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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).

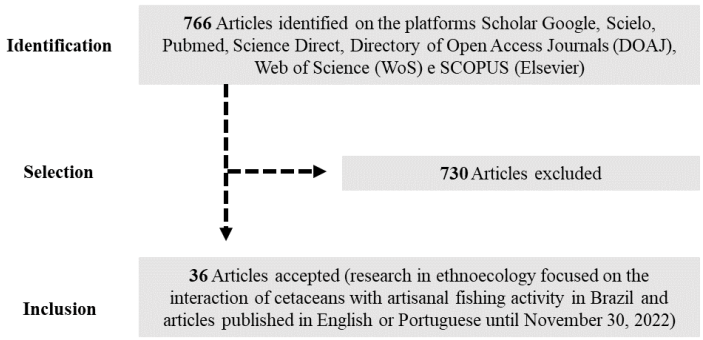


**Figure 1.** Steps in article selection process.

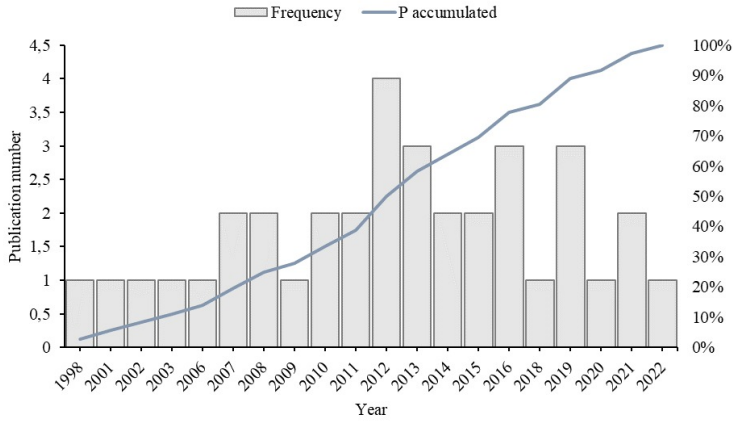


**Figure 2.** The annual number of publications on the interactions between artisanal fisheries and small cetaceans in Brazil published between 1998 and 2022 ($n = 36$).

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

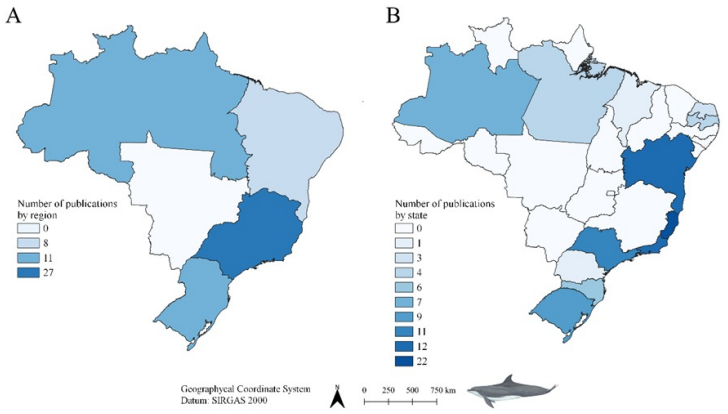


**Figure 3.** Map of the number of publications in Brazil from 1998 to 2022. A. Number of publications by region. B. Number of publications by state.

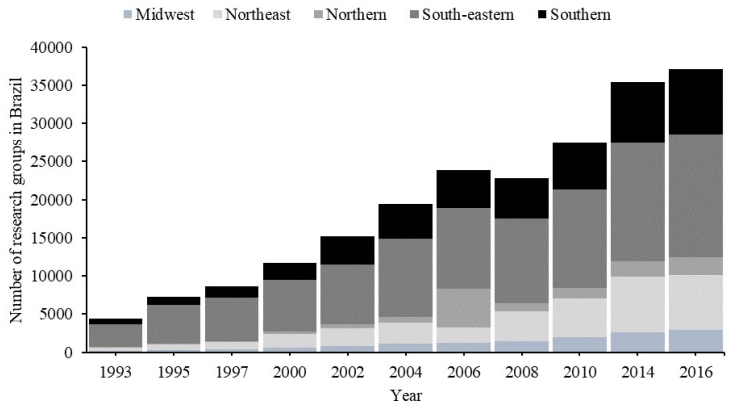


**Figure 4.** Temporal evolution of the number of research groups inventoried by the Directory of Research Groups (DGP) by region of Brazil.

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-

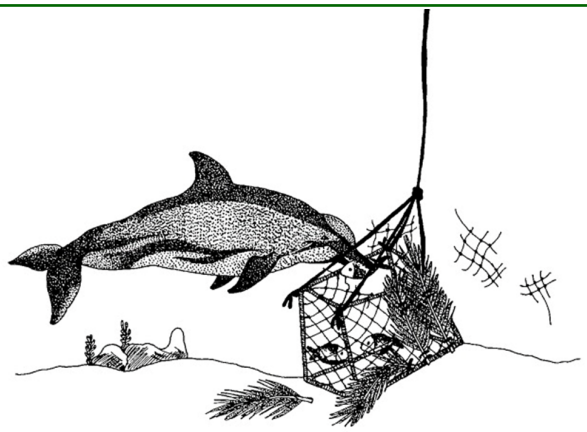

**Figure 6.** Illustration of predation-type interaction.

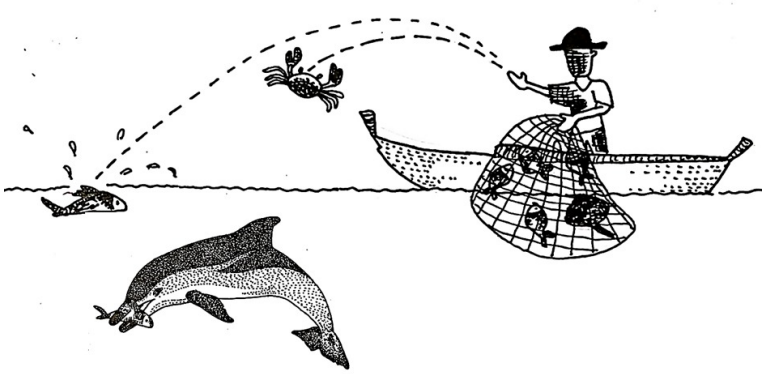

**Figure 7.** Illustration of discard-type interaction.

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

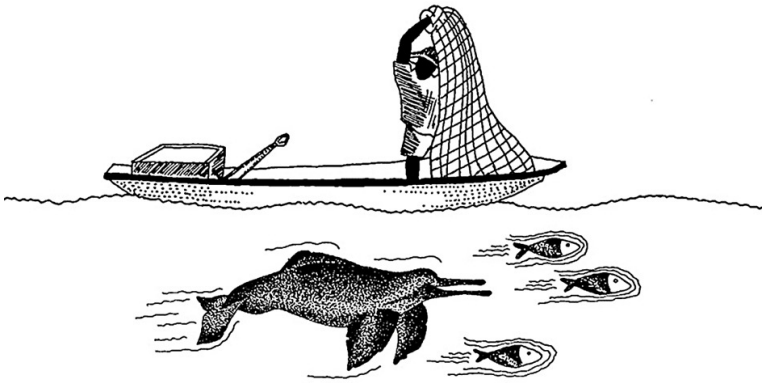

**Figure 8.** Illustration of the scare-type interaction.

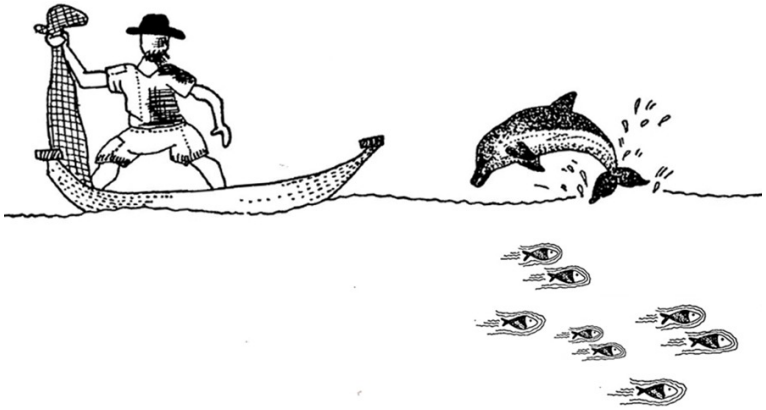

**Figure 9.** Illustration of signalling type interaction.

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

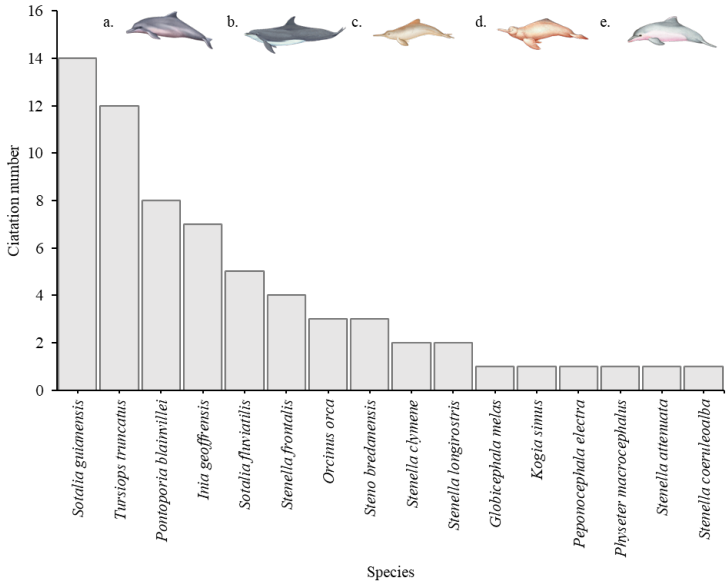


**Figure 10.** The number of records by species identified in the analysed studies, highlighting the most cited: a. *Sotalia guianensis*. b. *Tursiops truncatus*. c. *Pontoporia blainvillei*. d. *Inia geoffrensis*. e. *Sotalia fluviatilis*.

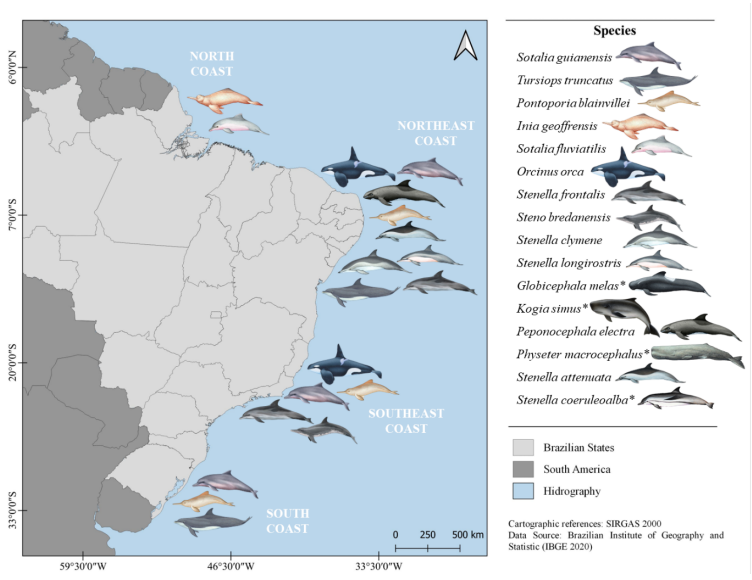


**Figure 11.** Number of species identified per region in Brazil.

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.

## REFERENCES

Abreu JS, Domit C, Zappes CA (2017) **Is there dialogue between researchers and traditional community members? The importance of integration between traditional knowledge and scientific knowledge to coastal management.** *Ocean & Coastal Management* 141:10-19. doi: 10.1016/j.ocecoaman.2017.03.003.

Agardy T, Di Sciara GN, Christie P (2011) **Mind the gap: addressing the shortcomings of marine protected areas through large scale marine spatial planning.** *Marine Policy* 35:226-232. doi: 10.1016/j.marpol.2010.10.006.

Albuquerque NS, Souto AS (2013) **Motorboat noise can potentially mask the whistle sound of estuarine dolphins (*Sotalia guianensis*).** *Ethnobiology and Conservation* 2:1-15. doi: 10.15451/ec2013-8-2.5-1-15.

Albuquerque UP, Silva JS, Campos JLA, Sousa RS, Silva TC, Alves RRN (2013) **The current status of ethnobiological research in Latin America: gaps and perspectives.** *Journal of Ethnobiology and Ethnomedicine* 9:1-9. 10.1186/1746-4269-9-72.

Alves LCPDS, Zappes CA, Andriolo A (2012) **Conflicts between river dolphins (Cetacea: Odontoceti) and fisheries in the Central Amazon: a path toward tragedy?.** *Zoologia (Curitiba)* 29:420-429. 10.1590/S1984-46702012000500005.

Amaral KB, Danilewicz D, Zerbini A, Di Beneditto AP, Andriolo A, Alvares DJ, Secchik E, Ferreiral E, Sucunzac F, Borges-Martinsb M, Santos MCO, Cremer M, Denuncio P, Ottc PH, Morenoa IB (2018) **Reassessment of the franciscana *Pontoporia blainvillei* (Gervais & d'Orbigny, 1844) distribution and niche characteristics in Brazil.** *Journal of Experimental Marine Biology and Ecology* 508:1-12. 10.1016/j.jembe.2018.07.010.

Amponsah SK, Asiedu BA, Apraku A, Ntim L, Failler P, Henneh S, Amekor W, Ackah R, Waerebeek KV (2023) **Socioeconomics and management of small cetacean bycatch in Ghana.** *Journal of Cetacean Research and Management* 24:227-239. 10.47536/jcrm.v24i1.798.

Andrew NL, Béné C, Hall SJ, Allison EH, Heck S, Ratner BD (2007) **Diagnosis and management of small-scale fisheries in developing countries.** *Fish and Fisheries* 8:227-240. doi: 10.1111/j.1467-2679.2007.00252.x.

Araújo JP (2008) **Influência das condições ambientais sobre o comportamento do Boto-Cinza (*Sotalia guianensis*) e sua interação com as atividades antrópicas em Pernambuco. PhD Thesis, Universidade Federal de Pernambuco.** [https://repositorio.ufpe.br/handle/123456789/8092] Accessed August 20, 2022.

Azevedo ADF, Carvalho RR, Kajin M, Sluys MV, Bisi TL, Cunha HA, Lailson-Brito Jr, J (2017) **The first confirmed decline of a delphinid population from Brazilian waters: 2000–2015 abun-**

**dance of *Sotalia guianensis* in Guanabara Bay, South-eastern Brazil.** *Ecological Indicators* 79:1-10. doi: 10.1016/j.ecolind.2017.03.045.

Azevêdo EDL, Alves RRN, Dias TLP, Álvaro ÉLF, Barbosa JEDL, Molozzi J (2022) **Perception of the local community: What is their relationship with environmental quality indicators of reservoirs?.** *Plos One* 17:e0261945. doi: 10.1371/journal.pone.0261945.

Azevêdo EL, Drumond MA, Alves RRN, Dias TLP, Molozzi J (2020) **Evaluating conservation threats to reservoirs in the semiarid region of Brazil using the perception of residents.** *Ethnobiology and Conservation* 9:1-15. doi: 10.15451/ec2020-02-9.04-1-15.

Barbosa Filho MLV, Souza GBG, Lopes, SF, Hauser-Davis RA, Siciliano S, Mourao JS (2021) **Reef fisher perceptions acknowledge the socio-environmental effectiveness of a 20-year old Brazilian Marine Protected Area.** *Marine Policy* 134:104797. doi: 10.1016/j.marpol.2021.104797.

Barbosa-Filho ML, Barreto RM, Siciliano S, Seminara CI, Costa-Neto EM (2018) **Use of cetaceans as bait in southern Bahia, Brazil, by expert fishermen that market shark fins.** *Ethnobiology Letters* 9:12-18. doi: 10.14237/ebl.9.2.2018.953.

Barbosa-Filho MLV, Costa-Neto EM, Danilewicz D (2016) **Dolphin harpooning off the coast of Bahia, Brazil.** *Marine Biodiversity Records* 9:1-3. doi: 10.1186/s41200-016-0046-1.

Bazzalo M, Flores PA, Pereira MG (2008) **Uso de hábitat y principales comportamientos del delfín gris (*Sotalia guianensis*, Van Bénéden, 1864) en la Bahía Norte, Estado de Santa Catarina, Brasil.** *Mastozoología Neotropical* 15:9-22.

Bearzi G, Fortuna C, Reeves R (2009) **Ecology and conservation of common bottlenose dolphins *Tursiops truncatus* in the Mediterranean Sea.** *Mammal Review* 39:92-123. doi: 10.1111/j.1365-2907.2008.00133.x.

Berkes F (2006) **From community-based resource management to complex systems: the scale issue and marine commons.** *Ecology and Society* 11:1-19.

Berninsone LG, Bordino P, Gnecco M, Foutel M, Mackay AI, Werner TB (2020) **Switching gillnets to longlines: an alternative to mitigate the bycatch of Franciscana Dolphins (*Pontoporia blainvillei*) in Argentina.** *Frontiers in Marine Science* 7:1-19. doi: 10.3389/fmars.2020.00699.

Bezamat C, Hammond PS, Castilho PV, Simões-Lopes PC, Daura-Jorge FG (2021) **Dolphin population specialized in foraging with artisanal fishers requires zero-bycatch management to persist.** *Aquatic Conservation: Marine and Freshwater Ecosystems* 31:3133-3145. doi: 10.1002/aqc.3694.

Bisi TL, Dorneles PR, Lailson-Brito J, Lepoint G, Azevedo ADF, Flach L, Malm O, Das K (2013) **Trophic relationships and habitat preferences of delphinids from the southeastern Brazilian coast determined by carbon and nitrogen stable isotope composition.** *Plos One* 8:1-8. doi: 10.1371/journal.pone.0082205.

Bordino P, Kraus S, Albareda D, Fazio A, Palmerio A, Mendez M, Botta S (2002) **Reducing incidental mortality of Franciscana dolphin *Pontoporia blainvillei* with acoustic warning devices attached to fishing nets.** *Marine Mammal Science* 18:833-842. doi: 10.1111/j.1748-7692.2002.tb01076.x.

Bossart GD (2011) **Marine mammals as sentinel species for oceans and human health.** *Veterinary pathology* 48:676-690. doi: 10.1177/030098581038852.

Brandalise LT, Bertolini GRF, Rojo CA, Lezana ÁGR, Possamai O (2009) **A percepção e o comportamento ambiental dos universitários em relação ao grau de educação ambiental.** *Gestão & Produção* 16:273-285. doi: 10.1590/S0104-530X2009000200010.

Brando S, Broom DM, Acasuso-Rivero C, Clark F (2018) **Optimal marine mammal welfare under human care: Current efforts and future directions.** *Behavioural Processes* 156:16-36. doi: 10.1016/j.beproc.2017.09.011.

Brasil. Ministério da Pesca e Aquicultura (2015) **Boletim Estatístico da Pesca e Aquicultura.** 2015. MPA. [http://www.icmbio.gov.br/cepsul/images/stories/biblioteca/download/estatistica/est2011_bol__bra.pdf%0Ahttp://www.mma.gov.br/estruturas/253/_publicacao/253_publicacao02022012041757.pdf.] Acceessed April 27, 2022.

Brasil. Ministério do Meio Ambiente. Gabinete do Ministro (2022) **Portaria MMA nº 148, de 7 de junho de 2022.** MMA. [https://www.in.gov.br/en/web/dou/-/portariamma-n-148-de-7-de-junho-de-2022406272733] Acceessed April 27, 2022.

Brito T (2012) **O conhecimento ecológico local e a interação de botos com a pesca no litoral do estado do Pará, região Norte–Brasil.** *Biotemas* 25:259-277. doi: 10.5007/2175-7925.2012v25n4p259.

Brum SM, Silva VMF, Rossoni F, Castello L (2015) **Use of dolphins and caimans as bait for *Calophysus macropterus* (Lichtenstein, 1819) (Siluriforme: Pimelodidae) in the Amazon.** *Journal of Applied Ichthyology* 31:675-680. doi: 10.1111/jai.12772.

Campbell E, Mangel JC, Alfaro-Shigueto J, Mena JL, Thurstan RH, Godley BJ (2020a) **Coexisting in the Peruvian Amazon: interactions between fisheries and river dolphins.** *Journal for Nature Conservation* 56:1-26. doi: 10.1016/j.jnc.2020.125859.

Campbell, E, Pasara-Polack, A, Mangel JC, Alfaro-Shigueto J (2020b) **Use of small cetaceans as bait in small-scale fisheries in Peru.** *Frontiers in Marine Science* 7:1-9. doi: 10.3389/fmars.2020.534507.

Cantor M, Simões-Lopes PC, Daura-Jorge FG (2018) **Spatial consequences for dolphins specialized in foraging with fishermen.** *Animal Behaviour* 139:19-27. doi: 10.1016/j.anbehav.2018.03.002.

Cantor M, Wedekin LL, Daura-Jorge FG, Rossi-Santos MR, Simões-Lopes PC (2012a) **Assessing population parameters and trends of Guiana dolphins (*Sotalia guianensis*): An eight-year mark-recapture study.** *Marine Mammal Science* 28:63-83. doi: 10.1111/j.1748-7692.2010.00456.x.

Cantor M, Wedekin LL, Guimaraes PR, Daura-Jorge FG, Rossi-Santos MR, Simoes-Lopes PC (2012b) **Disentangling social networks from spatiotemporal dynamics: the temporal structure of a dolphin society.** *Animal Behaviour* 84:641-651. doi: 10.1016/j.anbehav.2012.06.019.

Carolsfeld J, Bank W (2003) **Migratory Fishes of South America: Biology, Fisheries and Conservation Status.** IDRC.

Carrera ML, Favaro EGP, Souto A (2008) **The response of marine tucuxis (*Sotalia fluviatilis*) towards tourist boats involves avoidance behaviour and a reduction in foraging.** *Animal Welfare* 17:117-123. doi: 10.1017/S0962728600027627.

Carzon P, Clua É, Dudzinski KM, Delfour F (2023) **Deleterious behaviors and risks related to close interactions between humans and free-ranging dolphins: A review.** *Biological Conservation* 279:109948. doi: 10.1016/j.biocon.2023.109948.

Castellucci W (2021) **Baleias e Império: os Estados Unidos ea expansão baleeira nos mares do Atlântico Sul (1761-1844).** *Revista de História (São Paulo)* 180:1-34. doi: 10.11606/issn.2316-9141.rh.2021.165401.

Catão B (2021) **Águas de dançar juntos: coordenação e sintonização multiespécies na pesca com os botos em Laguna (SC, Brasil).** *Ilha Revista de Antropologia* 23:30-49. doi: 10.5007/2175-8034.2021.e77519.

Catão B, Barbosa GC (2018) **"Good dolphins", fishes and fishermen: about the conjoint fishing in Laguna (Santa Catarina, Brazil).** *Revista Do Instituto de Estudos Brasileiros* 69:205-225. doi: 10.11606/issn.2316-901X.v0i69p205-225.

Celeste RK, Gehrke GH, Santos CMD, Moyses SJ (2021) **Trends in general and public health scientific output of authors affiliated to Brazilian institutions among high-impact and SciELO journals: 1995-2019.** *Cadernos de Saúde Pública* 37:1-12. doi: 10.1590/0102-311X00197820.

Cezar LS, Theis R (2021) **Ser ou não ser pescadora artesanal? Trabalho feminino, reconhecimento e representação social entre marisqueiras da Bacia de Campos, RJ.** *Revista de Antropologia* 63:1-20. doi: 10.11606/1678-9857.ra.2020.178848.

Cherem JJ, Simões-Lopes PC, Althoff S, Graipel ME (2004) **Lista dos mamíferos do estado de Santa Catarina, sul do Brasil.** *Mastozoología neotropical* 11:151-184.

Civil MA, Cheney B, Quick NJ, Islas-Villanueva V, Graves JA, Janik VM, Thompson PM, Hammond PS (2019) **Variations in age-and sex-specific survival rates help explain population trend in a discrete marine mammal population.** *Ecology and Evolution* 9:533-544. doi: doi.org/10.1002/ece3.4772.

Clegg IL, Rödel HG, Delfour F (2017) **Bottlenose dolphins engaging in more social affiliative behaviour judge ambiguous cues more optimistically.** *Behavioural Brain Research* 322:115-122. doi: 10.1016/j.bbr.2017.01.026.

Connor RC, Krützen M, Allen SJ, Sherwin WB, King SL (2022) **Strategic intergroup alliances increase access to a contested resource in male bottlenose dolphins.** *Proceedings of the National Academy of Sciences* 119:1-8. doi: 10.1073/pnas.212172311.

Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. CAPES (2021) **Sistema de Informações Georreferenciadas.** GEOCAPES [https://geocapes.capes.gov.br/geocapes] Acceessed February 3, 2023.

Cram DL, van der Wal JEM, Uomini N, Cantor M, Afan AI, Attwood MC, Amphaeris J, Balasani F, Blair CJ, Bronstein JL, Buanachique IO, Cuthill RRT, Das J, Daura-Jorge FG, Deb A, Dixit T,

Dlamini GS, Dounias E, Gedi II, Gruber M, Hoffmann LS, Holzlehner T, Isack HA, Laltaika EA, Lloyd-Jones DJ, Lund J, Machado AMS, Mahadevan L, Moreno IB, Nwaogu CJ, Pierotti R, Rucunua SA, Santos WF, Serpa N, Smith BD, Sridhar H, Tolkova I, Tun T, Valle-Pereira JVS, Wood BM, Wrangham RW, Spottiswoode CN (2022) **The ecology and evolution of human-wildlife cooperation.** *People and Nature* 4:841-855. doi: 10.1002/pan3.10369.

Cranford TW, Amundin M, Norris KS (1996) **Functional morphology and homology in the odontocete nasal complex: implications for sound generation.** *Journal of morphology* 228:223-285. doi: 10.1002/(SICI)1097-4687(199606)228:3<223::AID-JMOR1>3.0.CO;2-3.

Cunha HA, Medeiros BV, Barbosa LA, Cremer MJ, Marigo J, Lailson-Brito J, Azevedo AF, Solé-Cava AM (2014) **Population structure of the endangered franciscana dolphin (*Pontoporia blainvillei*): reassessing management units.** *Plos One* 9:1-8. doi: 10.1371/journal.pone.0085633.

Cunha HA, Silva, VMF, Lailson-Brito J, Santos MDO, Flores PA, Martin AR, Azevedo AF, Fragoso ABL, Zanelatto RC, Solé-Cava AM (2005) **Riverine and marine ecotypes of *Sotalia* dolphins are different species.** *Marine Biology* 148:449-457. doi: 10.1007/s00227-005-0078-2.

Currey RJ, Dawson SM, Slooten E, Schneider K, Lusseau D, Boisseau OJ, Haase P, Williams JA (2009) **Survival rates for a declining population of bottlenose dolphins in Doubtful Sound, New Zealand: an information theoretic approach to assessing the role of human impacts.** *Aquatic conservation: marine and freshwater ecosystems* 19:658-670. doi: 10.1002/aqc.1015.

Danilewicz D, Secchi ER, Ott PH, Moreno IB, Bassoi M, Borges-Martins M (2009) **Habitat use patterns of franciscana dolphins (*Pontoporia blainvillei*) off southern Brazil in relation to water depth.** *Journal of the Marine Biological Association of the United Kingdom* 89:943-949. doi: 10.1017/S002531540900054X.

Daura-Jorge FG, Wedekin LL, Piacentini VDQ, Simões-Lopes, PC (2005) **Seasonal and daily patterns of group size, cohesion and activity of the estuarine dolphin, *Sotalia guianensis* (PJ van Bénéden) (Cetacea, Delphinidae), in southern Brazil.** *Revista Brasileira de Zoologia* 22:1014-1021. doi: 10.1590/S0101-81752005000400029.

Daura-Jorge FG, Wedekin LL, Simões-Lopes PC (2004) **Variação sazonal na intensidade dos deslocamentos do boto-cinza, *Sotalia guianensis* (Cetacea: Delphinidae), na Baía Norte da Ilha de Santa Catarina.** *Biotemas* 17:203-216.

Davis A, Wagner JR (2003) **Who knows? On the importance of identifying "experts" when researching local ecological knowledge.** *Human ecology* 31:463-489. doi: 10.1023/A:1025075923297.

Davis LE, Gallman RE, Gleiter K (2007) **Pursuit of Leviathan: Technology, Institutions, Productivity, and Profits in American Whaling, 1816-1906. University of Chicago Press.**

De la Torre-Castro M, Fröcklin S, Börjesson S, Okupnik J, Jiddawi NS (2017) **Gender analysis for better coastal management–Increasing our understanding of social-ecological seascapes.** *Marine Policy* 83:62-74. doi: 10.1016/j.marpol.2017.05.015.

Deconto LS, Novelli MB, Lima, DJS, Monteiro-Filho EL (2021) **Influence of natural and anthropogenic sound sources on the soundscape of the Cananéia estuary, southeastern Brazil.** *Marine Pollution Bulletin* 169:1-9. doi: 10.1016/j.marpolbul.2021.112502.

DeMaster DP, Fowler CW, Perry SL, Richlen MF (2001) **Predation and competition: the impact of fisheries on marine-mammal populations over the next one hundred years.** *Journal of Mammalogy* 82:641-651. doi: 10.1644/1545-1542(2001)082<0641:PACTIO>2.0.CO;2.

Di Beneditto APM (2003) **Interactions between gillnet fisheries and small cetaceans in northern Rio de Janeiro, Brazil: 2001-2002.** *Latin American Journal of Aquatic Mammals* 2:79-86. doi: 10.5597/lajam00035.

Di Beneditto APM (2003) **Interactions between gillnet fisheries and small cetaceans in northern Rio de Janeiro, Brazil: 2001-2002.** *Latin American Journal of Aquatic Mammals* 2:79-86. doi: 10.5597/lajam00035.

Di Beneditto APM (2004) **Guia para estudo de cetáceos. (Vol. 1). Universidade Estadual do Norte Fluminense Darcy Ribeiro, Centro de Biociências e Biotecnologia, Laboratório de Ciências Ambientais.**

Diegues AC (1999) **A sócio-antropologia das comunidades de pescadores marítimos no Brasil. Etnográfica.** *Revista do Centro em Rede de Investigação em Antropologia* 3:361-376. doi: 10.4000/etnografica.3047.

Diegues AC (2008) **Marine protected areas and artisanal fisheries in Brazil.** International Collective in Support of Fishworkers.

Diegues ACS (2000) **Etnoconservação da natureza: enfoques alternativos. Etnoconservação: novos rumos para a proteção da natureza nos trópicos.**

Dolman SJ, Breen CN, Brakes P, Butterworth A, Allen SJ (2022) **The individual welfare concerns for small cetaceans from two bycatch mitigation techniques.** *Marine Policy* 143:105126. doi: 10.1016/j.marpol.2022.105126.

Domiciano IG, Domit C, Broadhurst MK, Koch MS, Bracarense APF (2016) **Assessing disease and mortality among small cetaceans stranded at a world heritage site in southern Brazil.** *Plos One* 11:1-17. doi: 10.1371/journal.pone.0149295.

Dudzinski KM, Frohoff T (2008) **Dolphin Mysteries: Unlocking the Secrets of Communication.** Yale University Press.

Cervantes Escobar A, Arturo Ruiz-Luna, Robles, César Alejandro Berlanga (2023) **Social perceptions of ecosystem services delivered by coastal wetlands: their value and the threats they face in northwestern Mexico**. *Ethnobiology and Conservation* 12: 1-15.

El-Hani CN, Poliseli L, Ludwig D (2022) **Beyond the divide between indigenous and academic knowledge: Causal and mechanistic explanations in a Brazilian fishing community.** *Studies in History and Philosophy of Science* 91:296-306. doi: 10.1016/j.shpsa.2021.11.001.

Fader JE, Baird RW, Bradford AL, Dunn DC, Forney KA, Read AJ (2021) **Patterns of depredation in the Hawai 'i deep-set longline fishery informed by fishery and false killer whale behavior.** *Ecosphere* 12:1-23. doi: 10.1002/ecs2.3682.

Fernández-Vidal D, Muiño R (2014) **Fact or fiction? Assessing governance and co-management of Marine Reserves of Fishing Interest in Cedeira and Lira (NW Spain).** *Marine Policy* 47:15-22. doi: 10.1016/j.marpol.2014.01.016.

Ferreira EC, Muelbert MM, Secchi ER (2010) **Distribuição espaço-temporal das capturas acidentais de toninhas (*Pontoporia blainvillei*) em redes de emalhe e dos encalhes ao longo da costa sul do Rio Grande do Sul, Brasil.** *Atlântica (Rio Grande)* 32:183-197. doi: 0.5088/atlântica.v32i2.2468.

Fettuccia DDC, Silva VMF, Simões-Lopes PC (2009) **Non-metric characters in two species of *Sotalia* (Gray, 1866) (Cetacea, Delphinidae).** *Brazilian Journal of Biology* 69:907-917. doi: 10.1590/S1519-69842009000400020.

Forney KA, Southall BL, Slooten E, Dawson S, Read AJ, Baird RW, Brownell Jr RL (2017) **Nowhere to go: noise impact assessments for marine mammal populations with high site fidelity.** *Endangered Species Research* 32:391-413. doi: 10.3354/esr00820.

Freitas Netto R (2003) **Levantamento das artes pesca no litoral do Espírito Santo e suas Interações com os Cetáceos.** MSc. dissertation, Universidade Estadual do Norte Fluminense.

Freitas Netto R, Di Beneditto APM (2008) **Interactions between fisheries and cetaceans in Espírito Santo State coast, southeastern Brazil.** *Revista Brasileira de Zoociências* 10:55-63.

Fruet PF, Genoves RC, Möller LM, Botta S, Secchi ER (2015) **Using mark-recapture and stranding data to estimate reproductive traits in female bottlenose dolphins (*Tursiops truncatus*) of the Southwestern Atlantic Ocean.** *Marine Biology* 162:661-673. doi: 10.1007/s00227-015-2613-0.

Fruet PF, Secchi ER, Di Tullio JC, Kinas PG (2011) **Abundance of bottlenose dolphins, *Tursiops truncatus* (Cetacea: Delphinidae), inhabiting the Patos Lagoon estuary, southern Brazil: implications for conservation.** *Zoologia (Curitiba)* 28:23-30. doi: 10.1590/S1984-46702011000100004.

Galvão JR, Tedesco CD (2022) **Contributions of environmental perception to sustainability in the buffer zone of a protected area.** *Ambiente & Sociedade* 25:1-22. doi: 10.1590/1809-4422asoc20180262r5r1vu2022L4OA.

Gariboldi MC, Túnez JI, Dejean CB, Failla M, Vitullo AD, Negri MF, Cappozzo HL (2015) **Population genetics of Franciscana dolphins (*Pontoporia blainvillei*): introducing a new population from the southern edge of their distribution.** *Plos One* 10:1-15. doi: 10.1371/journal.pone.0132854.

Gariboldi MC, Túnez JI, Failla M, Hevia M, Panebianco MV, Paso Viola MN, Vitullo AD, Cappozzo HL (2016) **Patterns of population structure at microsatellite and mitochondrial DNA markers in the franciscana dolphin (*Pontoporia blainvillei*).** *Ecology and evolution* 6:8764-8776. doi: 10.1002/ece3.2596.

GC, Silva RF, Oliveira IN, Paulino LRS, Monteiro PFF, Carvalho RCX (2021) **Estudos de Etnozoologia Realizados nas Comunidades Pesqueiras no Nordeste do Brasil: Revisão Sistemática.** *Revista Brasileira de Meio Ambiente* 9:146-164. doi: 10.5281/zenodo.5703361.

Gerhardinger LC, Godoy EA, Jones PJ (2009) **Lo-**

**cal ecological knowledge and the management of marine protected areas in Brazil.** *Ocean & Coastal Management* 52:154-165. doi: 10.1016/j.ocecoaman.2008.12.007.

Gillet A, Frédérich B, Parmentier E (2019) **Divergent evolutionary morphology of the axial skeleton as a potential key innovation in modern cetaceans.** *Proceedings of the Royal Society B* 286:1-9. doi: 10.1098/rspb.2019.1771.

Gomez JJ, Cassini MH (2015) **Environmental predictors of habitat suitability and biogeographical range of Franciscana dolphins (*Pontoporia blainvillei*).** *Global Ecology and Conservation* 3:90-99. doi: 10.1016/j.gecco.2014.11.007.

Gravena W, Nunes MS, Souza, IS (2021) **Aquatic Mammals of the Amazon: A Review of Gene Diversity, Population Structure and Phylogeography Applied to Conservation.** In: Molecular Ecology and Conservation Genetics of Neotropical Mammals. Springer International Publishing.

Hamilton S, Baker GB (2019) **Technical mitigation to reduce marine mammal bycatch and entanglement in commercial fishing gear: lessons learnt and future directions.** *Reviews in Fish Biology and Fisheries* 29:223-247. doi: 10.1007/s11160-019-09550-6.

Ingram SN, Rogan E (2002) **Identifying critical areas and habitat preferences of bottlenose dolphins *Tursiops truncatus*.** *Marine Ecology Progress Series* 244:247-255. doi: 10.3354/meps244247.

Iriarte V, Marmontel M (2013) **Insights on the use of dolphins (boto, *Inia geoffrensis* and tucuxi, *Sotalia fluviatilis*) for bait in the piracatinga (*Calophysus macropterus*) fishery in the western Brazilian Amazon.** *J. Cetacean Res. Manage* 13:163-173. doi: 10.47536/jcrm.v13i2.546.

Jacobs MH, Harms M (2014) **Influence of interpretation on conservation intentions of whale tourists.** *Tourism Management* 42:123-131. doi: 10.1016/j.tourman.2013.11.009.

Jimenez ÉA, Barboza RSL, Amaral MT, Frédou FL (2019) **Understanding changes to fish stock abundance and associated conflicts: Perceptions of small-scale fishers from the Amazon coast of Brazil.** *Ocean & Coastal Management* 182:1-12. doi: 10.1016/j.ocecoaman.2019.104954.

Johnson A (1974) **Ethnoecology and planting practices in a swidden agricultural system 1.** *American ethnologist* 1:87-101. doi: 10.1525/ae.1974.1.1.02a00050.

Junior WC (2022). **Whaling in the South Atlantic: Hunting Whales along the Brazilian Coast (1760–1850).** In: Oxford Research Encyclopedia of Latin American History. New York: Oxford University Press.

Katsanevakis S, Stelzenmüller V, South A, Sørensen TK, Jones PJS, Kerr S, Badalamenti F, Anagnostou C, Breen P, Chust G, D'Anna G, Duijn M, Filatova T, Fiorentino F, Hulsman H, Johnson K, Karageorgis AP, Kröncke I, Mirto S, Pipitone C, Portelli S, Qiu W, Reiss H, Sakellariou D, Salomidi M, Van Hoof L, Vassilopoulou V, Fernández TV, Vögek S, Webern A, Zenetosa A, Ter Hofstede R (2011) **Ecosystem-based marine spatial management: review of concepts, policies, tools, and critical issues.** *Ocean & coastal management* 54:807-820. doi: 10.1016/j.ocecoaman.2011.09.002.

Kelkar N, Krishnaswamy J, Choudhary S, Sutaria D (2010) **Coexistence of fisheries with river dolphin conservation.** *Conservation Biology* 24:1130-1140. doi: 10.1111/j.1523-1739.2010.01467.x.

Khan A, Goodell JW, Hassan MK, Paltrinieri A (2022) **A bibliometric review of finance bibliometric papers.** *Finance Research Letters* 47:102520. doi: 10.1016/j.frl.2021.102520.

Khan A, Hassan MK, Paltrinieri A, Dreassi A, Bahoo S (2020) **A bibliometric review of takaful literature.** *International Review of Economics & Finance* 69:389-405. doi: 10.1016/j.iref.2020.05.013.

Laporta P, Martins CC, Lodi L, Domit C, Vermeulen E, Di Tullio JC (2016) **Report of the working group on habitat use of *Tursiops truncatus* in the Southwest Atlantic Ocean.** *Latin American Journal of Aquatic Mammals* 11:47-61. doi: 10.5597/00215.

Leopold M, Beckensteiner J, Kaltavara J, Raubani J, Caillon S (2013) **Community-based management of near-shore fisheries in Vanuatu: What works?** *Marine Policy* 42:167-176. doi: 10.1016/j.marpol.2013.02.013.

Li TM (1996) **Images of community: discourse and strategy in property relations.** *Development and change* 27:501-527. doi: 10.1111/j.1467-7660.1996.tb00601.x.

Lima GS, Menegario AA, Suarez CA, Kamazuka SH, Gemeiner H, Sánchez-Sarmiento AM, Ferioli RB, Barreto AS (2023) **Pelagic and estuarine birds as sentinels of metal (loid) s in the South Atlantic Ocean: Ecological niches as main factors acting on bioaccumulation.** *Environmental Pollution* 326:1-38. doi: 10.1016/j.envpol.2023.121452.

Lima MSP, Oliveira JEL, Nóbrega MF, Lopes PFM

(2017) **The use of Local Ecological Knowledge as a complementary approach to understand the temporal and spatial patterns of fishery resources distribution.** *Journal of Ethnobiology and Ethnomedicine* 13:1-12. doi: 10.1186/s13002-017-0156-9.

Linke S, Bruckmeier K (2015) **Co-management in fisheries–experiences and changing approaches in Europe.** *Ocean & Coastal Management* 104:170-181. doi: 10.1016/j.ocecoaman.2014.11.017.

Loch C, Marmontel M, Simoes-Lopes PC (2009) **Conflicts with fisheries and intentional killing of freshwater dolphins (Cetacea: Odontoceti) in the Western Brazilian Amazon.** *Biodiversity and Conservation* 18:3979-3988. doi: 10.1007/s10531-009-9693-4.

Loch TK, Riechers M (2021) **Integrating indigenous and local knowledge in management and research on coastal ecosystems in the Global South: A literature review.** *Ocean & Coastal Management* 212:1-19. doi: 10.1016/j.ocecoaman.2021.105821.

Lodi L (2003) **Seleção e uso do habitat pelo botocinza, *Sotalia guianensis* (van Bénéden, 1864) (Cetacea, Delphinidae), na Baía de Paraty, Estado do Rio de Janeiro.** *Bioikos–Título não-corrente* 17:1-16.

Lodi L, Borobia M (2013) **Baleias, Botos E Golfinhos Do Brasil.** Guia De Identificação. 1a edição ed. Technical, Rio de Janeiro.

Lodi L, Zappes CA, Santos ÁSG (2013) **Aspectos etnoecológicos e implicações para a conservação de *Tursiops truncatus* (Cetartiodactyla: Delphinidae) no Arquipélago das Cagarras, Rio de Janeiro, Brasil.** *Sitientibus série Ciências Biológicas* 13:1-12. doi: 10.13102/scb200.

Machado, AMS, Daura-Jorge FG, Herbst DF, Simoes-Lopes PC, Ingram SN, Castilho PV, Peroni N (2019) **Artisanal fishers' perceptions of the ecosystem services derived from a dolphin-human cooperative fishing interaction in southern Brazil.** *Ocean & coastal management* 173:148-156. doi: 10.1016/j.ocecoaman.2019.03.003.

Mangel JC, Alfaro-Shigueto J, Van Waerebeek K, Cáceres C, Bearhop S, Witt MJ, Godley BJ (2010) **Small cetacean captures in Peruvian artisanal fisheries: high despite protective legislation.** *Biological Conservation* 143:136-143. doi: 10.1016/j.biocon.2009.09.017.

Mann J, Connor RC, Barre LM, Heithaus MR (2000) **Female reproductive success in bottlenose dolphins (*Tursiops* sp.): life history, habitat, provisioning, and group-size effects.** *Behavioral Ecology* 11:210-219. doi: 10.1093/beheco/11.2.210.

Manzan MF, Lopes PF (2015) **Fishers' knowledge as a source of information about the estuarine dolphin (*Sotalia guianensis*, van Bénéden, 1864).** *Environmental monitoring and assessment* 187:1-15. doi: DOI 10.1007/s10661-014-4096-8.

Marmontel VIM (2013) **River dolphin (*Inia geoffrensis*, *Sotalia fluviatilis*) mortality events attributed to artisanal fisheries in the Western Brazilian Amazon.** *Aquatic Mammals* 39:116-124. doi: 10.1578/AM.39.2.2013.116.

Martins LR, Tabajara LL, Ferreira ER (2004) **Linha de Costa: problemas e estudos.** *Revista Gravel* 2:40-56.

Meirelles ACO, Barros HMDR (2007) **Plastic debris ingested by a rough-toothed dolphin, *Steno bredanensis*, stranded alive in northeastern Brazil.** *Biotemas* 20:127-131.

Meirelles ACO, Monteiro-Neto C, Martins AM, Costa AF, Barros HM, Alves MDO (2009) **Cetacean strandings on the coast of Ceará, north-eastern Brazil (1992–2005).** *Journal of the Marine Biological Association of the United Kingdom* 89:1083-1090. doi: 10.1017/S0025315409002215.

Meirelles AD, Ribeiro AC, Silva CPN, Soares-Filho AA (2010) **Records of Guiana dolphin, *Sotalia guianensis*, in the state of Ceará, northeastern Brazil.** *Latin American Journal of Aquatic Mammals* 8:97-102. doi: 10.5597/lajam00157.

Mintzer VJ, Diniz K, Frazer TK (2018) **The use of aquatic mammals for bait in global fisheries.** *Frontiers in Marine Science* 5:1-26. doi: 10.3389/fmars.2018.00191.

Mintzer VJ, Martin AR, Silva VM, Barbour AB, Lorenzen K, Frazer TK (2013) **Effect of illegal harvest on apparent survival of Amazon River dolphins (*Inia geoffrensis*).** *Biological Conservation* 158:280-286. doi: 10.1016/j.biocon.2012.10.006.

Mintzer VJ, Schmink M, Lorenzen K, Frazer TK, Martin AR, Silva VM (2015) **Attitudes and behaviors toward Amazon River dolphins (*Inia geoffrensis*) in a sustainable use protected area.** *Biodiversity and Conservation* 24:247-269. doi: 10.1007/s10531-014-0805-4.

Molnár Z, Babai D (2021) **Inviting ecologists to delve deeper into traditional ecological knowledge.** *Trends in Ecology & Evolution* 36:679-690. doi: 10.1016/j.tree.2021.04.006.

Monteiro-Filho ELA, Bonin CA, Rautenberg M (1999) **Interações interespecíficas dos**

**mamíferos marinhos na região da Baía de Guaratuba, litoral sul do Estado do Paraná.** *Biotemas* 12:119-132.

Monteiro-Neto C, Alves-Júnior TT, Avila FC, Campos AA, Costa AF, Silva CN, Furtado-Neto MAA (2000) **Impact of fisheries on the tucuxi (*Sotalia fluviatilis*) and rough-toothed dolphin (*Steno bredanensis*) populations off Ceará state, northeastern Brazil.** *Aquatic Mammals* 26:49-56.

Moreno IB, Tavares M, Danilewicz D, Ott PH, Machado R (2009) **Description of the coastal medium scale fishery on the northern Rio Grande do Sul State: fishing communities from Imbé/Tramandaí and Passo de Torres/Torres.** *Boletim do Instituto de Pesca* 35:129-140.

Morton FB, Robinson LM, Brando S, Weiss A (2021) **Personality structure in bottlenose dolphins (*Tursiops truncatus*).** *Journal of Comparative Psychology* (Washington, D.C.: 1983) 135:219-231. doi: 10.1037/com0000259.

Moura EG, Camargo Junior KR (2017) **A crise no financiamento da pesquisa e pós-graduação no Brasil.** *Cadernos de Saúde Pública* 33:1-3. doi: 10.1590/0102-311X00052917.

Moura FBP, Marques JGW (2007) **Conhecimento de pescadores tradicionais sobre a dinâmica espaço-temporal de recursos naturais na Chapada Diamantina, Bahia.** *Biota Neotropica* 7:119-126. doi: 10.1590/S1676-06032007000300014.

Moura JF (2009) **O boto-cinza (*Sotalia guianensis*) como sentinela da saúde dos ambientes costeiros: estudo das concentrações de mercúrio no estuário Amazônico e costa norte do Rio de Janeiro.** MSc. dissertation, Fundação Oswaldo Cruz.

Nardin D, Franzen AC (2023) **Relações entre biomimética, pensamento sistêmico e conhecimento ecológico tradicional: um guia para tomada de decisões arquitetônicas regenerativas.** MSc. dissertation, Universidade Federal de Santa Maria.

Custodio Nascimento M, Santos SR, Vianna M (2023) **A Bibliometric Analysis Concerning Local Ecological Knowledge on Elasmobranchs and Chimaeras**. *Ethnobiology and Conservation* 12: 1-19.

Nóbrega DN, Monteiro BEF, Limeira MCA, Melo ALTM, Nunes DM, Silva RAF, Alves Noke WD, Odell DK (2002) **Interactions Between the Indian River Lagoon Blue Crab Fishery and the Bottlenose Dolphin, *Tursiops truncatus*.** *Marine Mammal Science* 18:819-832. doi: 10.1111/j.1748-7692.2002.tb01075.x.

Ota Y, Just R (2008) **Fleet sizes, fishing effort and the 'hidden' factors behind statistics: An anthropological study of small-scale fisheries in UK.** *Marine Policy* 32:301-308. doi: 10.1016/j.marpol.2007.06.006.

Ott PH, Secchi ER, Moreno IB, Danilewicz D, Crespo EA, Bordino P, Ramos R, Beneditto APD, Bertozzi C, Bastida R, Zanelatto R, Perez JE, Kinas PG (2002) **Report of the Working Group on Fishery Interactions.** *Latin American Journal of Aquatic Mammals* 1:55-64. doi: 10.5597/lajam00008.

Parsons ECM, Rose NA (2022) **The history of cetacean hunting and changing attitudes to whales and dolphins.** In: Marine Mammals: the Evolving Human Factor. Cham: Springer International Publishing.

Paschoalini VU, Santos MCO (2020) **Movements and habitat use of bottlenose dolphins, *Tursiops truncatus*, in south-eastern Brazil.** *Journal of the Marine Biological Association of the United Kingdom* 100:651-662. doi: 10.1017/S0025315420000387.

Pereira MG, Bazzalo M, Flores PAC (2007) **Reações comportamentais na superfície de *Sotalia guianensis* (Cetacea, Delphinidae) durante encontros com embarcações na Baía Norte de Santa Catarina.** *Revista Brasileira de Zoociências* 9:123-135.

Perrin WF, Würsig B, Thewissen JGM (Eds.) (2009) **Encyclopedia of marine mammals.** Academic Press.

Pinheiro L, Cremer M (2003) **Etnoecologia e captura acidental de golfinhos (Cetacea: Pontoporidae e Delphinidae) na Baía da Babitonga, Santa Catarina.** *Desenvolvimento e Meio Ambiente* 8:69-75.

Pita P, Fernández-Vidal D, García-Galdo J, Muíño R (2016) **The use of the traditional ecological knowledge of fishermen, cost-effective tools and participatory models in artisanal fisheries: Towards the co-management of common octopus in Galicia (NW Spain).** *Fisheries Research* 178:4-12. doi: 10.1016/j.fishres.2015.07.021.

Piwetz S (2019) **Common bottlenose dolphin (*Tursiops truncatus*) behavior in an active narrow seaport.** *Plos One* 14:1-23. doi: 10.1371/journal.pone.0211971.

Prado JHF, Secchi ER, Kinas PG (2013) **Mark-recapture of the endangered franciscana dol-**

**phin (*Pontoporia blainvillei*) killed in gillnet fisheries to estimate past bycatch from time series of stranded carcasses in southern Brazil.** *Ecological Indicators* 32:35-41. doi: 10.1016/j.ecolind.2013.03.005.

Przbylski CB, Monteiro-Filho ELA (2001) **Interação entre pescadores e mamíferos marinhos no litoral do Estado do Paraná-Brasil**. *Biotemas* 14:141-156.

Purcell SW, Tagliafico A, Cullis BR, Gogel BJ (2020) **Understanding gender and factors affecting fishing in an artisanal shellfish fishery.** *Frontiers in Marine Science* 7:297. doi: 10.3389/fmars.2020.00297.

Mani Rai I, Dhakal RK (2024) **Politics of Knowledge in Conservation:(De) valued Traditional Ecological Knowledge of Bote in Chitwan National Park, Nepal**. *Ethnobiology and Conservation* 13:1-13.

Quintana-Rizzo E (2011) **Harpooning and entanglement of wild dolphins in the Pacific coast of Guatemala**. *Latin American Journal of Aquatic Mammals* 9:179-182. doi: 10.5597/lajam00187.

Read AJ (2008) **The Looming Crisis: Interactions between Marine Mammals and Fisheries.** *Journal of Mammalogy* 89:541-548. doi: 10.1644/07-MAMM-S-315R1.1.

Ribeiro WC, Lobato W, Liberato RDC (2009) **Notas sobre fenomenologia, percepção e educação ambiental.** *Revista Sinapse Ambiental* 6:42-65.

Rodrigues GA, Fontes DF, Santiago DAM (2018) **A matança de boto na região Amazônica por pescadores.** *Revista de Estudos Interdisciplinares do Vale do Araguaia - REIVA* 1:1-5.

Rosa GA, Zappes CA, Di Beneditto APM (2012) **Etnoecologia de pequenos cetáceos: interações entre a pesca artesanal e golfinhos no norte do estado do Rio de Janeiro, Brasil.** *Biotemas* 25:293-304. doi:10.5007/2175-7925.2012v25n3p293.

Rosa LD, Secchi ER (2007) **Killer whale (*Orcinus orca*) interactions with the tuna and swordfish longline fishery off southern and southeastern Brazil: a comparison with shark interactions.** *Journal of the Marine Biological Association of the United Kingdom* 87:135-140. doi: 10.1017/S0025315407054306.

Santamaría L, Méndez PF (2012) **Evolution in biodiversity policy – current gaps and future needs.** *Evolutionary Applications* 5:202-218. doi: 10.1111/j.1752-4571.2011.00229.x.

Santos LB, Sousa RO, Ferreira LSS, Nápolis PMM (2022) **Estudos sobre percepção ambiental no Brasil: uma revisão.** *Revista Brasileira de Educação Ambiental (RevBEA)* 17:131-148. doi: 10.34024/revbea.2022.v17.12270.

Santos MCO (2010) **Guiana dolphins (*Sotalia guianensis*) displaying beach hunting behavior in the Cananéia Estuary, Brazil: social context and conservation issues.** *Brazilian Journal of Oceanography* 58:143-152. doi: 10.1590/S1679-87592010000200005.

Santos MCO, Figueiredo GC (2016) **A rare sighting of a bottlenose whale (*Hyperoodon planifrons*, Flower, 1882) in shallow waters off Southernern Brazil.** *Brazilian Journal of Oceanography* 64:105-110. doi: 10.1590/S1679-87592016108006401.

Santos MCO, Rosso S (2008) **Social organization of marine tucuxi Dolphins, *Sotalia guianensis*, in the Cananéia estuary of Southernern Brazil.** *Journal of Mammalogy* 89:347-355. doi: 10.1644/07-MAMM-A-090R2.1.

Santos MCO, Siciliano S, Vicente AF de C, Alvarenga FS, Zampirolli É, Souza SP, Maranho A (2010) **Cetacean records along São Paulo state coast, Southernern Brazil.** *Brazilian Journal of Oceanography* 58:123-142. doi: 10.1590/S1679-87592010000200004.

Santos SR, Macedo MLC, Maciel TR, Souza GBG, Silva Almeida L, Gadig OBF, Vianna M (2022) **A tale that never loses in the telling: Considerations for the shifting ethnobaseline based on artisanal fisher records from the southwestern Atlantic.** *Ethnobiology and Conservation* 11: 1-20.

Santos ML, Lemos VM, Vieira JP (2018) **No mullet, no gain: cooperation between dolphins and cast net fishermen in southern Brazil.** *Zoologia (Curitiba)*, 35:1-13. doi: 10.3897/zoologia.35.e24446.

Schwartzman S (2006) **A universidade primeira do Brasil: entre intelligentsia, padrão internacional e inclusão social.** *Estudos Avançados* 20:161-189. doi: 10.1590/S0103-40142006000100012.

Secchi E, Ott P, Danilewicz D (2003) **Effects of fishing by-catch and conservation status of the franciscana dolphin, *Pontoporia blainvillei*.** *Marine Mammals: Fisheries, Tourism and Management Issues* 174-191.

Secchi E, Santos MCO, Reeves R (2018) ***Sotalia guianensis***. (*Sotalia guianensis* (errata version published in 2019). The IUCN Red List of Threatened Species, 2018. [https://dx.doi.org/10.2305/

IUCN.UK.2018-2.RLTS.T181359A144232542.en] Acceessed April 24, 2023.

Secchi ER, Cremer MJ, Danilewicz D, Lailson-Brito J (2021) **A synthesis of the ecology, human-related threats and conservation perspectives for the endangered franciscana dolphin**. *Frontiers in Marine Science* 8:1-18. doi: 10.3389/fmars.2021.617956.

Secchi ER, Kinas PG, Muelbert M (2004) **Incidental catches of franciscana in coastal gillnet fisheries in the Franciscana Management Area III: period 1999-2000.** *Latin American Journal of Aquatic Mammals* 3:61-68. doi: 10.5597/lajam00049.

Serres A, Delfour F (2017) **Environmental changes and anthropogenic factors modulate social play in captive bottlenose dolphins (*Tursiops truncatus*).** *Zoo Biology* 36:99-111. doi: 10.1002/zoo.21355.

Shostell J, Ruiz-García M (2010) **An introduction to River Dolphin species.** In: Ruiz-García M, Shostell J, (eds) Biology, Evolution and Conservation of River Dolphins within South America and Asia. 1 ed. Nova Science Publishers., Inc. Ed. New York.

Shrestha S, Shrestha B, Bygvraa DA, Jensen OC (2022) **Risk assessment in artisanal fisheries in developing countries: A systematic review.** *American Journal of Preventive Medicine* 62:255-264. doi: 10.1016/j.amepre.2021.08.031.

Siciliano S (1994) **Review of small cetaceans and fishery interactions in coastal waters in Brazil.** *Reports of the International Whaling Commission* 15:241-250.

Siciliano S, Viana MC, Bonvicino CR, Ruenes GF, Donato ALDS, Emin-Lima R, Costa AF (2023). **Giving names to the characters: identifying, tracing and estimating the multiple use of aquatic wildlife in Brazil**. In Galetti Jr, P. M. 23 ed Conservation Genetics in the Neotropics Cham: Springer International Publishing, Swiss, pp. 325-349.

Silva CV, Moreira SC, Zappes CA, Di Beneditto APM (2014) **Pesca artesanal e cetáceos que ocorrem no litoral leste do Rio de Janeiro: uma abordagem etnoecológica para verificar a existência de manejo tradicional.** *Boletim do Instituto de Pesca* 40:521-539.

Silva PP (2004) **From common property to co-management: lessons from Brazil's first maritime extractive reserve.** *Marine Policy* 28:419-428. doi: 10.1016/j.marpol.2003.10.017.

Silva V, Trujillo F, Martin A, Zerbini AN, Crespo E, Aliaga-Rossel E, Reeves R (2018) ***Inia geoffrensis***. *The IUCN Red List of Threatened Species 2018*. doi: 10.2305/IUCN.UK.2018-2.RLTS.T10831A50358152.en.

Silva VM, Brum SM, Mello DMD, Amaral RS, Gravena W, Campbell E, Gonçalves RS, Mintzer V (2023) **The Amazon River dolphin, *Inia geoffrensis*: What have we learned in the last two decades of research?** *Latin American Journal of Aquatic Mammals* 18:139-157. doi: 10.5597/lajam00298.

Silvano RAM, Begossi A (2012) **Fishermen's local ecological knowledge on Southernern Brazilian coastal fishes: contributions to research, conservation, and management.** *Neotropical Ichthyology* 10:133-147. doi: 10.1590/S1679-62252012000100013.

Simões-Lopes PC, Daura-Jorge FG, Cantor M (2016) **Clues of cultural transmission in cooperative foraging between artisanal fishermen and bottlenose dolphins, *Tursiops truncatus* (Cetacea: Delphinidae).** *Zoologia (Curitiba)* 33:1-4. doi: 10.1590/S1984-4689zool-20160107.

Simões-Lopes PC, Fabián ME, Menegheti JO (1998) **Dolphin interactions with the mullet artisanal fishing on Southern Brazil: a qualitative and quantitative approach.** *Revista Brasileira de Zoologia* 15:709-726. doi: 10.1590/S0101-81751998000300016.

Smith AM, Smith BD (1998) **Review of status and threats to river cetaceans and recommendations for their conservation.** *Environmental Reviews* 6:189-206. doi: 10.1139/a99-002.

Smith LED, Khoa SN, Lorenzen K (2005) **Livelihood functions of inland fisheries: policy implications in developing countries.** *Water Policy* 7:359-383. doi: 10 .2166/wp.2005.0023.

Souza RCF, Ramos MA, de Albuquerque UP, Souto A, Schiel N (2022) **Visitors' perception when participating in a poorly planned ecotourism activity: the case of dolphin watching in Northeastern Brazil.** *Journal of Ecotourism* 21:197-209. doi: 10.3390/su14094899.

Stephenson RL, Wiber M, Paul S, Angel E, Benson A, Charles A, Chouinard O, Edwards D, Foley P, Lane D, McIsaac J, Neis B, Parlee C, Pinkerton E, Saunders M, Squires K, Sumaila UR (2019) **Integrating diverse objectives for sustainable fisheries in Canada.** *Canadian Journal of Fisheries and Aquatic Sciences* 76:480-496. doi: 10.1139/cjfas-2017-0345.

Sturtevant WC (1964) **Studies in Ethnoscience1.** *American Anthropologist* 66:99131. doi: 10.1525/aa.1964.66.3.02a00850.

Suffredini IB, Arruda JR, Rodrigues FSTP, Andrade C, Carvalho, BRR, Rodrigues KFS, Bonamin LV (2023) **The brazilian ethnoveterinary analyzed by the one world-one health™ perspective.** *Pharmacognosy Reviews* 17:1-14. doi: 10.5530/phrev.2023.17.6.

Syme J, Kiszka JJ, Parra GJ (2023) **Habitat partitioning, co-occurrence patterns, and mixed-species group formation in sympatric delphinids.** *Scientific Reports* 13:3599. doi: 10.1038/s41598-023-30694-w.

Teixeira JVDS, Santos JSD, Guanaes DHA, Rocha WDD, Schiavetti A (2020) **Uses of wild vertebrates in traditional medicine by farmers in the region surrounding the Serra do Conduru State Park (Bahia, Brazil).** *Biota Neotropica* 20:1-15. doi: 10.1590/1676-0611-BN-2019-0793.

Tittensor DP, Beger M, Boerder K, Boyce DG, Cavanagh RD, Cosandey-Godin A, Crespo GO, Dunn DC, Ghiffary W, Grant SM, Hannah L, Halpin PN, Harfoot M, Heaslip SG, Jeffery NW, Kingston N, Lotze HK, McGowan J, McLeod E, McOwen CJ, O'Leary BC, Schiller L, Stanley RRE, Westhead M, Wilson KL, Worm B (2019) **Integrating climate adaptation and biodiversity conservation in the global ocean.** *Science Advances* 5:1-15. doi: 0.1126/sciadv.aay9969.

Tittensor DP, Mora C, Jetz W, Lotze HK, Ricard D, Berghe EV, Worm B (2010) **Global patterns and predictors of marine biodiversity across taxa.** *Nature* 466:1098-1101. doi: 10.1038/nature09329.

Tixier P, Lea M-A, Hindell MA, Welsford D, Mazé C, Gourguet S, Arnould JPY (2021) **When large marine predators feed on fisheries catches: Global patterns of the depredation conflict and directions for coexistence.** *Fish and Fisheries* 22:31-53. doi: 10.1111/faf.12504.

Toledo GAC, Campos BATP, Feitosa ICS, Souto AS, Alves RRN (2010) **Interações entre pescadores artesanais eo boto-cinza (*Sotalia guianensis* - Van Bénéden, 1864) na região de Baía Formosa, Rio Grande do Norte - Brasil.** MSc. dissertation, Universidade Federal do Rio Grande do Norte. [https://repositorio.ufrn.br/handle/123456789/14040A] Acceessed August 20, 2023.

Tosi CH, Magalhães FA, Garri RG (2009) **Meat consumption of a Fraser's dolphin (*Lagenodelphis hosei*) stranded alive on the northern Brazilian coast.** *Marine Biodiversity Records* 2:1-4. doi: 10.1017/S1755267208000043.

Tregenza NJC, Berrow SD, Hammond PS, Leaper R (1997) **Harbour porpoise (*Phocoena phocoena* L.) by-catch in set gillnets in the Celtic Sea.** *ICES Journal of Marine Science* 54:896-904. doi: 10.1006/jmsc.1996.0212.

Tripathy DB, Gupta A, Agarwal P, Mishra A, Jain AK (2024) **Oils and fats as raw materials for industry.** John Wiley & Sons.

Trujillo-González F, Mosquera-Guerra F, Franco, N (2019) **Delfines de río: especies indicadoras del estado de salud de los ecosistemas acuáticos de la Amazonia y la Orinoquia.** *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales* 43:199-211. doi: 10.18257/raccefyn.765.

Tullio JCD, Fruet PF, Secchi ER (2015) **Identifying critical areas to reduce bycatch of coastal common bottlenose dolphins *Tursiops truncatus* in artisanal fisheries of the subtropical western South Atlantic.** *Endangered Species Research* 29:35-50. doi: 10.3354/esr00698.

Urquhart J, Acott TG, Symes D, Zhao M (2014) **Introduction: Social Issues in Sustainable Fisheries Management.** In: Urquhart J, Acott TG, Symes D, Zhao M (eds) Social Issues in Sustainable Fisheries Management. 2014 ed. Springer Netherlands, Dordrecht, pp. 1-20.

Vidal MD, Santos PMC, Marmontel M, Moura JF, Siciliano S (2022) **Easy food in the jungle: evaluating presence and relationships of Amazon River dolphin (*Inia geoffrensis*) at a provisioning site in the Amazon, Brazil.** *Latin American Journal of Aquatic Mammals* 17:43-50. doi: 10.5597/lajam00282.

Wang J, Yang Y, Yang F, Li Y, Li L, Lin D, He T, Liang B, Zhang T, Lin Y, Li P, Liu W (2016) **A framework for the assessment of the spatial and temporal patterns of threatened coastal delphinids.** *Scientific Reports* 6:19883. doi: 10.1038/srep19883.

Wells RS, Natoli A, Braulik G (2019) ***Tursiops truncates***. In: The IUCN Red List of Threatened Species 2019. [https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T22563A156932432.en] Acessado em 20 abril 2023.

Würsig B (1989) **Cetaceans.** *Science* 244:1550-1557. doi: 10.1126/science.2662403.

Yang N, Price M, Xu Y, Zhu Y, Zhong X, Cheng Y, Wang B (2023) **Assessing global efforts in the selection of vertebrates as umbrella species for conservation.** *Biology* 12:1-20. doi: 10.3390/biology12040509.

Zappes CA (2007) **Estudo etnobiológico comparativo do conhecimento popular de pescadores**

**em diferentes regiões do litoral brasileiro e implicações para a conservação do Boto-cinza *Sotalia guianensis* (van Bénéden, 1864) (Cetacea, Delphinidae).** MSc. dissertation, Universidade Federal de Juiz de Fora. [https://repositorio.ufjf.br/jspui/handle/ufjf/2903] Acceessed August 20, 2023.

Zappes CA, Alves LCPS, Silva CV, Azevedo AF, Di Beneditto APM, Andriolo A (2013) **Accidents between artisanal fisheries and cetaceans on the Brazilian coast and Central Amazon: Proposals for integrated management.** *Ocean & Coastal Management* 85:46-57. doi: 10.1016/j.ocecoaman.2013.09.004.

Zappes CA, Andriolo A, Silva FO, Monteiro-Filho ELA (2009) **Potential conflicts between fishermen and *Sotalia guianensis* (van Bénéden, 1864) (Cetacea, Delphinidae) in Brazil.** *Sitientibus Série Ciências Biológicas* 9:208-214. doi: 10.13102/scb8013.

Zappes CA, Andriolo A, Simões-Lopes PC, Di Beneditto APM (2011) **'Humandolphin (*Tursiops truncatus* Montagu, 1821) cooperative fishery' and its influence on cast net fishing activities in Barra de Imbé/Tramandaí, Southern Brazil.** *Ocean & Coastal Management* 54:427-432. doi: 10.1016/j.ocecoaman.2011.02.003.

Zappes CA, Gatts CEN, Lodi LF, Simoes-Lopes PC, Laporta P, Andriolo A, Di Beneditto APM (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.** *Ocean & Coastal Management* 98:120-129. doi: 10.1016/j.ocecoaman.2014.06.014.

Zappes CA, Monteiro-Filho ELA, Oliveira F, Andriolo A (2010) **O comportamento do boto-cinza *Sotalia guianensis* (van Bénéden, 1864) (Cetacea; Delphinidae) através do olhar dos pescadores artesanais.** *Revista de Etologia* 9:17-28.

Zerbini AN, Andriolo A, Heide-Jørgensen MP, Pizzorno JL, Maia YG, VanBlaricom GR, DeMaster DP, Simões-Lopes PC, Moreira S, Bethlem C (2006) **Satellitemonitored movements of humpback whales Megaptera novaeangliae in the Southwest Atlantic Ocean.** *Marine Ecology Progress Series* 313:295-304. doi: 10.3354/meps313295.

Zerbini AN, Secchi E, Crespo E, Danilewicz D, Reeves R (2017) **Pontoporia blainvillei**. In: The IUCN Red List of Threatened Species 2017). [https://dx.doi.org/10.2305/IUCN.UK.20173.RLTS.T17978A50371075.en] Acceessed August 20, 2023.

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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<br>Theft<br>Entanglement |
| VIDAL; MOURA; MUNIZ, 2019. | * |
| BARBOSA-FILHO et al., 2020. | * |
| FILGUEIRA et al., 2021. | Trapped<br>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;<br>Boto-caldeirão;<br>Golfinho;<br>Golfinho-flipper |
| | Stenella frontalis (G. Cuvier, 1829) | Boto;<br>Boto-rajado;<br>Boto-caldeirão;<br>Boto-malhado;<br>Golfinho;<br>Golfinho-malhado |
| | Sotalia guianensis (Van Bénéden, 1864) | Boto;<br>Boto-preto;<br>Golfinho;<br>Toninha; |
| | Pontoporia blainvillei (Gervais & d'Orbigny, 1844) | Toninha;<br>Boto;<br>Boto-branco;<br>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;<br>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 |
| | Sotalia fluviatilis (Gervais & Deville in Gervais, 1853) | * |
| | Sotalia guianensis (Van Bénéden, 1864) | * |
| ROSA; ZAPPES; DI BENEDITTO, 2012. | 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;<br>Boto-comum;<br>Rosa;<br>Branco;<br>Canaã;<br>Canarana;<br>Boto;<br>Amarelo;<br>Amarelão;<br>Nari-nari;<br>Bicudo;<br>Soma |
| BARBOSA-FILHO et al., 2020. | * | * |
| FILGUEIRA et al., 2021. | Sotalia guianensis (Van Bénéden, 1864) | Boto-cinza;<br>Golfinho;<br>Boto;<br>Golfinho-nariz-de-garrafa |
| MARMONTEL et al., 2021. | Inia geoffrensis (Blainville, 1817) | Boto;<br>Golfinho |
| | Sotalia fluviatilis (Gervais & Deville in Gervais, 1853) | Tucuxi;<br>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 | * | * |

Continuous...

| 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 | * | * |