species and its habitat.

Usage categories

Some studies (n = 8, 100%) identified the usage categories attributed to cetaceans, as detailed in Additional File 5. The most common use of derivatives from deceased animals was bait, accounting for 31% ($n = 13$) of the cases. This was followed by consumption use, comprising 26% ($n = 11$), and the discarding of unwanted catches at 21% ($n = 9$) (Table 4). Additionally, all fishermen reported releasing live animals that were accidentally entangled in their fishing gear.

The use of dolphin derivatives is diverse, reflecting diverse human interactions with marine animals (Toledo et al. 2010; Bossart 2011). Their use as bait for fishing is prevalent in many regions worldwide, where the presence of dolphins attracts other fish and facilitates catches (Iriarte and Marmontel 2013; Barbosa-Filho et al. 2018; Mintzer et al. 2018; Campbell et al. 2020a). Despite being illegal in many countries (Barbosa-Filho et al. 2016; Campbell et al. 2020b; Amponsah et al. 2023), this practice persists, particularly in developing regions, where socioeconomic factors compel fishermen to seek effective, fresh, and often free bait (Mintzer et al. 2018). This activity has been reported for both marine species and freshwater cetaceans, such as the Amazon River dolphin (*Inia geoffrensis*) and "tucuxi" (*Sotalia fluviatilis*), used to catch "piracatinga" (*Calophysus macropterus*) in Brazil, Colombia, and Peru (Mintzer et al. 2013; Brum et al. 2015; Campbell et al. 2020a). For marine species, their use is mainly associated with shark fishing (Mangel et al. 2010; Quintana-Rizzo 2011).

Furthermore, the use of resources from these animals for subsistence has been documented in coastal communities in Brazil (Tosi et al. 2009; Meirelles et al. 2010; Brum et al. 2015; Barbosa-Filho et al. 2018). For example, *S. guianensis* meat is consumed by traditional communities in the states of Bahia (Zappes et al. 2009), Espírito Santo (Freitas Netto and Di Beneditto 2008), Paraná (Przbylski and Monteiro-Filho 2001), and the northern region of the country (Siciliano 1994; Brum et al. 2015). These practices significantly affect these animals and their ecosystems. Recent research in Brazil and globally focuses on various issues related to the conservation and management of dolphin species, particularly their accidental capture in fishing activities (Secchi et al. 2021), their use in ethnoveterinary and medicinal practices (Teixeira et al. 2020; Suffredini et al. 2023), and the illegal trade of derivatives (Siciliano et al. 2023). These studies underscore the urgent need for mitigation measures to reduce accidental capture, conservation policies to combat illegal trade, and the importance of international collaboration in protecting these populations and preserving marine ecosystems.

Ethnoecology as a conservation tool for cetaceans in Brazil

Considering the interactions of small cetaceans with fishing activities in Brazil, a study by Rosa et al. (2012) conducted in Porto de Atafona, a district in São João da Barra, Rio de Janeiro, highlighted the significant challenges in conservation efforts. The study identified a lack of regular monitoring of accidental captures, and the absence of population size estimates is a major obstacle in conserving dolphin species in Brazil. Furthermore, the researchers found that engaging with fishing communities facilitated the conservation process, as the fishermen provided vital information on the accidental capture of cetaceans in gillnets in Northern Rio de Janeiro. This collaboration was enhanced through logbooks and identification of overlapping areas of cetacean habitats and fishing activities.

Studying the ecology of species in their natural environment is an important component in developing strategies for in situ conservation (Katsanevakis et al. 2011; Santamaría and Méndez 2012; Tittensor et al. 2019). Research on the ecology and behaviour of cetaceans has increased, revealing several anthropogenic impacts that contribute to the decline of some populations due to mortality and habitat abandonment (Fernández-Vidal and Muiño 2014; Fruet et al. 2011; Azevedo et al. 2017; Forney et al. 2017). Charismatic species, such as dolphins, are often used as conservation "flagships" (Smith and

Table 4. Usage categories reported by fishermen in the reviewed literature.

Usage categories	Number of reports (n)	%
Bait	13	31,00%
Consumption	11	26,00%
Discard	9	21,00%
Commercialization	4	10,00%
Ethnomedicine	2	5,00%
Ethnoveterinary	1	2,00%
Directed to environmental agencies	1	2,00%
Scientific research	1	2,00%
Total	42	100,00%

Smith 1998; Jacobs and Harms 2014; Brando et al. 2018). However, an integrated approach that considers both species and ecosystems is the most effective strategy for developing conservation actions (Sidding et al. 2016).

The practice of artisanal fishing close to the coast and coastal habits of cetaceans indicate that fishermen and dolphins share the same area, leading to various interactions. This proximity allows fishermen to observe the animals and enhances their ability to identify them. Consequently, ethnoecological studies that incorporate the perceptions of traditional fishermen and ecological knowledge of cetacean species can assist in shaping conservation strategies. These studies demonstrate that traditional fishermen should not be seen merely as threats to cetacean conservation, but as allies, provided they are included from the outset in developing conservation actions.

CONCLUSION

This study highlighted persistent gaps in our understanding of the interactions between small cetaceans and artisanal fishing, particularly in the Northern and Northeastern regions of Brazil. We emphasise the necessity of enhanced research efforts and incentives in these regions, as the LEK and perspectives of fishermen can significantly contribute to future studies on species distribution, monitoring of feeding and reproduction areas, and even estimates of dolphin mortality due to bycatch in fishing gear.

Additionally, more profound knowledge of the interactions between fishing and cetaceans will facilitate the improvement of fishing gear, aiming to reduce bycatch and optimise these activities across various aquatic environments in the country. Understanding these interactions is crucial for promoting the conservation of these animals, given that accidental capture remains a potentially impactful factor for the populations of small cetaceans in Brazil.

Interactions with artisanal fishing were identified in 16 of the 37 odontocete species known to occur in Brazil, with a particular emphasis on species such as *S. guianensis*, *T. truncatus*, *P. blainvillei*, *I. geoffrensis*, and *S. fluviatilis*. This underscores the need to target conservation actions or measures, especially for the most frequently cited species in these studies, as estimates based on interviewees' perceptions showed a higher frequency of interaction between these animals and fishing activities in Brazil. Therefore, continuous monitoring of these activities with small cetaceans is recommended throughout the area of occurrence to gather more data on the impact of bycatch on these populations.

This study described 12 types of interactions based on the categories proposed by Di Beneditto (2004) – such as Trapped, Cooperation, Collison, Entanglement, Theft, Harpooning, and Ambush – and introduced five new descriptions based on our analyses: Scare away, Signalling, Drive away, Depredation and Disposal. The adverse effects of these interactions on at least one species highlight that dolphins and fishermen do not coexist harmoniously. Furthermore, the different uses of cetaceans can exert additional pressure on these species, potentially hastening their decline towards extinction. Therefore, it is crucial to implement educational actions among fishermen to aid in biodiversity conservation.

In summary, this review demonstrates that ethnoecological studies focusing on the knowledge of traditional communities can provide valuable information for developing management plans for species and ecosystems. By conducting ethnographic studies, we

can address key questions regarding areas of occurrence, aspects of fishing, types of interactions, and cetacean species involved in these activities, thereby identifying potential anthropogenic impacts and the need for conservation measures.

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DATA AVAILABILITY

All data used to support the findings of this study are available from the corresponding author upon request at any time.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

CONTRIBUTION STATEMENT

Conceived from the presented idea: BCS, ELA.
Performed data analysis: BCS.
Wrote the first draft of the manuscript: BCS, ELA.
Reviewed and finalized the manuscript: BCS, ELA, AS.
Translation to English: RNUS.
Guidance: ELA.

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Additional Files

Add File 1. Total papers surveyed (until November 30, 2022) on interactions between artisanal fishing and small cetaceans in Brazil (n = 36).

References	Article title	Region	State	Cities	Publication year
ZERBINI; KOTAS, 1998.	A note on cetacean bycatch in pelagic drift-netting off southern Brazil	South-eastern; Southern	São Paulo; Santa Catarina	Ubatuba; Itajaí/Navegantes	1998
DI BENEDITTO; RAMOS, 2001.	Biology and conservation of the franciscana (Pontoporia blainvillei) in the north of Rio de Janeiro State, Brazil	South-eastern	Rio de Janeiro	Barra do Itabapoana; Macaé	2001
BERTOZZI; ZERBINI, 2002.	Incidental mortality of franciscana (Pontoporia blainvillei) in the artisanal fishery of Praia Grande, São Paulo state, Brazil	South-eastern	São Paulo	Praia Grande	2002
PINHEIRO; CREMER, 2003.	Etnoecologia e captura acidental de golfinhos (Cetacea: Pontoporidae e Delphinidae) na Baía da Babitonga, Santa Catarina	Southern	Santa Catarina	São Francisco do Sul	2003
FERREIRA; HANAZAKI; SIMÕES-LOPES, 2006.	The environmental conflicts and the estuarine dolphin (Sotalia guianensis) conservation from the Costeira da Armação community point of view, in the anhatomirim environmental protection area, south of Brazil	Southern	Santa Catarina	Governador Celso Ramos	2006
SOUZA; BEGOSSI, 2007.	Whales, dolphins or fishes? The ethnotaxonomy of cetaceans in São Sebastião, Brazil	South-eastern	São Paulo	São Sebastião	2007
ROSA; SECCHI, 2007.	Killer whale (Orcinus orca) interactions with the tuna and swordfish longline fishery off southern and south-eastern Brazil: a comparison with shark interactions	South-eastern	São Paulo	Santos; Guarujá; Cubatão	2007

Continuous...

References	Article title	Region	State	Cities	Publication year
FREITAS-NETTO; DI BENEDITTO, 2008.	Interactions between fisheries and cetaceans in Espírito Santo State coast, southeastern Brazil	South-eastern	Espírito Santo	Itaúnas; Povoação; Pontal do Ipiranga; Barra Sêca; São Mateus; Barra Nova; Conceição da Barra; Itaúnas; Presidente Kennedy; Marataízes; Itaipava; Piúma; Anchieta; Guarapari; Vila Velha; Vitória; Serra; Nova Almeida; Aracruz; Itapemirim	2008
PETERSON; HANAZAKI; LOPES, 2008.	Natural resource appropriation in cooperative artisanal fishing between fishermen and dolphins (Tursiops truncatus) in Laguna, Brazil	Southern	Santa Catarina	Laguna	2008
ZAPPES et al., 2009.	Potential conflicts between fishermen and Sotalia guianensis (van Bénéden, 1864) (Cetacea, Delphinidae) in Brazil	Northeast; South-eastern	Bahia; Espírito Santo; Rio de Janeiro; São Paulo	Prado; Nova Viçosa; Barra do Riacho; Baía de Sepetiba; Cananéia	2009
ZAPPES et al., 2010a.	Ethnobiology and photo-identification: identifying anthropic impacts on boto-cinza dolphin Sotalia guianensis in Sepetiba Bay, Brazil.	South-eastern	Rio de Janeiro	Rio de Janeiro	2010
ZAPPES et al., 2010b.	O comportamento do boto-cinza Sotalia guianensis (van Bénéden, 1864) (Cetacea; Delphinidae) através do olhar dos pescadores artesanais	Northeast; South-eastern	Bahia; Espírito Santo; Rio de Janeiro; São Paulo	Prado; Nova Viçosa; Barra do Riacho; Baía de Sepetiba; Cananéia	2010

Continuous...

References	Article title	Region	State	Cities	Publication year
ZAPPES et al., 2011a.	Interações entre o golfinho-nariz-de-garrafa (Tursiops truncatus) e a pesca artesanal no Arquipélago das Cagarras e áreas adjacentes, Rio de Janeiro, Brasil	South-eastern	Rio de Janeiro	Rio de Janeiro	2011
ZAPPES et al., 2011b.	Human-dolphin (Tursiops truncatus Montagu, 1821) cooperative fishery'and its influence on cast net fishing activities in Barra de Imbé/-Tramandaí, Southern Brazil	Southern	Rio Grande do Sul	Imbé; Tramandaí	2011
BRITO, 2012.	O conhecimento ecológico local e a interação de botos com a pesca no litoral do estado do Pará, região Norte – Brasil	Northern	Pará	Soure; Maracanã; Colares	2012
ROSA; ZAPPES; DI BENEDITTO, 2012.	Etnoecologia de pequenos cetáceos: interações entre a pesca artesanal e golfinhos no norte do estado do Rio de Janeiro, Brasil	South-eastern	Rio de Janeiro	Atafona	2012
COSTA; LE PENDU; NETO, 2012.	Behaviour of Sotalia guianensis (van Bénéden, 1864) (Cetacea, Delphinidae) and ethnoecological knowledge of artisanal fishermen from Canavieiras, Bahia, Brazil	Northeast	Bahia	Canavieiras	2012
ALVES; ZAPPES; ANDRIOLO, 2012.	Conflicts between river dolphins (Cetacea: Odontoceti) and fisheries in the Central Amazon: a path toward tragedy?	Northern	Amazonas	Manacapuru	2012
ZAPPES et al., 2013.	Accidents between artisanal fisheries and cetaceans on the Brazilian coast and Central Amazon: Proposals for integrated management	Northern; Northeast; South-eastern ; Southern	Amazonas; Bahia; Espírito Santo; Rio de Janeiro; São Paulo; Santa Catarina; Rio Grande do Sul	Novo Airão; Manacapuru; Prado; Nova Viçosa; Barra do Riacho; Baía de Sepetiba; Complexo Estuarino Lagunar Iguape-Cananéia; Garopaba; Lagoa dos Patos	2013
LODI; ZAPPES; SANTOS, 2013.	Aspectos etnoecológicos e implicações para a conservação de Tursiops truncatus (Cetartiodactyla: Delphinidae) no Arquipélago das Cagarras, Rio de Janeiro, Brasil	South-eastern	Rio de Janeiro	Rio de Janeiro	2013

Continuous...

References	Article title	Region	State	Cities	Publication year
PASCHOAL; MONTEIRO-FILHO; MARMONTEL, 2013.	Local knowledge of the Amazon river dolphin (Inia geoffrensis Blainville, 1817) in the Lake Amanã region, Amazonas	Northern	Amazonas	Manaus	2013
ZAPPES et al., 2014.	Comparison of local knowledge about the bottlenose dolphin (Tursiops truncatus Montagu, 1821) in the Southwest Atlantic Ocean: New research needed to develop conservation management strategies	South-eastern ; Southern	Rio de Janeiro; Rio Grande do Sul	Arquipélago das Cagarras Rio de Janeiro; Barra de Imbé Tramandaí Lagoa dos Patos	2014
SILVA et al., 2014.	Pesca artesanal e cetáceos que ocorrem no litoral leste do Rio de Janeiro: uma abordagem etnoecológica para verificar a existência de manejo tradicional	South-eastern	Rio de Janeiro	Cabo Frio	2014
MINTZER et al., 2015.	Attitudes and behaviors toward Amazon River dolphins (Inia geoffrensis) in a sustainable use protected area	Northern	Amazonas	Japurá; Alvarães; Tefé	2015
MANZAN; LOPES, 2015.	Fishers' knowledge as a source of information about the estuarine dolphin (Sotalia guianensis, van Bénéden, 1864)	Northeast	Rio Grande do Norte	Tibau do Sul; Pipa; Baía Formosa	2015
BARBOSA-FILHO; COSTA-NETO; DANILEWICZ, 2016.	Dolphin harpooning off the coast of Bahia, Brazil	Northeast	Bahia	Canavieiras; Una; Ilhéus	2016
ZAPPES et al., 2016.	Traditional knowledge identifies causes of bycatch on bottlenose dolphins (Tursiops truncatus Montagu 1821): An ethnobiological approach	Southern	Rio Grande do Sul	Imbé; Tramandaí; Rio Grande	2016

Continuous...

References	Article title	Region	State	Cities	Publication year
BRITO; NOGUEIRA; RODRIGUES, 2016.	Etnoecologia de pequenos cetáceos por pescadores artesanais do município de Marabá, sudeste do estado do Pará-Brasil	Northern	Pará	Marabá	2016
ZAPPES et al., 2018.	Artisanal fishing and the franciscana (Pontoporia blainvillei) in Southern Brazil: ethnoecology from the fishing practice	Southern	Paraná	Guaraqueçaba	2018
MACHADO et al., 2019.	Artisanal fishers' perceptions of the ecosystem services derived from a dolphin-human cooperative fishing interaction in southern Brazil	Southern	Santa Catarina	Laguna	2019
SEMINARA; BARBOSA-FILHO; PENDU, 2019.	Interactions between cetaceans and artisanal fishermen from Ilhéus, Bahia - Brazil	Northeast	Bahia	Ilhéus	2019
VIDAL; MOURA; MUNIZ, 2019.	Conhecimentos e crenças de pescadores artesanais sobre os golfinhos fluviais do Médio Rio Tapajós, Pará	Northern	Pará	Trairão; Itaituba	2019
BARBOSA-FILHO et al., 2020.	Artisanal fisher perceptions on ghost nets in a tropical South Atlantic marine biodiversity hotspot: Challenges to traditional fishing culture and implications for conservation strategies	Northeast	Bahia	Ilhéus	2020
FILGUEIRA et al., 2021.	Traditional knowledge of artisanal Fishers and Sotalia guianensis (Van Bénéden, 1864) (Cetacea, Delphinidae) in the Extractive Reserve Baía do Tubarão (Brazilian Amazon coast)	Northeast	Maranhão	Humberto de Campos	2021
MARMONTEL et al., 2021.	Unveiling the Conservation Status of Inia and Sotalia in the Brazilian Northeastern Amazon	Northern	Amapá	Not informed	2021
COOK, et al., 2022.	Human-wildlife conflicts with crocodilians, cetaceans and otters in the tropics and subtropics	Northern	Amazonas	Carauari	2022

Add File 2. List of cities represented by the surveyed articles ($n = 58$), the numbers of studies by cities, their states and regions.

City	Number of searches	State	Region
Rio de Janeiro	8	Rio de Janeiro	Southern-eastern
Aracruz	4	Espírito Santo	Southern-eastern
Cananéia	3	São Paulo	Southern-eastern
Conceição da Barra	3	Espírito Santo	Southern-eastern
Ilhéus	3	Bahia	Northerneast
Nova Viçosa	3	Bahia	Northerneast
Prado	3	Bahia	Northerneast
São Mateus	3	Espírito Santo	Southern-eastern
Tramandaí	3	Rio Grande do Sul	Southern
Canavieiras	2	Bahia	Northerneast
Imbé	2	Rio Grande do Sul	Southern
Lagoa dos Patos	2	Rio Grande do Sul	Southern
Linhares	2	Espírito Santo	Southern-eastern
Rio Grande	2	Rio Grande do Sul	Southern
Serra	2	Espírito Santo	Southern-eastern
Tibau do Sul	2	Rio Grand e do Norte	Northerneast
Alvarães	1	Amazonas	Northern
Anchieta	1	Espírito Santo	Southern-eastern
São João da Barra	1	Rio de Janeiro	Southern-eastern
Baía Formosa	1	Rio Grand e do Norte	Northerneast
Bom Jesus do Itabapoana	1	Rio de Janeiro	Southern-eastern
Navegantes	1	Santa Catarina	Southern
Ilha Comprida	1	São Paulo	Southern-eastern

Continuous...

City	Number of searches	State	Region
Cabo Frio	1	Rio de Janeiro	Southern-eastern
Carauari	1	Amazonas	Northern
Colares	1	Pará	Northern
Iguape	1	São Paulo	Southern-eastern
Cubatão	1	São Paulo	Southern-eastern
Garopaba	1	Santa Catarina	Southern
Governador Celso Ramos	1	Santa Catarina	Southern
Guarapari	1	Espírito Santo	Southern-eastern
Guaraqueçaba	1	Paraná	Southern
Guarujá	1	São Paulo	Southern-eastern
Humberto de Campos	1	Maranhão	Northerneast
Petrópolis	1	Rio de Janeiro	Southern-eastern
Itajaí	1	Santa Catarina	Southern
Itapemirim	1	Espírito Santo	Southern-eastern
Japurá	1	Amazonas	Northern
Laguna	1	Santa Catarina	Southern
Macaé	1	Rio de Janeiro	Southern-eastern
Manacapuru	1	Amazonas	Northern
Manaus	1	Amazonas	Northern
Marabá	1	Pará	Northern
Marataízes	1	Espírito Santo	Southern-eastern
Novo Airão	1	Amazonas	Northern
Piúma	1	Espírito Santo	Southern-eastern
Praia Grande	1	São Paulo	Southern-eastern
Presidente Kennedy	1	Espírito Santo	Southern-eastern

Continuous...

City	Number of searches	State	Region
Santos	1	São Paulo	Southern-eastern
São Francisco do Sul	1	Santa Catarina	Southern
São Sebastião	1	São Paulo	Southern-eastern
Soure	1	Pará	Northern
Tefé	1	Amazonas	Northern
Trairão	1	Pará	Northern
Ubatuba	1	São Paulo	Southern-eastern
Una	1	Bahia	Northerneast
Vila Velha	1	Espírito Santo	Southern-eastern
Vitória	1	Espírito Santo	Southern-eastern

Add File 3. Types of interactions between cetaceans and artisanal fishing classified by the surveyed studies.

References	Interaction
ZERBINI; KOTAS, 1998.	Trapped
DI BENEDITTO; RAMOS, 2001.	Trapped
BERTOZZI; ZERBINI, 2002.	Trapped
PINHEIRO; CREMER, 2003.	Trapped
FERREIRA; HANAZAKI; SIMÕES-LOPES, 2006.	Entanglement
SOUZA; BEGOSSI, 2007.	*
ROSA; SECCHI, 2007.	Depredation
DE FREITAS NETTO; DI BENEDITTO, 2008.	Trapped
	Collision
	Entanglement
	Harpooning
	Theft
	Ambush
	Cooperation
PETERSON; HANAZAKI; LOPES, 2008.	Cooperation
	Trapped
	Entanglement
	Theft
ZAPPES et al., 2009.	Entanglement
ZAPPES et al., 2010a.	Entanglement
ZAPPES et al., 2010b.	Cooperation
ZAPPES et al., 2011a.	Scaring away
	Collision

Continuous...

References	Interaction
ZAPPES et al., 2011b.	Trapped
	Cooperation
	Trapped
	Drive away
	Signalling
BRITO, 2012.	Cooperation
	Scaring away
	Theft
ROSA; ZAPPES; DI BENEDITTO, 2012.	Trapped
	Collision
	Trapped
	Collision
COSTA; LE PENDU; NETO, 2012.	Cooperation
	Entanglement
ALVES; ZAPPES; ANDRIOLO, 2012.	Collision
	Theft
	Disposal
	Harpooning
	Entanglement
ZAPPES et al., 2013.	*
LODI; ZAPPES; SANTOS, 2013.	Trapped
PASCHOAL; MONTEIRO-FILHO; MARMONTEL, 2013.	Theft
	Collision
	Scaring away

Continuous...

References	Interaction
ZAPPES et al., 2014.	Signalling
	Cooperation
	Scaring away
	Collision
	Trapped
	Theft
	Entanglement
SILVA et al., 2014.	Investida
	Collision
MINTZER et al., 2015.	Trapped
	Signalling
	Cooperation
MANZAN; LOPES, 2015.	Signalling
	Cooperation
	Trapped
	Scaring away
	Theft
BARBOSA-FILHO; COSTA-NETO; DANILEWICZ, 2016.	Harpooning
ZAPPES et al., 2016.	Trapped
BRITO; NOGUEIRA; RODRIGUES, 2016.	Trapped
	Theft
	Collision
	Scaring away
ZAPPES et al., 2018.	*
MACHADO et al., 2019.	*

Continuous...

References	Interaction
SEMINARA; BARBOSA-FILHO; PENDU, 2019.	Scaring away Theft Entanglement
VIDAL; MOURA; MUNIZ, 2019.	*
BARBOSA-FILHO et al., 2020.	*
FILGUEIRA et al., 2021.	Trapped Cooperation
MARMONTEL et al., 2021.	Trapped
COOK, et al., 2022.	*

Add File 4. List of cetacean species that interact with artisanal fishing in Brazil based on surveyed works.

Reference	Scientific name	Common name
ZERBINI; KOTAS, 1998.	Physeter macrocephalus (Linnaeus, 1758)	*
	Kogia simus (Owen, 1866)	*
	Globicephala melas (Traill, 1809)	*
	Tursiops truncatus (Montagu, 1821)	*
	Stenella longirostris (Gray, 1828)	*
	Stenella clymene (Gray, 1846)	*
	Stenella coeruleoalba (Meyen, 1833)	*
DI BENEDITTO; RAMOS, 2001.	Pontoporia blainvillei (Gervais & d'Orbigny, 1844)	*
BERTOZZI; ZERBINI, 2002.	Pontoporia blainvillei (Gervais & d'Orbigny, 1844)	*
PINHEIRO; CREMER, 2003.	Sotalia guianensis (Van Bénéden, 1864)	Boto
FERREIRA; HANAZAKI; SIMÕES-LOPES, 2006.	Sotalia guianensis (Van Bénéden, 1864)	Boto; Golfinho
SOUZA; BEGOSSI, 2007.	Orcinus orca (Linnaeus, 1758)	Baleia; Orca; Baleia-orca; Baleia-branca;
	Steno bredanensis (Lesson, 1828)	Boto
		Boto; Golfinho

Continuous...

Reference	Scientific name	Common name
	Tursiops truncatus (Montagu, 1821)	Boto; Boto-caldeirão; Golfinho; Golfinho-flipper
	Stenella frontalis (G. Cuvier, 1829)	Boto; Boto-rajado; Boto-caldeirão; Boto-malhado; Golfinho; Golfinho-malhado
	Sotalia guianensis (Van Bénéden, 1864)	Boto; Boto-preto; Golfinho; Toninha;
	Pontoporia blainvillei (Gervais & d'Orbigny, 1844)	Toninha; Boto; Boto-branco; Golfinho
ROSA; SECCHI, 2007.	Orcinus orca (Linnaeus, 1758)	*
FREITAS-NETTO; DI BENEDITTO, 2008.	Pontoporia blainvillei (Gervais & d'Orbigny, 1844)	Manico
	Sotalia guianensis (Van Bénéden, 1864)	Cachimbo; Boto
PETERSON; HANAZAKI; LOPES, 2008.	Tursiops truncatus (Montagu, 1821)	Boto
ZAPPES et al., 2009.	Sotalia guianensis (Van Bénéden, 1864)	Boto-cinza
ZAPPES et al., 2010.	Sotalia guianensis (Van Bénéden, 1864)	Boto-cinza

Continuous...

Reference	Scientific name	Common name
ZAPPES et al., 2010.	Sotalia guianensis (Van Bénéden, 1864)	Boto
ZAPPES et al., 2011a.	Tursiops truncatus (Montagu, 1821)	*
ZAPPES et al., 2011b.	Tursiops truncatus (Montagu, 1821)	Boto
BRITO, 2012.	Inia geoffrensis (Blainville, 1817)	Malhado; Boto-vermelho
ROSA; ZAPPES; DI BENEDITTO, 2012.	Sotalia fluviatilis (Gervais & Deville in Gervais, 1853)	*
	Sotalia guianensis (Van Bénéden, 1864)	*
	Pontoporia blainvillei (Gervais & d'Orbigny, 1844)	*
	Steno bredanensis (Lesson, 1828)	*
COSTA; LE PENDU; NETO, 2012.	Sotalia guianensis (Van Bénéden, 1864)	Boto; Golfinho; Toninha
ALVES; ZAPPES; ANDRIOLO, 2012.	*	Golfinho-pretinho
	*	Roxo
	*	Golfinho
	*	Golfinho-do-amazonas
	*	Roxinho
	*	Tucuxi
	*	Boto-vermelho
ZAPPES et al., 2013.	Inia geoffrensis (Blainville, 1817)	Boto; Boto-vermelho
	Sotalia guianensis (Van Bénéden, 1864)	Boto; Boto-cinza
	Tursiops truncatus (Montagu, 1821)	Boto; Boto-canjeirão

Continuous...

Reference	Scientific name	Common name
LODI; ZAPPES; SANTOS, 2013.	Tursiops truncatus (Montagu, 1821)	Golfinho-flíper
PASCHOAL; MONTEIRO-FILHO; MARMONTEL, 2013.	Inia geoffrensis (Blainville, 1817)	Boto-vermelho; Boto-roxo
	Sotalia fluviatilis (Gervais & Deville in Gervais, 1853)	Tucuxi
ZAPPES et al., 2014.	Tursiops truncatus (Montagu, 1821)	Boto; Golfinho; Tonina
SILVA et al., 2014.	Pontoporia blainvillei (Gervais & d'Orbigny, 1844)	Golfinho; Boto; Golfinho-branco
	Tursiops truncatus (Montagu, 1821)	Golfinho; Boto; Toninha; Golfinho-cinza
	Steno bredanensis (Lesson, 1828)	Golfinho; Boto; Toninha
	Stenella frontalis (G. Cuvier, 1829)	Golfinho; Boto; Toninha
MINTZER et al., 2015.	Inia geoffrensis (Blainville, 1817)	
	Sotalia guianensis (Van Bénéden, 1864)	Boto; Golfinho
	Tursiops truncatus (Montagu, 1821)	Boto-cinza
	Stenella clymene (Gray, 1846)	*
MANZAN; LOPES, 2015.		

Continuous...

Reference	Scientific name	Common name
	Stenella attenuata (Gray, 1846)	*
	Stenella longirostris (Gray, 1828)	*
	Peponocephala electra (Gray, 1846)	*
	Pontoporia blainvillei (Gervais & d'Orbigny, 1844)	*
	Orcinus orca (Linnaeus, 1758)	*
BARBOSA-FILHO; COSTA-NETO; DANILEWICZ, 2016.	*	Toninha
	*	Golfinho
	*	Boto
ZAPPES et al., 2016.	Tursiops truncatus (Montagu, 1821)	Roazes; Nariz-de-garrafa
BRITO; NOGUEIRA; RODRIGUES, 2016.	Sotalia fluviatilis (Gervais & Deville in Gervais, 1853)	Boto-cinza; Boto-preto
	Inia geoffrensis (Blainville, 1817)	Boto-rosa; Malhado
ZAPPES et al., 2018.	Pontoporia blainvillei (Gervais & d'Orbigny, 1844)	Toninha
	Sotalia guianensis (Van Bénéden, 1864)	*
MACHADO et al., 2019.	*	*
SEMINARA; BARBOSA-FILHO; PENDU, 2019.	Tursiops truncatus (Montagu, 1821)	Golfinho
	Sotalia guianensis (Van Bénéden, 1864)	Boto
	Stenella frontalis (G. Cuvier, 1829)	Pinta-preta
VIDAL; MOURA; MUNIZ, 2019.	Sotalia fluviatilis (Gervais & Deville in Gervais, 1853)	Tucuxi; Preto; Pequeno; Boto-cinza

Continuous...

Reference	Scientific name	Common name
	Inia geoffrensis (Blainville, 1817)	Vermelho; Boto-comum; Rosa; Branco; Canaã; Canarana; Boto; Amarelo; Amarelão; Nari-nari; Bicudo; Soma
BARBOSA-FILHO et al., 2020.	*	*
FILGUEIRA et al., 2021.	Sotalia guianensis (Van Bénéden, 1864)	Boto-cinza; Golfinho; Boto; Golfinho-nariz-de-garrafa
MARMONTEL et al., 2021.	Inia geoffrensis (Blainville, 1817)	Boto; Golfinho
	Sotalia fluviatilis (Gervais & Deville in Gervais, 1853)	Tucuxi; Boto-cinza
COOK, et al., 2022.	*	*

Add File 5. Categories of use of animals caught by artisanal fishermen in Brazil based on the surveyed studies. (*) Absence of reports.

Article	Use	Description
A note on cetacean bycatch in pelagic driftnetting off southern Brazil	Discard	Dead animals are discarded at sea
Biology and conservation of the francBaitna (Pontoporia blainvillei) in the north of Rio de Janeiro State, Brazil	Bait	Fat from accidentally captured dolphins is used as bait
Incidental mortality of francBaitna (Pontoporia blainvillei) in the artisanal fishery of Praia Grande, São Paulo state, Brazil	Discard	Dead animals are thrown into the sea
	Directed to environmental agencies	Dead animals are sent for research purposes
Etnoecologia e captura acidental de golfinhos (Cetacea: Pontoporidae e Delphinidae) na Baía da Babitonga, Santa Catarina	Ethnomedicine	The "oil" from dead dolphins, removed by cooking the fat, is used as an insect repellent and leather softener
	Ethnoveterinary	The "oil" from dead dolphins, removed by cooking the fat, is used to treat wounds in domestic animals and cattle
	Bait	Derivatives of dead animals are used as bait in shark fishing
The environmental conflicts and the estuarine dolphin (Sotalia guianensis) conservation from the Costeira da Armação community point of view, in the anhatomirim environmental protection area, south of Brazil	Consumption	The meat of dead animals is used for personal consumption
Whales, dolphins or fishes? The ethnotaxonomy of cetaceans in São Sebastião, Brazil	*	*
Interactions between fisheries and cetaceans in Espírito Santo State coast, southeastern Brazil	Bait	Derivatives of dead animals are used as bait for fishing
	Consumption	The meat of dead animals is used for human consumption

Continuous...

Article	Use	Description
Natural resource appropriation in cooperative artisanal fishing between fishermen and dolphins (Tursiops truncatus) in Laguna, Brazil	*	*
Potential conflicts between fishermen and Sotalia guianensis (van Bénéden, 1864) (Cetacea, Delphinidae) in Brazil		The meat of dead animals is used for consumption by fishermen and their families
		Derivatives of dead animals are used as Bait
		Dead animals are discarded at sea
Ethnobiology and photo-identification: identifying anthropic impacts on boto-cinza dolphin Sotalia guianensis in Sepetiba Bay, Brazil.	*	*
O comportamento do boto-cinza Sotalia guianensis (van Bénéden, 1864) (Cetacea; Delphinidae) através do olhar dos pescadores artesanais	*	*
Interações entre o golfinho-nariz-de-garrafa (Tursiops truncatus) e a pesca artesanal no Arquipélago das Cagarras e áreas adjacentes, Rio de Janeiro, Brasil	Discard	Dead animals are discarded at sea
	Bait	Derivatives of dead animals are used as Bait
	Consumption	The meat of dead animals is used for consumption by the fisherman's family
Human-dolphin (Tursiops truncatus Montagu, 1821) cooperative fishery'and its influence on cast net fishing activities in Barra de Imbé/Tramandaí, Southern Brazil	*	*
O conhecimento ecológico local e a interação de botos com a pesca no litoral do estado do Pará, região Norte – Brasil	Discard	Dead animals are released into the sea
	Consumption	The meat of dead animals is used for consumption
	Bait	Derivatives of dead animals are used as Bait
	Commercialization	The eyes and genitalia of animals can be used as an economic and emotional attraction

Continuous...

Article	Use	Description
Etnoecologia de pequenos cetáceos: interações entre a pesca artesanal e golfinhos no norte do estado do Rio de Janeiro, Brasil	Discard	Dead animals are released into the sea
	Bait	The muscles and fat from the animal carcass are used to make Bait
Behaviour of Sotalia guianensis (van Bénéden, 1864) (Cetacea, Delphinidae) and ethnoecological knowledge of artisanal fishermen from Canavieiras, Bahia, Brazil	*	*
Conflicts between river dolphins (Cetacea: Odontoceti) and fisheries in the Central Amazon: a path toward tragedy?	Bait	Derivatives of dead animals are used as Bait
	Consumption	The meat of dead animals is used for human consumption
	Commercialization	The carcasses of dead animals are sold
Accidents between artisanal fisheries and cetaceans on the Brazilian coast and Central Amazon: Proposals for integrated management	*	*
Aspectos etnoecológicos e implicações para a conservação de Tursiops truncatus (Cetartiodactyla: Delphinidae) no Arquipélago das Cagarras, Rio de Janeiro, Brasil	*	*
Local knowledge of the Amazon river dolphin (Inia geoffrensis Blainville, 1817) in the Lake Amanã region, Amazonas	Ethnomedicine	The reproductive organ of the male Amazon river dolphin can be used to cure heart disease and illnesses that affect children
Comparison of local knowledge about the bottlenose dolphin (Tursiops truncatus Montagu, 1821) in the Southwest Atlantic Ocean: New research needed to develop conservation management strategies	Discard	Dead animals are discarded at sea
	Commercialization	Derivatives of dead animals are sold
	Consumption	The meat of dead animals is used for family consumption
	Bait	Derivatives of dead animals are used as Bait

Continuous...

Article	Use	Description
Pesca artesanal e cetáceos que ocorrem no litoral leste do Rio de Janeiro: uma abordagem etnoecológica para verificar a existência de manejo tradicional	*	*
Attitudes and behaviors toward Amazon River dolphins (Inia geoffrensis) in a sustainable use protected area	Bait	Derivatives of dead animals are used as Bait
Fishers' knowledge as a source of information about the estuarine dolphin (Sotalia guianensis, van Bénéden, 1864)	Consumption	The meat of dead animals is used for consumption
	Discard	Dead animals are discarded at sea
	Discard	Dead animals are buried
	Directed to environmental agencies	Dead animals are returned to the Environmental Organs
Dolphin harpooning off the coast of Bahia, Brazil	Bait	Derivatives of dead animals are used as Bait
	Consumption	The meat of dead animals is used for consumption
Traditional knowledge identifies causes of bycatch on bottlenose dolphins (Tursiops truncatus Montagu 1821): An ethnobiological approach	*	*
Etnoecologia de pequenos cetáceos por pescadores artesanais do município de Marabá, sudeste do estado do Pará-Brasil	*	*
Artisanal fishing and the francBaitna (Pontoporia blainvillei) in Southern Brazil: ethnoecology from the fishing practice	*	*
Artisanal fishers' perceptions of the ecosystem services derived from a dolphin-human cooperative fishing interaction in southern Brazil	*	*
Interactions between cetaceans and artisanal fishermen from Ilhéus, Bahia - Brazil	Bait	Derivatives of dead animals are used as Bait
	Consumption	The meat of dead animals is cooked and consumed
Conhecimentos e crenças de pescadores artesanais sobre os golfinhos fluviais do Médio Rio Tapajós, Pará	*	*

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Article	Use	Description
Artisanal fisher perceptions on ghost nets in a tropical South Atlantic marine biodiversity hotspot: Challenges to traditional fishing culture and implications for conservation strategies	*	*
Traditional knowledge of artisanal Fishers and Sotalia guianensis (Van Bénéden, 1864) (Cetacea, Delphinidae) in the Extractive Reserve Baía do Tubarão (Brazilian Amazon coast)	Discard	Dead animals are discarded at sea
	Consumption	The meat of dead animals is used for personal consumption
	Bait	Derivatives of dead animals are used as Bait
Unveiling the Conservation Status of Inia and Sotalia in the Brazilian Northeastern Amazon	Bait	Derivatives of dead animals are used as Bait
	Consumption	The meat of dead animals is used for personal consumption
	Commercialization	Derivatives of dead animals are sold
Human-wildlife conflicts with crocodilians, cetaceans and otters in the tropics and subtropics	*	*