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EDITED BY
Alex Souza Lira,
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REVIEWED BY
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El Colegio de Michoacán, Mexico
Jose Jaime Pascual-Fernández,
University of La Laguna, Spain

*CORRESPONDENCE
Dannieli Firme Herbst
✉ danniherbst@gmail.com

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Historical newspapers unlock new insights into the evolution of seafood value chains in Brazil

Dannieli Firme Herbst[1]*, Leopoldo Cavaleri Gerhardinger[1], Cecile Brugere[2], Thais Peixoto Macedo[1], Luiz Geraldo Silva[3] and André Carlo Colonese[1]

[1]Institute of Environmental Science and Technology (ICTA), Universitat Autònoma de Barcelona, Bellaterra, Spain, [2]Soulfish Research & Consultancy, York, United Kingdom, [3]Department of History, Universidade Federal do Paraná (UFPR), Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Curitiba, Brazil

Introduction: This study examines the understudied historical evolution of the seafood value chain in southern Brazil by analysing newspaper articles from Santa Catarina state, published between 1855 and 2019.

Methods: Through a meticulous review of 598 selected articles, we reconstruct the development and transformation of small-scale fisheries (SSF) and their interaction with the emerging industrial fishing sector.

Results and discussion: Our findings highlight the central role of SSF in the seafood value chain, contributing significantly to production, processing, retail, and trade, despite increasing competition and challenges from industrial fishing and aquaculture. The analysis reveals shifts in fish species targeted, processing methods employed, market dynamics, and consumption patterns over time. Notably, the study uncovers the resilience and adaptability of SSF in maintaining their importance to local economies and food security, amidst technological, economic, and regulatory changes. Furthermore, it underscores the often-overlooked contributions of women in seafood value chains, advocating for their equitable recognition. By providing a comprehensive and multi-faceted historical perspective, this research can inform contemporary policy-making, aiming to foster more resilient, inclusive, and sustainable seafood value chains in Brazil.

KEYWORDS

Santa Catarina, historical newspapers, small-scale fisheries, seafood value chain, historical ecology, Brazil

Introduction

Coastal communities worldwide have historically depended on coastal resources, with seafood value chains playing a crucial role in food production, economic activity, and income generation (Begossi, 1995; Marean, 2010; Jimenez et al., 2020). In Brazil, small-scale fisheries (SSF) have traditionally played a central role in seafood value chains, contributing significantly to both total fish landings and employment in the capture sector (Vasconcellos et al., 2011; Pincinato et al., 2022). Recent studies, however, have shown some alarming figures, with fish production from SSF decreasing over the last decades in some areas of Brazil (Freire et al., 2021; Andriguetto-Filho et al., 2022). While this downward trend may in part reflect

deficiencies in monitoring systems and the effects of overfishing (Freire et al., 2021; Seminara et al., 2024), others suggest that it results from complex historical maladaptive responses to multiple drivers, such as technology, market opportunities, subsidies, and institutions, as well as legal restrictions (Andriguetto-Filho et al., 2022).

Overall the emerging picture raises concerns about the future of SSF in Brazil, particularly in regards to their contribution to food security, income, livelihoods, and conservation and management initiatives. It also reinforces the emerging view that the challenges faced by SSF have deep historical origins (Sandoval et al., 2021; Herbst et al., 2023). Historical perspectives on commercial fisheries harvests in Brazil are limited to recent decades with large national fisheries subsidies, from the 1960s onwards (Seixas and Troutt, 2003; Abdallah and Sumaila, 2007; Perez et al., 2009; Neto et al., 2021; Valenti et al., 2021; Andriguetto-Filho et al., 2022). Nevertheless, studies have shown that the combination of nationalistic agendas, industrialization, and the emergence of a middle class in urban areas in the late 19th and early 20th centuries played a role in the emergence of the industrial fishing sector in Brazil. For instance, Herbst et al. (2023) proposed the 1920s and 1930s as the period of "incubation" of the Brazilian fishing industry, but our understanding of this process remains historically fragmented.

Public media, such as newspapers, are valuable repositories of historical information on evolving political and economic contexts and their synergistic impacts on public opinions. Newspapers, in particular, have wide distribution and frequent publication schedules, ranging from daily to semi-annual releases, and ongoing digitization initiatives have enhanced their accessibility in Brazil (Sandoval et al., 2021; Herbst et al., 2023). They are, however, rarely used to document the past evolution of fisheries before official reporting of landings began in the 1950s. Here, we present a historical analysis of Brazil's seafood value chain based on newspaper articles published in Santa Catarina state (southern Brazil) between 1855 and 2019. Santa Catarina is currently the largest fish-producing state in the country, where the landings from SSF are reported to have been facing increased competition with the rising industrial sector since the 1950s (Freire et al., 2021). In this paper, we expand this time horizon by reporting on data covering nearly 160 years, focusing on the late 19th and early 20th centuries due to signifi cant gaps in our knowledge of these decades. We aim to assess the evolution of the main components of the seafood value chain and the evolving nature of SSF during the emergence of the industrial fisheries sectors.

Methodology

Data collection and analysis

We used the database generated by Herbst et al. (2023), based on newspapers sourced from the Brazilian Digital Newspapers and Periodicals Library using the keywords "*pesca*" (fishing) and "*peixe*" (fish) (*Hemeroteca Digital Brasileira, Fundação Biblioteca Nacional, BNDigital*). This reference database consisted of approximately 24 thousand reviewed news items, of which 598 were selected from newspapers published in Santa Catarina state between 1840 and 2019. The data mining and analytical approach selected items that presented information considered relevant for discussing seafood value chains: (i) ecological data (i.e., species, habitats, or species-specific information); (ii) political context related to fishing regulations, enforcement, and management; and (iii) market data.

An analytical framework was created by grouping the items into five value chain stages: Production, Processing, Retail, Trading, and Consumption, with the Retail and Trading categories specifically addressing market-related issues. Production referred to small-scale fisheries, industrial fisheries, or aquaculture. Processing methods followed the classification of 9 types, including those listed in Belton et al. (2022), and new methods emerging in our research. Some fish processing methods were grouped as: sun-dried was considered as "dried," oil as a "by-product," and smoked, cooked, roe, and shredded as "others." Retail was defined as direct sales by fishers in informal settings, such as on the beach and streetside, or in small quantities to markets. In contrast, Trading referred to large-scale transactions that involved intermediaries and other stakeholders, including larger market operations and international trade deals. We categorized the scale of the market in each item as local (city), regional (Santa Catarina), national (Brazil), or international, and we recorded any intermediaries and sales venues that were mentioned.

When possible, aquatic organisms linked to the seafood value chain had their common name converted to scientific names at the minimum identified taxonomic level, based on local literature (Gerhardinger et al., 2020; Freire et al., 2021; Herbst et al., 2023). Only species mentioned more than five times, however, were included in the analysis to ensure we focused on the most prevalent data. Whaling was excluded because of its minor contribution to diet, and its overall declining importance from the late 19th century onwards. All data was tabulated in a spreadsheet (Supplementary information 1), and data visualization was performed using R software (R 4.3.0; ggplot and ggsankey) (Wickham, 2016; Sjoberg, 2021).

Results

Of the 598 items recorded by Herbst et al. (2023), 284 reported valuable information on the seafood value chain between 1856 and 2019. The items were mostly concentrated between 1900–1909 and 1930–1940, and again between 1990–2000 and 2000–2009 (Supplementary information 1). This temporal fluctuation is a product of the number of digitized news items in the Hemeroteca Digital Brasileira, as observed in previous studies (Sandoval et al., 2021; Herbst et al., 2023). Out of the 284 items, 137 (48.2%) reported information on Production, and 137 (48.2%) on Trading, followed by 124 items (43.6%) containing data on Processing, 115 (40.5%) on Retail, and 54 items (19%) on Consumption. These categories were often reported together in the same items, with Production showing considerable relative variation through time (Figure 1).

Seafood production

The data on production reveals that from the late 19th century throughout most of the 20th century the seafood value chain in Santa Catarina was largely associated with SSF (68.4%, n = 169 Production classifications), followed by the industrial sector (19.9%, $n = 49$) and then by the sharp rise of aquaculture (11.7%, $n = 29$) in the 21st century. The emergence of industrial fishing in the 1880s, and the later development of aquaculture in the 1980s and its expansion from 2000,

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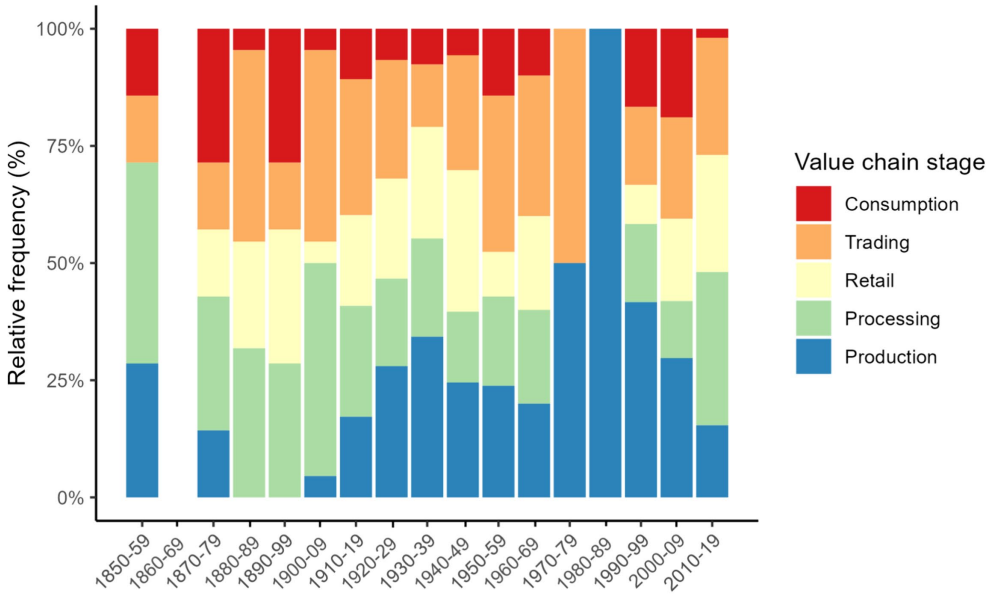

FIGURE 1
Relative frequency of seafood value chain stages in newspaper items per decade.

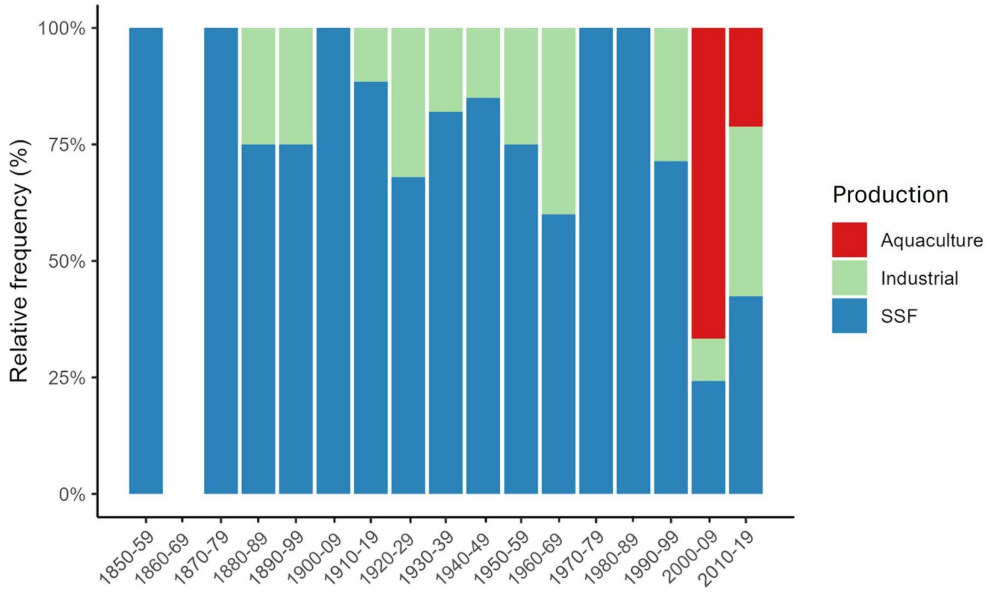

FIGURE 2
Relative frequency of seafood production type per decade.

coincided with reductions in SSF (Figure 2). Since the late 19th century, the newspapers reported a wide variety of SSF contributions to seafood production, ranging from direct capture for local markets, to supplying resources for the emerging industrial sectors (*A Notícia*, February 23, 1937, *A Notícia*, May 20, 1939, *Correio do Povo*, September 2, 1939), and specialized labor forces for industrial fleets and others states (*O Estado*, August 14, 24, 30, and 31, 1928), with the backing and interest of the navy (*A Notícia*, February 23, 1937). From 1880 to 1930, an emerging number of small fish processing enterprises attempted to establish themselves in Santa Catarina, focusing on the exploitation of shrimp (canned and dried) and fish (dried and salted), specifically targeting species such as mullet, black drum, shark, and bluefish. These early industries largely relied on purchasing their fish from small-scale fishers. Interest in specific local species was seen from the 1930s. For example, with cod being a prized and preferred food in Brazil, the identification of a similar species in Santa Catarina ("abrótea, gasper or Brazilian cod" - Gaddidae) presented an opportunity for market competition and attracted non-local vessels from the Companhia de Santos to the Santa Catarina coast (*O Estado*, August 14, 24, 30, and 31, 1928). These external fishing vessels were

viewed as clandestine or even pirates by the local communities (*O Estado*, September 13, 1928; *A Notícia*, February 24, 1931). Similarly, sardines, nowadays a prominent product from Santa Catarina, were initially underutilised and mostly imported in canned form. Interest in local sardine resources began to emerge in the 1930s (*A Notícia*, May 20, 1939), and more systematic exploitation started in the city of Porto Belo via artisanal fishing methods (*Correio do Povo*, September 2, 1939). This eventually paved the way for the transition to industrial fishing practices.

From the 1960s, public fisheries subsidies provided by the Superintendency of Fisheries Development (SUDEPE), were intensified (*Blumenau em Cadernos*, March 1960; *Correio do Povo*, November 30, 1968), coinciding with the growth of the fishing industries in the Vale do Itajaí region in Santa Catarina (*Blumenau em Cadernos*, March 1960). A 2015 news report emphasized the disparity in fishing capacities between artisanal and industrial fishing, stating, "The industrial fleet has much greater fishing power compared to artisanal fishing" (*Zero*, July 2015), particularly in the context of mullet fisheries.

Aquaculture has been practised in Brazil since the 1980s, but it notably expanded in the 2000s in inland cities of Santa Catarina, such as Jaraguá do Sul, Brusque, Guaramirim, and Blumenau (*Correio do Povo*, April 6, 2004). Tilapia is the main fish species cultivated (*Correio do Povo*, April 10, 2001) in terms of aquaculture pounds. In 2009, a significant shift occurred in the national fishing industry management when Brazil established its first Ministry of Fisheries and Aquaculture. During a visit to Santa Catarina, Minister Altemir Gregolim underscored the goal of increasing fish production, particularly through aquaculture in Santa Catarina. He pointed out the need for greater industrialization and market expansion, noting that Brazil's annual aquaculture exports stood at 9,000 tons, half of which originated from western Santa Catarina (*O Município*, July 22, 2009).

Seafood processing

Out of the 124 news items covering fish processing, 679 instances were coded into the 9 different types of processing. The data reveals a consistent preference for fresh fish (44%, $n = 300$,), while dried and frozen fish both account for 11.3% ($n = 77$) of the methods, followed by canned (7.8%, $n = 58$), by-products (7.4%, $n = 50$), salted (6.6%, $n = 45$), filleted (5%, $n = 34$), sliced (2.3%, $n = 18$), and other methods (4%, $n = 27$), as presented in Figure 3. The period from 1880 to 1959 saw a wider array of processing methods. Until the 1930s, there was no mention of efficient, large-scale freezing techniques. Instead, fishers and traders employed a variety of methods, including drying/sun-drying, salting, canning, smoking, and cooking. Dried fish, in particular, was noted for its extended shelf life and utility during periods of scarcity (*Zero*, June 8, 1996). While not as commonly reported, salting, dried, and smoking are long-standing processing practices, ingrained in the cultural heritage of Brazilian coastal communities. Their sustained use may be attributed to traditional culinary customs, local preferences, or the practical benefits they provide for preserving and storing food. Today, the availability of dried and salted fish in Brazilian markets has significantly diminished, with the notable exception of cod (dried and salted).

Our results reveal that mullet (*Mugil liza*, 12%, $n = 81$) and shrimp (Penaeidae, 10%, n = 59) were the most frequently processed species. Notably, mullet has been subjected to every known processing technique (*O Município*, May 25, 2016). Beyond their flesh and roe (classified as "others") for human consumption, mullet viscera were reported as fertilizer, and their oil was used as lubricant and fuel ("by-products"). Other taxa were also used for oil production, including Elasmobranchii (sharks and rays), cetaceans (dolphins and whales), and catfish (Ariidae). Up until the 1960s, a diverse array of by-products was exploited, but in modern times this category has been largely confined to shark fin exports.

Frozen seafood appeared in newspapers from the 1930s and 1940s. Fish fillets emerged as a processed product post-1950s and, alongside fresh and frozen fish, constitute one of the most prevalent processing methods in current times (Figure 4). The main species processed into fillets include tilapia (*Oreochromis niloticus*), drums (Sciaenidae, particularly "pescadinha"), Brazilian cod (Urophycis sp.), sardines (*Sardinella brasiliensis*), sole (Paralichthyidae) and hake (Merlucciidae).

The "others" category in seafood processing, up to the 1950s, was typically linked to cooked seafood for export. In contemporary practices, this category has evolved to include the processing of swimming crabs (Brachyura), which are sold shredded, and shucked shellfish (Bivalve). Mullet roe, considered as "others," has been consistently harvested over time, with current trends showing an increased focus on its exportation as "bottarga" (*O Município*, May 25, 2016).

Although seafood production appears to have been mostly for local household and market consumption, imports of seafood, particularly processed species, have been documented since the 1870s and included canned fish (sardines – Clupeidae, shrimp – Penaeidae, anchovies – Engraulidae), salted and dried fish (cod – Gadidae), and, more recently, frozen varieties (salmon – Salmonidae, conger – *Conger* sp., hake – Merlucciidae). From 1870 onwards, evidence points to the export of dried (bluefish – *Pomatomus saltatrix*; shark - Elasmobranchii; shrimp – Penaeidae), salted (native catfish – Ariidae, Brazilian cod - *Urophycis* sp.), canned (shrimp; bivalves; mullet – *Mugil liza*; bluefish – *Pomatomus saltatrix*), and by-products (oil from Elasmobranchii, "colla" from fish viscera and shark fins). In 1907, concerns were raised about the excessive exports of dried shrimp reducing its availability to local consumers (*Commercio de Joinville*, May 18, 1907). Frozen seafood appeared in newspapers from the 1930s and 1940s, and filleting from the 1950s.

Market and the role of intermediaries

In our analysis, we traced the evolution of market dynamics, looking at both trading and retail aspects. We reviewed 137 news articles on trading and 115 on retail, leading to 269 market-related classifications that fell into the following categories: Local (62%, $n = 168$), Regional (7%, $n = 18$), National (18%, $n = 48$), Export (7%, $n = 18$), and Import (6%, $n = 17$). Local markets have consistently been a central part of the fish trade and consumption landscape in Santa Catarina (Figure 5), with retail sales playing a significant role. Regional and national markets have also been integral to Santa Catarina's trade, with their importance growing after 1900 (Figure 5).

Seafood production from SSF was mostly distributed through intermediaries. These were reported as "pombeiros," "correios" (*A*

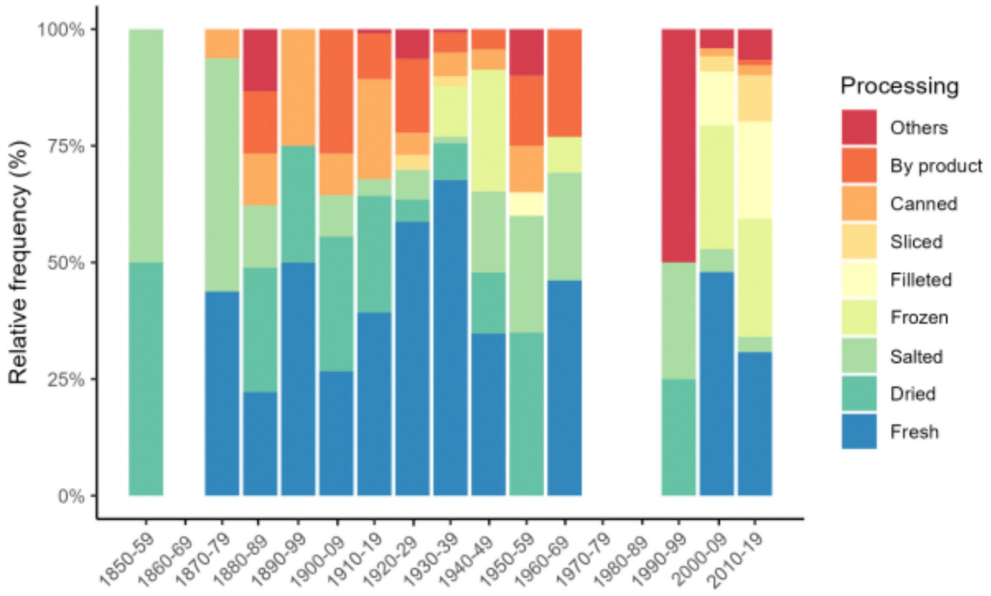

FIGURE 3
Historical changes in relative frequency of seafood processing methods over time.

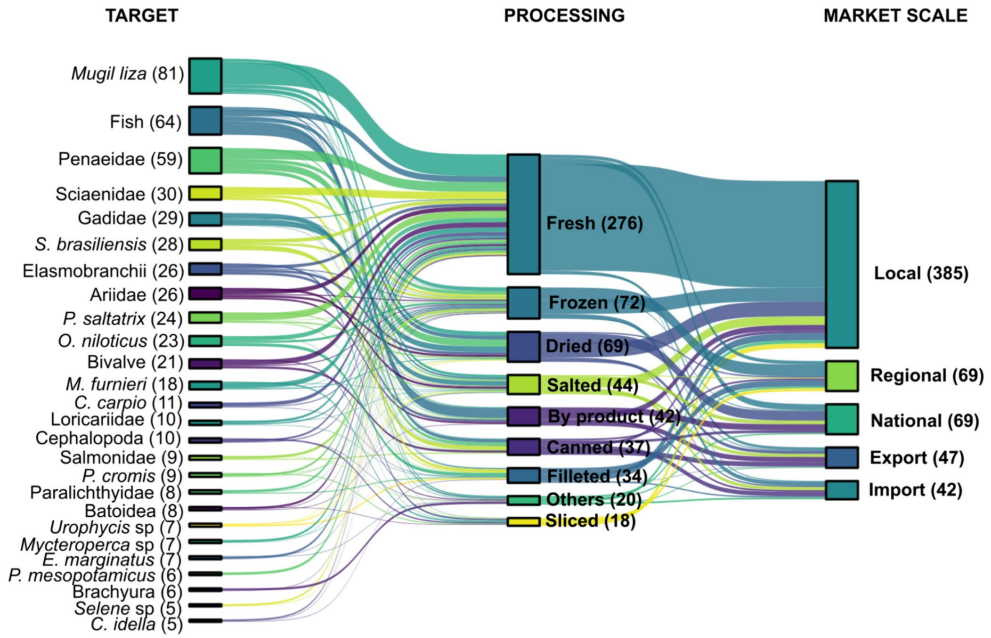

FIGURE 4
The flux of the main targeted taxa (>5 citations) associated with the types of food processing and markets from 1855 to 2019. The diagram elucidates the frequency distribution of individual taxa across the variables "processing" and "market scale".

regeneração, June 6, 1884), or "açambarcadores" (*O Dia*, August 20, 1918) since the late 19th century. These intermediaries were often reported as wielding significant power and influence in the market and the seafood value chain by exploiting fishers, consumers, or both (*O Imparcial*, December 19, 1915; *Republica*, June 20, 1920; *A Noticia*, May 5, 1931; *A Notícia*, May 25, 1935). Low prices paid to fishermen and high prices charged to fishmongers and end consumers were particularly prevalent in the principal local and public markets of Santa Catarina, such as in the cities of Florianópolis, Joinville, São Francisco do Sul, Laguna, and Jaraguá do Sul.

Since the 1920s, advancements in infrastructure and technology, such as new roads, trucks, and refrigeration systems, enabled intermediaries to expand their market reach to regional, national, and

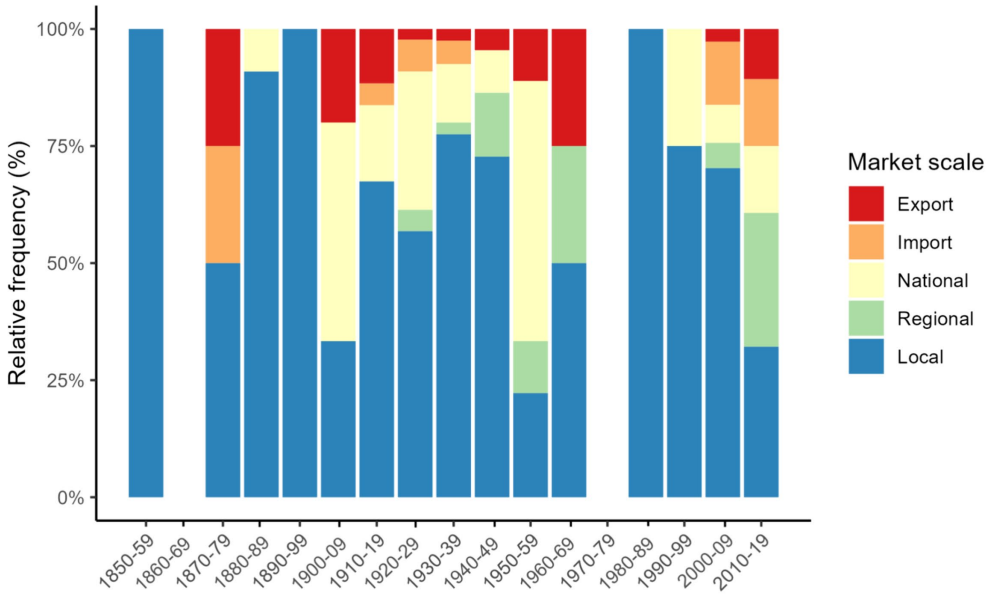

FIGURE 5
Market destination of seafood caught in Santa Catarina state per decade.

even international levels (*Republica*, April 8, 1919; *O Estado*, June 5, 1929; *Republica*, June 8, 1929; *O Estado*, June 12, 1938; *A Noticia*, May 24, 1941). Their operations were supported by fishing guilds (*Colônias de Pescadores, Boletim Commercial*, November 1943) and facilitated by maritime shipping, for instance from the city of São Francisco do Sul (*A Noticia*, April 2, 1942).

As early as 1884, we found instances where small-scale fishers took action to regulate their catch sizes, aiming to mitigate market competition with intermediaries (*A regeneração*, June 6, 1884). When they opted to curtail their fishing efforts, a choice often necessitated by technological or market restrictions, they were stigmatized as lazy, unproductive, and lacking ambition (*O Estado*, October 18, 1926). Furthermore, local fishermen and citizens believed that establishing fish warehouses (*entrepostos*) with associated processing facilities would counteract the market dominance of intermediaries, activating the local market and ensuring fairer prices (*A Gazeta*, June 4, 1939; *O Estado*, June 12, 1938). The outcome, however, was contrary to their hopes. In the 1930s and 1940s, several species including mullet - a key food source accessible to all social classes - had prices rising to levels considered unaffordable and this was largely attributed to market speculations by intermediaries (*A Noticia*, August 12, 1932; *O Estado*, May 23, 1933; *A Noticia*, May 20, 1939; *A Noticia*, May 24, 1942). This trend has long persisted within the fishing communities of Santa Catarina, just as the belief in warehouses as a solution to reduce the influence of intermediaries in controlling SSF (*Zero*, November, 2012).

It is worth noting the almost complete absence of information on the role of women in the seafood value chain. Women were primarily mentioned in the context of their roles as "wives," tasked with domestic duties including childcare and cooking (*O Estado*, May 17, 1937; *Subcomissão Catarinense de Folclore*, 1959). Nevertheless, while men's participation in the fishing value chain is prominently featured in historical reports, a 1951 article (*Subcomissão Catarinense de Folclore*, Ed. 8) revealed that the process of "escalar" (which involves cleaning, salting, and drying) large catches of fish, like mullet, croaker, bluefishe, pompano, and yellowtail, was a family affair, with women playing a significant role and undertaking substantial work throughout this process. Gender was largely ignored otherwise, until a news item in 2016 raised attention to gender issues, particularly highlighting the often invisible role of women in the sector (*Zero*, June 2016).

Fish consumption and preferences

The newspapers offer insights into how seafood was valued in society and the drivers of change in seafood habits. Throughout the historical record, 54 news articles specifically discussed aspects of fish consumption in Santa Catarina. The results show that in the late 19th and early 20th centuries, seafood production supplied, in particular, local household consumption and markets, together with the cultivation of cassava and the production of cassava flour for subsistence and local commerce (*A Regeneração*, June 18, 1885). This way of life gave rise to a distinct class of fishers, often perceived as impoverished individuals whose diets were mainly composed of fish, shellfish (particularly the cockle, known locally as "berbigão"), and flour (*Republica*, May 31, 1895). Fish and cassava flour, or "pirão," became emblematic of Santa Catarina's cuisine, inspiring a variety of recipes and food combinations (*Subcomissão Catarinense de Folclore*, 1991).

Public institutions such as military quarters (*O Argos da província*, December 23, 1856), prisons (*A Regeneração*, December 16, 1885), and hospitals (*O Estado*, November 1, 1899) were also part of this chain, as consumers. Amongst the most demanded species (fresh and dried) featured black drum, mullet, bluefish, and dried shark (locally termed "charque de cação"). By contrast, more distinguished varieties of fish, such as species with white flesh and fewer bones, or imported products (e.g., cod), were perceived as items for the elite (*A Época*, September 9, 1911).

Beginning in the 1930s, newspaper editorials started to reflect on the changing status of fish from a staple for the less affluent to a delicacy for the wealthy (*A Noticia*, August 7, 1938; *Republica*, October 22, 1937; *A Noticia*, May 24, 1942). News reports of seafood being sold at very high prices in restaurants and hotels also increased (*A Noticia*, May 25, 1935). These observations were often made against the backdrop of years marked by reduced fishing yields and inflated prices, which were attributed to overfishing (*A Semana*, July 21, 1920), adverse weather conditions (*Republica*, April 8, 1930), and economic downturns (*A Noticia*, September 18, 1936). Demand for fish increased in key urban centers in the states of Santos, São Paulo, and Rio de Janeiro, attracting non-local fishing companies to Santa Catarina that competed and acquired seafood products directly from local producers (*O Dia*, January 13, 1944). As a consequence, a considerable amount of seafood was diverted to outside markets, inflating local prices and affecting local livelihoods (e.g., *O Estado*, 09 July 1925; 13 September 1928, 06 October 1946, 25 June 1951, 25 August 1951; *A Noticia*, 23 February 1931).

The most frequently featured species in news about the fish value chain reflect dietary preferences, including mullet, shrimp, cod (Brazilian and imported), drum, bluefish, shark and, recently, tilapia. During the mullet season from May to July, towns were reported to be filled with the aroma of mullet, showcasing its culinary versatility through frying, drying/salting ("escalada"), stuffing, and baking. Its roe also appealed to many palates (*O Estado*, June 5, 1929). Similarly, shrimp was prepared in various ways and universally enjoyed (*A Gazeta*, March 14, 1935). Both mullet and shrimp, being abundant, became staples in high demand for direct consumption, local sale, or external trade in dried form. Their diverse preparation methods have cemented them as cultural traditions in the state (*Subcomissão Catarinense de Folclore*, 1991). However, noticeable population declines of these species in recent years have become a cause for concern (*A Ponta*, July 1993; *Zero*, June 2015).

The last few decades have witnessed notable changes in fish consumption trends in Santa Catarina, including: (i) decreased fish consumption, often limited to religious events (Semana Santa – *Correio do Povo*, March 22 April 2005; O Município, April 13, 2006); (ii) lower seasonal consumption due to storage capacities following advances in refrigeration technology (*O Município*, June 9, 2015); (iii) increased aquaculture, mainly tilapia (fish with white flesh and few bones) (*Correio do Povo*, 10 April 2001; *O Município*, 15 August 2008); (iv) preference for processed and easily prepared fish (*O Município*, April 5, 2012; March 28, 2018; April 24, 2017); (v) market competitiveness with imported fish - the high cost of national fish has made imported fish more accessible to Brazilians (*O Município*, June 5, 2019).

Discussion

The industrialization of fisheries and seafood systems over the past century is a worldwide phenomenon with direct consequences for the health of marine resources and mounting social struggles faced by small-scale fishers today (Clark, 2022). Over the past 160 years, Brazil's seafood value chain has undergone profound socio-economic, environmental, political, and technological changes leading to the accelerated pace towards industrialization. Our historical analysis within a broad temporal range enables a socioecological perspective on fishing and the fish value chain (Pradhan et al., 2022). Examining the past can reveal what aspects of culture and tradition people value, and the extent to which some processes have changed or remained constant.

The late 19th and early 20th centuries marked a turning point for coastal development in Brazil, driven by population growth and market changes. Coffee became the main agricultural product, leading to infrastructure development for commodity distribution (i.e., port of Santos, railroads), regional markets, and new social classes in coastal areas of the southeast (e.g., Santos, Rio de Janeiro) (Moya, 2020; Klein and Luna, 2023). Simultaneously, governmental control over coastal populations increased, imposing new regulations, sanctions, and market forces on small-scale fisheries (Silva, 1988, 2001). From the 1850s, and especially from the 1930s ("Brazil's Industrial Revolution," Bresser Pereira, 1962), policies aimed to boost commercial fishing were promoted, with fiscal incentives for private investors (fish catching, salting, and drying concessions in 1859), new regulatory authorities (Inspetoria da Pesca in 1912), and the creation of seafood markets and fishing schools. These incentives were driven by urban seafood demand, international economic forces, national interests (Brasil, 1945), and the decline of whaling (Ellis, 1958a,b). However, they favored capitalized investors (Brasil, 1920, 1945), neglecting small-scale fishers often seen as backward and responsible for local stock depletion (Silva, 1988; Sandoval et al., 2021; Herbst et al., 2023).

Our study reveals that small-scale fishers have been crucial in seafood production, processing, and supply chains, showcasing resilience and adaptability amid social and economic challenges. Globally, SSF contribute to over half of the global catch and support countless livelihoods, especially those of women and coastal populations (Allison et al., 2012; Tigchelaar et al., 2022). In Santa Catarina, the shift from SSF to the dominance of the industrial system intensified in the 1960s and 1970s, driven by significant public subsidies (Diegues, 1983; Abdallah and Sumaila, 2007; Filho, 2016). This transformation involved various stages affected by political and market conditions, including consumption patterns and international trade. Our findings trace the early effects of industrialization to the late 19th and early 20th centuries, highlighting persistent factors influencing fish consumption in Brazil today: cultural food preferences, ecological resource availability/seasonality, market dynamics, fishing gear and vessels, fish conservation, and road development. These circumstances facilitated a gradual transition (Diegues, 1983).

The shift from traditional fish processing methods like drying and salting (Belton et al., 2022) to advanced technologies (e.g., filleted, frozen, canned) has enhanced food preservation, quality, and market appeal. Despite these advancements, consumer preference for fresh fish remains strong, showing the industry's responsiveness to local demand amid perishable goods challenges. Market dynamics, shaped by intermediaries, have significantly impacted SSF. Newspapers often reported intermediaries negatively, blaming them for power asymmetries and unfair benefit distribution in the seafood value chain. The move from local to global markets has often marginalized small-scale fishers, weakening their negotiating power and economic stability (Hendriks, 2022). Recent studies indicate that bypassing intermediaries can boost fishers' financial autonomy, reducing poverty risks and empowering impoverished communities (Bartkus et al.,

2022). The lack of public investments in education and autonomy for small-scale fishers during the late 19th and most of the 20th centuries likely hindered producers and consumers from bypassing intermediaries, worsening social struggles in Santa Catarina's fishing communities. Intermediaries still pose a significant barrier to transforming seafood value chains in Brazil and elsewhere (De Andrade et al., 2021; Bartkus et al., 2022; Abreu et al., 2024).

Our results indicate that societal perceptions and preferences around seafood have evolved. Once a staple food during the late 19th and early 20th centuries it has become a more affluent culinary item. In Santa Catarina state, seafood is still part of the local coastal cuisine, but is increasingly confined to religious holidays (Valenti et al., 2021; Flores et al., 2022; St Louis et al., 2023). The rise of aquaculture has significantly changed food habits and preferences in recent decades (Valenti et al., 2021; Flores et al., 2022). This 'aquaculture revolution' is evident in inland cities of Santa Catarina, reflecting increased investments between 1990 and 2020 (Valenti et al., 2021). The high cost of domestic fish has made imported seafood more competitive in Brazil, offering alternatives to local varieties. These changes are driven by demographic shifts (Pereira, 2011), increased urbanization, coastal city industrialization following transportation infrastructure development (do Amaral Pereira, 2015), and other economic forces shaping Brazil's coastal societies since the late 1970s.

Brazil has historical ties to global fish markets, with significant growth since the 2000s. Despite its large aquaculture and fishing output, it is the largest fish importer in Latin America (Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, World Food Programme, World Health Organization, and The United Nations Children's Fund, 2020). There is a need to sustainably boost local fish production and consumption, especially for species that are critical to food security, such as croaker, mullet (Castro et al., 2016), tilapia (Filho et al., 2020; Pedroza Filho et al., 2020; St Louis et al., 2022), and sardines (Pincinato and Mazzalira, 2018). Changes in SSF dynamics and fish stocks directly affect local fish consumption of fishers and coastal communities. Reduced fish stocks and lower small-scale harvests impact the family economy and artisanal fishers' livelihoods, increasing vulnerability in their production methods and food access (Hanazaki and Begossi, 2003). In Santa Catarina, locally produced seafood remains a vital source of animal protein for local families, despite the easy access to industrialized foods and other animal protein sources (Hanazaki and Begossi, 2003; Castro et al., 2016).

Seafood from subsistence and small-scale commercial fisheries is often stigmatized in historical newspapers as "poor people's food," a perception still present in Brazilian society. Although fisheries research and policies have advanced in recognizing that fisheries are not synonymous with poverty but are a multidimensional concept (Béné, 2003), small-scale fishers in Latin America still face marginalization. There is growing awareness, however, of the valuable contributions of SSF to global food systems, livelihoods, culture, and the environment. The United Nations declared 2022 the International Year of Artisanal Fisheries and Aquaculture, supporting fisher-led campaigns to highlight these contributions worldwide (Espinoza-Tenorio et al., 2023; Gerhardinger et al., 2023).

Brazil's fisheries development and management have a troubled history, leading to deep resentment among fisherfolk organizations against policy disarray. The ineffectiveness of Brazil's SSF policies is mainly due to flawed institutional and legal frameworks that historically ignored socioeconomic factors, community expectations, and proper governance (De Mattos et al., 2022). Developing and implementing policies that respect historical interdependencies and align small-scale fisheries' interests with broader economic and ecological goals are crucial for inclusive and resilient seafood systems (Farmery et al., 2021). Our historical overview of the seafood value chain highlights the need for equitable transformation in the fisheries sector. Involving fishers and consumers in policy creation and implementation is essential to prevent supermarkets from dominating seafood value chains (Wilkinson, 2006).

Historically, imports were driven by food preferences, particularly cod. Between 1846 and 1851, cod and dried fish were among Brazil's largest imports, sourced from Germany, Great Britain, and France (Brasil, 1851, p. 66; Brasil, 1903, p. 432). Political efforts aimed to industrialize fishing and upgrade equipment to reduce cod imports (Brasil, 1863, p. 112). High import values persisted until the 1920s, with Brazilian cod production gaining traction in the 1930s (Herbst et al., 2023). Cod remains culturally preferred in Brazil, influenced by the Portuguese colonial legacy, but was traditionally accessible only to wealthier people. Marginalized coastal communities consumed locally available fish like mullet, bluefish, croaker, drum, shark, bivalves, and mangrove resources based on seasonality (Silva, 1988).

Our findings show resilience in food processing and consumption patterns. Despite historical changes, there has been a continuous preference for fresh fish, especially culturally important species like mullet and shrimp, indicating resistance to full industrialization. This signals to policymakers and fisheries managers that as aquaculture or farmed fish production increases, incentives should be provided to prioritize local markets. Promoting locally valued species, even if economically, less profitable, aligns with consumer preferences and cultural significance.

Finally, we emphasize the importance of understanding the roles and contributions of different societal groups in seafood value chains, especially regarding gender, class, and ethnicity (Leape et al., 2023). The sector's gendered division of labor has long undervalued women's contributions, highlighting the need for their equitable recognition and integration throughout the value chain for social justice and economic efficiency (Harper et al., 2020; Lawless et al., 2021). Our review indicates that bias against women was as significant in the past as it is today, with their support in fishing activities barely acknowledged. Shifting these ingrained beliefs is challenging. The future depends on inclusive political spaces where the voices of men and women fishers and fishworkers are central to decision-making, recognizing their crucial role in food security, nutrition, and environmental sustainability.

Conclusion

The 160-year history of Santa Catarina's seafood value chain underscores the enduring importance and adaptability of SSF amid the rise of industrial fishing and aquaculture. Despite significant pressures, SSF have maintained their role in supporting local economies and ensuring food security. The shift from SSF-driven systems to industrialized operations, however, has often come at a cost, marginalizing local fishers and allowing intermediaries to dominate price and distribution channels.

Our study highlights a persistent consumer preference for fresh, locally-produced fish, particularly culturally significant

species such as mullet and shrimp. This preference reflects a resistance to complete industrialization and points to the need for policies that support local markets and diverse processing methods. The historical analysis also confirms the overlooked contributions of women in the seafood value chain, and the need for their equitable recognition and market access.

By integrating historical insights into contemporary policy-making, we can promote more resilient and inclusive seafood value chains. Such an approach can address long-standing social injustices and ensure that the benefits of these chains are distributed more equitably, while fostering sustainable consumption patterns and biodiversity conservation. This holistic perspective is essential for developing fisheries policies that are fair, inclusive, and capable of adapting to future challenges.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

DH: Writing – review & editing, Writing – original draft, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. LG: Writing – review & editing, Writing – original draft, Validation, Investigation. CB: Conceptualization, Methodology, Writing – review & editing. TM: Writing – review & editing, Software, Methodology, Investigation, Formal analysis. LS: Writing – review & editing, Validation, Supervision. AC: Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Funding acquisition.

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Conflict of interest

CB was employed by Soulfish Research & Consultancy.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsufs.2024.1338436/full#supplementary-material

References

Abdallah, P. R., and Sumaila, U. R. (2007). An historical account of Brazilian public policy on fisheries subsidies. *Mar. Policy* 31, 444–450. doi: 10.1016/j.marpol.2007.01.002

Abreu, J. S., de Oliveira Côrtes, L. H., and Zappes, C. A. (2024). Critical points concerning artisanal fishing: an analysis from the perspective of artisanal fishers in southeastern Brazil. *Sociedade Natureza* 36:1–15. doi: 10.14393/SN-v36-2024-71106

Allison, E. H., Ratner, B. D., Åsgård, B., Willmann, R., Pomeroy, R., and Kurien, J. (2012). Rights-based fisheries governance: from fishing rights to human rights. *Fish Fish.* 13, 14–29. doi: 10.1111/j.1467-2979.2011.00405.x

Andriguetto-Filho, J. M., Medeiros, R. P., Vaz-dos-Santos, A. M., de Tarso, P., and da Cunha Chaves, P. (2022). Shrimp up, fish down, and vice-versa: fishers' strategies and long-term changes in small-scale fisheries landings at two spatial levels in southern Brazil. *Mar. Policy* 143:105184. doi: 10.1016/j.marpol.2022.105184

Bartkus, V. O., Brooks, W., Kaboski, J. P., and Pelnik, C. (2022). Big fish in thin markets: competing with the middlemen to increase market access in the Amazon. *J. Dev. Econ.* 155:102757. doi: 10.1016/j.jdeveco.2021.102757

Begossi, A. (1995). Fishing spots and sea tenure: incipient forms of local Management in Atlantic Forest Coastal Communities. *Hum. Ecol.* 23, 387–406. doi: 10.1007/BF01190138

Belton, B., Johnson, D. S., Thrift, E., Olsen, J., Hossain, M. A. R., and Thilsted, S. H. (2022). Dried fish at the intersection of food science, economy, and culture: a global survey. *Fish Fish.* 23, 941–962. doi: 10.1111/faf.12664

Béné, C. (2003). When fishery rhymes with poverty: a first step beyond the old paradigm on poverty in small-scale fisheries. *World Dev.* 31, 949–975. doi: 10.1016/S0305-750X(03)00045-7

Brasil, (1920). Ministério da Agricultura. Relatório I do ano de 1920. Source: CRL digital delivery system. p. 536.

Brasil, (1945). O Ministério da Agricultura no Governo Getúlio Vargas (1930-1944). Source: CRL Digital Delivery System. p. 431.

Brasil. (1851). Ministério da Fazenda. Proposta e relatório do ano de 1851. Source: CRL Digital Delivery System. P. 217.

Brasil. (1863). Additamento ao Relatório da Repartição dos negócios da fazenda (Ministério da Fazenda). Source: CRL Digital Delivery System. P. 136.

Brasil. (1903). Ministério da Fazenda. Relatório I do ano de 1903. Source: CRL Digital Delivery System. P. 1283.

Bresser Pereira, L. C. (1962). The rise of middle class and middle Management in Brazil. *J. Inter-Am. Stud.* 4, 313–326. doi: 10.2307/164949

Castro, M. S., Martins, I. M., and Hanazaki, N. (2016). Trophic relationships between people and resources: fish consumption in an artisanal fishers neighborhood in southern Brazil. *Ethnobiol. Conserv.* 5:1–16. doi: 10.15451/ec2016-7-5

Clark, T. P. (2022). Modernization, political economy, and limits to blue growth: a cross-national, panel regression study (1975–2016). *Rural. Sociol.* 87, 573–604. doi: 10.1111/ruso.12428

De Andrade, M. M., Xavier, L. Y., de Miranda Grilli, N., de Oliveira, C. C., de Andrade, D. A., Barreto, G. C., et al. (2021). Gender and small-scale fisheries in Brazil: insights for a sustainable development agenda. *Ocean Coast. Res.* 69:e21033. doi: 10.1590/2675-2824069.21033mmda

De Mattos, S. M. G., Mendonça, J. T., Ferreira, B. M. P., de Souza Mattos, M. P., Wojciechowski, M. J., et al. (2022). "Coastal small-scale fisheries in Brazil: resentment against policy disarray" in *Blue justice: Small-scale fisheries in a Sustainable Ocean economy*. eds. S. Jentoft, R. Chuenpagdee, A. B. Said and M. Isaacs (Cham: Springer International Publishing), 35–Pescadores, Camponeses E Trabalhadores Do Mar. Vol. Ensaios 94. Editora Ática.

Diegues, A. C. S. (1983). *Pescadores, Camponeses E Trabalhadores Do Mar. Vol. Ensaios 94. Editora Ática*. pgs. 292.

do Amaral Pereira, Raquel Maria Fontes. (2015). "Tourism and the socio-spatial dynamics of the coast of the state of Santa Catarina." Associação Nacional de Pesquisa e Pós-Graduação em Turismo (ANPTUR). Available at: https://www.proquest.com/docview/1752868797?pq-origsite=gscholar&fromopenview=true&sourcetype=Scholarly%20Journals.

Ellis, M. (1958a). Aspectos da pesca da baleia no Brasil Colonial (II). *Rev Hist* 16:149. doi: 10.11606/issn.2316-9141.rh.1958.106629

Ellis, M. (1958b). Aspectos da pesca da baleia no Brasil colonial (III). *Rev Hist* 16, 379–424. doi: 10.11606/issn.2316-9141.rh.1958.106737

Espinoza-Tenorio, A., Espinosa-Romero, M. J., Rojas-González, R. I., Campa-Madrid, A. K., Salas- Márquez, S., Lapuente-Landero, J. C., et al. (2023). *DDecálogo por el Año Internacional de la Pesca y la Acuicultura Artesanales en México". ECOSUR, COBI, INAPESCA, CINVESTAV. Campeche, México*. 24.

Farmery, A. K., Alexander, K., Anderson, K., Blanchard, J. L., Carter, C. G., Evans, K., et al. (2021). Food for all: designing sustainable and secure future seafood systems. *Rev. Fish Biol. Fish.* 32, 101–121. doi: 10.1007/s11160-021-09663-x

Filho, A. G. (2016). Regulação e institucionalização das atividades pesqueiras no Brasil. *Revista Digital Estudios Historicos* 16:10.

Filho, M. P., Ribeiro, V., Rocha, H. S., Ummus, M., and Vale, T. M. D. (2020). "Caracterização Da Cadeia Produtiva Da Tilápia Nos Principais Polos de Produção Do Brasil." Available at: https://www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/1125358.

Flores, R. M., Valladão, N. O., Widmar, K. Q., Preckel, P. V., and Filho, M. X. P. (2022). Establishing linkages between consumer fish knowledge and demand for fillet attributes in Brazilian supermarkets. *J. Int. Food Agribus. Mark.* 34, 368–388. doi: 10.1080/08974438.2021.1900016

Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, World Food Programme, World Health Organization, and The United Nations Children's Fund. (2020). *The state of food security and nutrition in the world 2020: Transforming food Systems for Affordable Healthy Diets*. The state of food security and nutrition in the world 2020: Transforming food Systems for Affordable Healthy Diets. Rome, FAO, 286p. Available at. doi: 10.4060/ca9692en

Freire, K. M. F., da Silva de Almeida, Z., Amador, J. R. E. T., Aragão, J. A., da Rocha Araújo, A. R., Ávila-da-Silva, A. O., et al. (2021). Reconstruction of marine commercial landings for the Brazilian industrial and artisanal fisheries from 1950 to 2015. *Front. Mar. Sci.* 8:659110. doi: 10.3389/fmars.2021.659110

Gerhardinger, L. C., Herbst, D. F., da Cunha, S. M. B., and de Paula Costa, M. D. (2020). Diagnóstico da Ictiofauna do Ecossistema Babitonga. *Revista CEPSUL - Biodiversidade e Conservação Marinha* 9:eb2020001. doi: 10.37002/revistacepsul.vol9.693eb2020001

Gerhardinger, L. C., Mills, E., Mesquita, B., Rivera, V. S., Kefalás, H. C., and Colonese, A. C. (2023). Challenging the blue economy: voices from artisanal fishing communities in Latin America and the Caribbean. *Development* 66, 95–104. doi: 10.1057/s41301-023-00366-3

Hanazaki, N., and Begossi, A. (2003). Does fish still matter? Changes in the diet of two Brazilian fishing communities. *Ecol. Food Nutr.* 42, 279–301. doi: 10.1080/03670240390229643

Harper, S., Adshade, M., Lam, V. W. Y., Pauly, D., and Rashid Sumaila, U. (2020). Valuing invisible catches: estimating the global contribution by women to small-scale marine capture fisheries production. *PLoS One* 15:e0228912. doi: 10.1371/journal.pone.0228912

Hendriks, S. L. (2022). Sustainable small-scale fisheries can help people and the planet. *Nature*, 606:650–652. doi: 10.1038/d41586-022-01683-2

Herbst, D. F., Rampon, J., Baleeiro, B., Silva, L. G., Fossile, T., and Colonese, A. C. (2023). 180 years of marine animal diversity as perceived by public Media in Southern Brazil. *PLoS One* 18:e0284024. doi: 10.1371/journal.pone.0284024

Jimenez, É. A., Amaral, M. T., de Souza, P. L., de Nazaré Ferreira Costa, M., Lira, A. S., and Frédou, F. L. (2020). Value chain dynamics and the socioeconomic drivers of small-scale fisheries on the Amazon coast: a case study in the state of Amapá, Brazil. *Mar. Policy* 115:103856. doi: 10.1016/j.marpol.2020.103856

Klein, H. S., and Luna, F. V. (2023). "*The nineteenth-century economy*". Cambridge: Cambridge University Press. in Brazil: an economic and social history from early man to the 21st century. eds. H.S. Klein and F.V. Luna. (Cambridge: Cambridge University Press), pg 107

Lawless, S., Cohen, P. J., Mangubhai, S., Kleiber, D., and Morrison, T. H. (2021). Gender equality is diluted in commitments made to small-scale fisheries. *World Dev.* 140:105348. doi: 10.1016/j.worlddev.2020.105348

Leape, J., Micheli, F., Tigchelaar, M., Allison, E. H., Basurto, X., Bennett, A., et al. (2023). "The vital roles of blue foods in the global food system" in *Science and Innovations for Food Systems Transformation. Eds J. von Braum, K.Afsana, L.O. Fresco, M.H.A. Hassan. (Springer), pp*. 401–419.

Marean, C. W. (2010). Pinnacle point cave 13B (Western Cape Province, South Africa) in context: the cape floral kingdom, shellfish, and modern human origins. *J. Hum. Evol.* 59, 425–443. doi: 10.1016/j.jhevol.2010.07.011

Moya, J. (2020). Immigration and the historical formation of Brazil. *Latin Am. Hist.* doi: 10.1093/acrefore/9780199366439.013.894

Neto, J. B. G., de Alencar Goyanna, F. A., Feitosa, C. V., and Soares, M. O. (2021). A sleeping Giant: the historically neglected Brazilian fishing sector. *Ocean Coast. Manag.* 209:105699. doi: 10.1016/j.ocecoaman.2021.105699

Pedroza Filho, M. X., Ribeiro, V. S., Rocha, H. S., Ummus, M. E., and Do Vale, T. M. (2020). "Caracterização Da Cadeia Produtiva Da Tilápia Nos Principais Polos de Produção Do Brasil." Available at: https://www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/1125358.

Pereira, R. M. F. D. A. (2011). Expansão urbana e turismo no litoral de Santa Catarina: o caso das microrregiões de Itajaí e Florianópolis. *Interações (Campo Grande)* 12, 101–111. doi: 10.1590/S1518-70122011000100010

Perez, J. A., Alvarez, P. R., Pezzuto, R. W., Luisa, A., and de Souza Soares. (2009). Deep-water fisheries in Brazil: history, status and perspectives. *Lat. Am. J. Aquat. Res.* 37, 513–542. doi: 10.3856/vol37-issue3-fulltext-18

Pincinato, R. B., and Mazzalira, F. A. (2018). Domestic landings and imports of seafood in emerging economies: the Brazilian sardines market. *Ocean Coast. Manang.* 165, 9–14. doi: 10.1016/j.ocecoaman.2018.08.008

Pincinato, R. B., Mezzalira, A. O., Bertolini, R. M. B., and Muñoz, A. E. P. (2022). The São Paulo wholesale seafood market: a study of fish prices in Brazil. *Aquac. Econ. Manag.* 26, 259–282. doi: 10.1080/13657305.2022.2079762

Pradhan, S. K., Nayak, P. K., and Armitage, D. (2022). A social-ecological systems perspective on dried fish value chains. *Curr. Res. Environ. Sustain.* 4:100128. doi: 10.1016/j.crsust.2022.100128

Sandoval, G., Fossile, T., Herbst, D. F., Begossi, A., Silva, L. G., and Colonese, A. C. (2021). 150 years of anthropogenic impact on coastal and ocean ecosystems in Brazil revealed by historical newspapers. *Ocean Coast. Manag.* 209:105662. doi: 10.1016/j.ocecoaman.2021.105662

Seixas, C., and Troutt, E. (2003). Evolution of a local Brazilian shrimp market. *Ecol. Econ. J. Int. Soc. Ecol. Econ.* 46, 399–417. doi: 10.1016/S0921-8009(03)00082-X

Seminara, C. I., Souza, G. B. G., Zapelini, C., Barbosa-Filho, M. L. V., and Profice, C. C. (2024). Opportunities and challenges for small-scale fisheries co-management: a case study of the unofficial landing records system in a Brazilian fishing community. *Mar. Policy* 160:105991. doi: 10.1016/j.marpol.2023.105991

Silva, L. G. (1988). *Os Pescadores Na História Do Brasil: Colônia E Império. Petrópolis: Vozes. Comissão Pastoral dos Pescadores*.

Silva, L. G. (2001). *A Faina, a Festa e o Rito. Uma etnografia histórica sobre as gentes do mar (sécs XVII ao XIX)*. Campinas: Papirus.

Sjoberg, D. (2021). "*ggsankey: Sankey, alluvial and Sankey bump plots. R package version*". 0.0.99999.

St Louis, T. J., Filho, M. X. P., and Flores, R. M. V. (2022). Consumption frequencies, determinants, and habits of aquaculture species in Brazil. *Aquacul. Int. J. Euro. Aquac. Soc.* 30, 919–936. doi: 10.1007/s10499-022-00838-2

St Louis, T. J., Filho, M. X. P., and Flores, R. M. V. (2023). Understanding consumption frequency across consumer segments and regions in the Brazilian aquaculture market. *Aquac. Econ. Manag.* 27, 569–598. doi: 10.1080/13657305.2022.2154869

Tigchelaar, M., Leape, J., Micheli, F., Allison, E. H., Basurto, X., Bennett, A., et al. (2022). The vital roles of blue foods in the global food system. *Glob. Food Sec.* 33:100637. doi: 10.1016/j.gfs.2022.100637

Valenti, W. C., Barros, H. P., Moraes-Valenti, P., Bueno, G. W., and Cavalli, R. O. (2021). Aquaculture in Brazil: past, present and future. *Aquac. Rep.* 19:100611. doi: 10.1016/j.aqrep.2021.100611

Vasconcellos, M., Diegues, A. C., and Kalikoski, D. C. (2011). "Coastal fisheries of Brazil" in *Coastal fisheries of Latin America and the Caribbean*. eds. S. Salas, R. Chuenpagdee, A. Charles and J. C. Seijo (Rome: FAO).

Wickham, H. (2016). *ggplot2: Elegant graphics for data analysis. New York: Springer-Verlag.*.

Wilkinson, J. (2006). Fish: a global value chain driven onto the rocks. *Sociol. Rural.* 46, 139–153. doi: 10.1111/j.1467-9523.2006.00408.x