



# Improving seafood systems with social network analysis: The case of cuttlefish marketing in Catalonia

Silvia Gómez<sup>\*</sup>, Beatriz Patraca, José Luis Molina

Dep. Social Anthropology Autonomous University of Barcelona Building B-Campus UAB 08193-Bellaterra (Cerdanyola del Vallès), Barcelona, Spain

## ARTICLE INFO

### Keywords:

Cuttlefish marketing  
Social networks analysis  
Social media analysis  
Seafood consumption  
Sustainability  
Digital ethnography

## ABSTRACT

Innovation in seafood marketing has multiplied, resulting in a constellation of emerging marketing initiatives from the fishing sector and seafood distributors to cope with resources scarcity, uncertainty, and climate change. Wholesalers, and retailers drawn on Social Network Sites (Facebook, Instagram, Whatsapp, Twitter, Youtube, TikTok) to disseminate the values associated with fish products. This study analyses the distribution network channels of the cuttlefish market in Catalonia (Spain) and the social media users. The methodology combines social network analysis, digital ethnography, and qualitative analysis based on structured, semi-structured, in-depth interviews and images. Results suggest the existence of a paradox between the values of seafood products associated with "proximity," "local," and "seasonal products" cohabiting with market values adapted to the contemporary lifestyle of "convenience" and accessibility. The spread of gastronomic culture has popularised the demand for cuttlefish, increasing market diversification and growing competition between the buying and selling network actors. While distributors can obtain resources from different sources, fishers must cope with the limitations of natural resources. We conclude that management plans should consider the integration of fishers in marketing channels and media discourses to improve the marketing of seafood products in pursuit of sustainability.

## 1. Introduction

Management plan regulations, including enhanced marketing campaigns, often reduce fishing capacity [1]. As a result, fishers' strategies to deal with scarcity, uncertainty, and climate change constraints, tighten market competition ([10,29]; Proserpi, 2019). Hence, small-scale fisheries today face transformative processes as a response to the challenges posed by globalized markets [9,34,51,6], developed over the past 50 years [2].

In the case of Europe, there is a structural imbalance between high seafood demand and self-production capability [14]. As a result, there is an increasing reliance on wild fish and aquaculture imports. This fact impacts local fish producers, who have increasingly reduced control over local markets, losing bargaining power and influence on seafood consumption (Gómez and [29]). In this vein, over recent years several marketing initiatives have emerged, promoted by different fishery actors (cooperatives, fishers' guilds, individual fishermen, or small-scale fishing associations, see Ertor-Akyazi et al., 2020; [7]; Gomez & [29] a; [35,40,41]). Wholesalers, retailers, fishmongers, and even

environmental companies launched marketing campaigns to cope with the supermarket competition, as pointed out in previous work [10].

Alternative marketing systems such as direct sales or short supply circuits give control back to the value chain, empowering fishers and highlighting the challenges faced at the forefront of fishery governance [45]. Furthermore, shifting the emphasis from production to post-production, and focusing on added values, enhances fishermen's commitment to resource protection within the ecological, social, and economic cycle [9].

Therefore, new seafood marketing models, as part of the transformation of the agri-food system (Arthur, 2021; Ertor-Akyazi et al., 2020; [10]), may be an opportunity window for the transition towards sustainability and not just a way to optimize profitability in small-scale fisheries (Gomez and Maynou 2021ab; [51]). Moreover, it makes fishers co-responsible for localized sustainability problems [44] by turning them into active agents of fishery transformation ([10]b). Hence, seafood distribution linked to resilience in fisheries [45] is now at the core of fishery policies [2]. The pandemic crisis reinforced this trend. The disruption of the global seafood supply at the onset of COVID-19

<sup>\*</sup> Corresponding author.

E-mail address: [silvia.gomez@uab.cat](mailto:silvia.gomez@uab.cat) (S. Gómez).

unveiled the weakness not just of global seafood markets [26] but also of local market systems, too dependent on hotels, restaurants, catering channels (“Canal Horeca” in Spain), and seafood imports. In addition, the situation in Spain, a country with high seafood consumption, was aggravated because of the lack of tourists during that period [32].

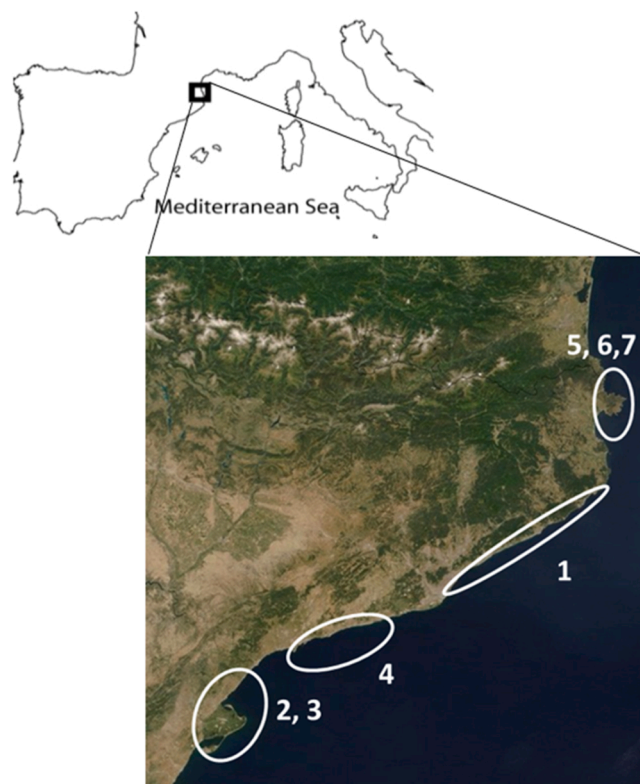
During the pandemic lockdown, the relocation of the seafood market and the closure of the Horeca channel pushed wholesalers and retailers to rely on domestic seafood distribution channels. This conjuncture boosted the proliferation of social media posts and online markets to reach consumers and encourage them to adopt new online purchasing patterns. Although with different impacts, this phenomenon occurred in different parts of the world ([25,46]; see also: <https://www.iied.org/evaluating-impact-covid-19-pandemic-small-scale-fisheries-its-markets>).

The coronavirus pandemic was also an opportunity to reframe seafood value chains to engage with more local, green, inclusive, sustainable, and ethical food [21,26]. Simultaneously, images and values projected about seafood were increasingly more sensitive towards an environmental-health-based approach. In this vein, several authors indicated seafood as a potentially healthy and environmentally friendly product, high in protein and essential micronutrients, and low in CO<sub>2</sub> emissions compared to other terrestrial animal production systems [5]. Specifically, the potential of cephalopods has been highlighted [31]. Hence, the post-COVID agenda [21] highlighted the plurality of positive values embedded in the value chain as a driver of decision-making for the consumption of healthy seafood.

This paper describes the distribution network channels of cuttlefish (*Sepia officinalis*) in Catalonia (northeastern region of Spain) and the social media used by these channels to project positive values on seafood products. The study is the result of a research project conducted in collaboration with the cuttlefish (*Sepia officinalis*) co-management committee of the Gulf of Roses and Pals intended to develop a socio-economic program.<sup>1</sup> Currently, there are 20 small-scale fishers involved in this committee, two scientific members, one NGO, and the public administration representatives.<sup>2</sup>

As part of the 2030 Catalan Maritime Strategy, the decree<sup>3</sup> (118/2018, of 19 June 2018) on the governance model of professional fishing in Catalonia was passed in 2018 to establish co-management as a proactive governance system that includes the viewpoints of different stakeholders (fishers, scientists, managers from public administration, and NGOs). This co-management system (Fig. 1) encompasses several co-management committees focused on specific species from different areas along the Catalan coast (blue crab from the Ebro Delta, octopus from the Ebro Delta and central Catalan coast, small pelagic fish from the Gulf of Roses, cuttlefish from the Gulf of Roses and Pals), co-management committee for the sand eel fishery, and the co-management committee of small-scale fishing in Cap de Creus. In addition, there are some preexisting management plans and fishery closures managed as an initiative of fishers’ guilds and by fishers themselves with the advice of expert scientists.<sup>4</sup>

The main objectives of co-management governance are to improve the fishery’s natural resources, its economic profitability, and promote the historical and cultural values attached to the territory. Achieving



**Fig. 1.** Co-management committees in Catalonia: 1. Co-management plan on Sand eel; 2, 3: Co-management plan on Blue crab from Ebro Delta, and octopus from Ebro Delta; 4: Co-management plan on octopus from central coast; 5, 6, 7: Co-management plan on small pelagic from Gulf of Roses, on cuttlefish from Gulf of Roses and Pals; and small-scale fishing from Cap de Creus. Source: Jordi Rodon, Catalan Government.

these objectives may help make fishing an attractive source of employment.

The Cuttlefish Co-management Committee of the Gulf of Roses and Pals was the first committee created by the decree on the governance of professional fishing (118/2018, of 19 June 2018). Cuttlefish is a traditional seasonal product of artisanal fisheries and falls in the scope of the co-management plan. Seasonality follows the criteria of traditional local ecological knowledge, which defines the local fishing calendar and its market. Thus, the cuttlefish season is marked between January and June when cuttlefish are adults. The fishing gear may be trammel nets or trammel nets combined with traps. The latter is a traditional fishing gear that was underused compared to trammel nets but has now been reintroduced because of its lower impact. However, the peak of fishing occurs around spring (between March and May), when the cuttlefish reaches a size attuned to market preferences. This biological phase coincides with the best weather for fishing. From June to August, few fishers catch cuttlefish, and those who do use traps. During the summer, female cuttlefish stay in specific areas, looking for places to lay their eggs. They prefer the branches of bushes (mastic or mastic trees, *Pistacia lentiscus*) for egg-laying, and fishers place them inside the traps to facilitate capture. However, it should be noted that catches at this time are low. Subsequently, from September to December, fishers voluntarily stop this fishing when the species are juvenile and have little market value.<sup>5</sup>

<sup>5</sup> Oral communication of a fisherman and a scientist working for the public administration.

<sup>1</sup> Funded by the European Maritime and Fisheries Fund (EEMF).

<sup>2</sup> Official journal of the Catalan Government. Resolution of 16 December 2021, on the authorization of vessels for the shellfishing of cuttlefish with traps and trammel net within the scope of the management plan of the cuttlefish of Roses and Pals Bays.

<sup>3</sup> Decree 118/2018 of 19 June on the governance model for professional fishing in Catalonia published at the Official Journal of the Generalitat de Catalunya (DOGC-A-18170141-2018). The decree, sets out the guidelines for the co-management decision making body (the co-management committee).

<sup>4</sup> Oral communication of Jordi Rodon, 18 of September of 2021, at 1st participatory process on small-scale fishing in Catalonia. See <https://www.congresartsmenors.cat/>.

The cuttlefish co-management plan approved in 2020,<sup>6</sup> seeks to fix the practice of fishing using traditional ecological knowledge regarding seasonality. The plan aims to adopt the necessary measures (see [3]) to protect and restore the resources according to maximum sustainable yield. Fishers suggested creating three closed zones to recover the eggs trapped in the net, with the intention of producing the effect of a nursery. Also, there is a limitation on cuttlefish fishing permits. Moreover, combining trammel nets and traps is a suitable option since the catch targeted by each fishing gear corresponds to a different fraction of the cuttlefish population, reducing the impact of the activity on the ecosystem. Also, the mesh size of the network is limited to 20 cm. Finally, to reinforce the traditionally established seasonality, a 60-day long closure on cuttlefish starts in September until the end of October, with a ban on recreational fishing.

Cuttlefish is a highly valued product of small-scale fishing, very popular in Catalonia's regional local gastronomy [28]. Despite the low impact of small-scale fisheries compared to trawl fisheries, the increase in small-scale fisheries' catches points toward the progressive intensification of fishing efforts on cuttlefish affecting its availability [28].

In short, this study aims to identify how commercial channels affect cuttlefish production and consumption. We adopt a relational approach to describe this "meshed network of formal and informal producers, distributors, retailers, and consumers" ([26], p. 8), including social media usage. We conclude with some recommendations to improve co-management systems toward sustainability.

## 2. Materials and methods

This research combines a variety of methods, including interviews, social network analysis of marketing networks, social media, whether as an online marketplace or as showcasing the product, and digital ethnography. Social networks are actors (individuals, organizations, enterprises) linked to each other by relationships. It combines the quantitative mathematical approach of graph theory with the qualitative approach of social science, providing comprehensive explanations of social relationships [39]. The graphs enable us to visualize these networks, along with the computation of centrality measures [30,52]. Fig. 2 presents the methodology.

Digital ethnography is the participant or non-participant observation of social interactions and posts in digital settings [22]. It inquires about ways of life in a digital, material, and sensorial world [36]. Also, it refers to an existing continuum of actions online and offline, assuming that both are in constant feedback. It is also "a way to conceptualize how the social media ethnographer makes ethnographic places that are traceable on the web" ([38], p. 127). In our case, we study this continuum by analyzing and observing the use of social media by participants (retailers, wholesalers, and others). The researchers complemented the observation with comments, interactions (likes), and direct questions (e.g., *We have seen that you have prepared a special basket for paellas and it has been successful on Instagram. Has this been reflected in sales?*).

With this aim, we adopted a convenience sampling strategy, looking to maximize the diversity of types of actors and tracking trends grouped under specific hashtags. Therefore, our approach, like most qualitative research, is non-probabilistic. The lack of statistical representativeness is offset by depth in understanding, interpretative enrichment, and meaning. This strategy allows us to explore a) who are the actors in the production and consumption chain that are effectively involved in digital platforms, b) how cuttlefish is represented in the collective imagination, and c) what are the values attached to cuttlefish, in special tradition, aspiration, and daily life.

<sup>6</sup> ORDER ARP/166/2020, of 1 October, approving the Management Plan for the professional shellfishing of cuttlefish (*Sepia officinalis*) on the beaches of Pals and Roses and establishing an annual ban and a catch limitation for recreational fishing.

In this regard, it is worth noting that eating absorbs a considerable part of human beings' time, energy, and technical knowledge [17], including odors, textures, and flavors. These characteristics have been transferred to digital platforms with renewed strength through the exhibition of food and cooking, highlighting in several cases social and environmental responsibility. Information shared through social media can be conceived as ongoing conversations among diverse actors [19]. This complementary analysis is essential because the consumers generate the content through digital tools that widen the traditional "word of mouth," resulting in a plurality of social influence processes [8].

### 2.1. Trade actor networks

In this section we follow Trivette's [48] work as a guide for applying social network analysis to food marketing channels, identifying the actors engaged in buying and selling seafood, and defining their ties.

Firstly, we collected relational attributes (from May to September 2021) through structured interviews (see [supplementary material](#)) with open-ended questions to 22 seafood distributors from the three existing profile groups of distributors (5 wholesalers, 15 retailers, 2 "alternatives"). The interviews were conducted mainly face-to-face and, in a few cases, by phone or email. In this case, wholesalers supply the Horeca channel but also retail sales (fishmongers); retailers correspond to proximity fishmongers, marketplace fishmongers, and direct selling to end customers in supermarkets. Finally, the label "alternatives" refers to the retail sale of selected products under proximity and environmental care criteria.

With the help of the fishmongers' and wholesalers' guilds and fishers' guilds, we selected different profiles of seafood distributors. There are 41 wholesale companies registered in the fish wholesalers' guild of Catalonia (<https://www.gmpbcn.com/>). Wholesale companies that operate only in Catalonia used to be of medium size (employing around ten workers). At the same time, larger companies (employing more than 20 workers, even hundreds) distribute to other wholesalers in Catalonia, Spain, and even to other countries in Europe. As regards retailers, they vary from being a one-person company to companies employing between one and five workers, or up to ten workers, and 80% of them operate in the metropolitan area of Barcelona (<https://gremipeixaters.cat/agremiats/#>). Under the category of "alternatives," according to previous work (see Gómez and [29]), there are 15 initiatives in Catalonia. We selected two of these for our study. One represents an autonomous fishers' initiative, whereas an environmental enterprise promoted the other. Also, one alternative was from Barcelona, and the other was from a coastal village in the Girona province. To maximize diversity, we took great care in selecting different profiles to illustrate the different realities. Two of the five wholesalers are large-sized companies, and the other three are of medium size. Seven retailers are from the Girona province (three located in the rural inland area), and eight are from Barcelona. We built a data matrix of the cuttlefish trade networks based on the participants' nominations, irrespective of the geographic location.

Secondly, the study reconstructs two types of networks using different name generators [43]. The first type elicits the main suppliers: *Who are my suppliers?* The second type, the main customers: *Who are my customers?* Hence, for the first type, to stimulate the elicitation of names, the name generator for distributor was as follows: *Please tell us, ranking them in order of importance, the main 5 suppliers in the last 12 months* (indicating their approximate contribution to the trade volume). For the second type of network, the name generator was as follows: *Please tell us, ranking them in order of importance, the main 5 customers in the last 12 months* (indicating their approximate contribution to the trade volume, see [supplementary material](#)). These networks illustrate the commercial relations with wholesalers' distributors, retailers, and "alternative" channels established between producers (fishers) and end users. After creating two data matrices, one for sellers and the other for customers,

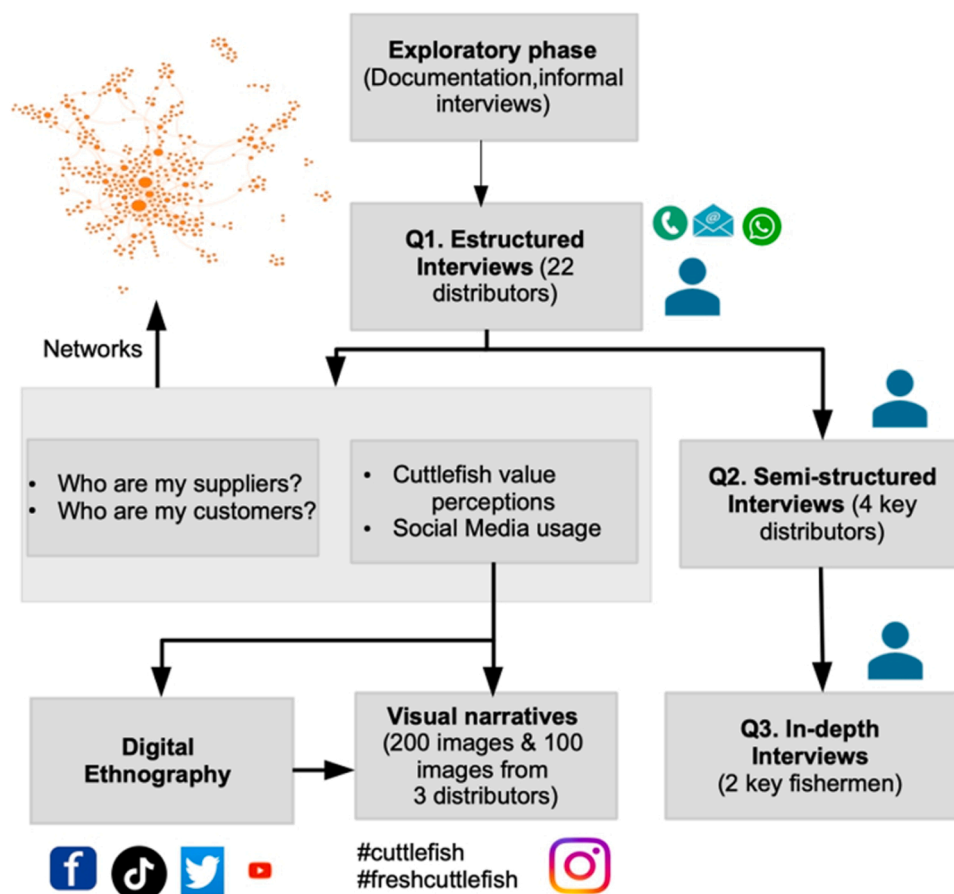


Fig. 2. Methodology.

we used the Gephi software [4] to visualize and calculate the centrality measures of the graphs.

The intensity of ties was measured with the participant's estimation of the trade volume, which can vary depending on the season and cuttlefish availability (see [supplementary material](#)). This estimation represents the strength of the link between nodes. Consequently, those distributors with just one customer show thicker lines, whereas those diversifying their supplies among different customers show thinner ones. This visualization enables us to identify the prominent actors (customers) and to observe the degree of market diversification highlighted in different colors –red for Girona, green for Barcelona, and blue for the rest of Spain. The yellow nodes are the alters, the actors nominated by the interviewees. The labels are literal translations from Catalan or Spanish versions of the questionnaire.

Finally, with the aid of structured interviews, we collected data on the following topics: (1) Distributor identifying attributes (sex, type of distributor, size of the enterprise); (2) Division of work between men and women; (3) Selling of the product (most sold species, alternative or traditional channels); (4) Uses of Social Media (product exhibition, publicity, registration of orders); (5) Buying and selling (commercial channels, perceptions, changes in recent years); (6) Characteristics of the cuttlefish (labeling, valuing, qualities, management plan, customers' perception).

## 2.2. Social media analysis

The analyses of visual discourse focused on the different possibilities under which users of digital platforms display cuttlefish to identify the implicit, explicit, congruent, and incongruent values of sustainability within the commercialization cycle. Through digital ethnography, we

analyzed public digital resources used by the 22 interviewed distributors (Facebook, Instagram, Web pages, and Twitter) to identify the kind of visibility of cuttlefish, customer interactions, and the frequency of use of these media.

As pointed out by Lewis [23], Titcomb [47], and [18], food comes into play in social media through images uploaded on platforms like Instagram. Therefore, Instagram emerges as an especially suitable place to capture visual narratives associated with products.

In order to address the visual narrative, we analyzed 200 images from Instagram, using the hashtags *#freshcuttlefish* and *#cuttlefish* to identify the values associated and the most frequent images showcased. In addition, we analyzed 100 images used by the distributors: one wholesaler, one retailer, and one alternative. The visual narratives focus on: (1) fishing and conservation, (2) selling and distribution, and finally, (3) consumption involving a broad spectrum of consumers: from households to relevant chefs.

Data scraping was performed with the *Phantombuster*<sup>7</sup> tool from the hashtag *#sepiafresca*. The images were published in a time frame from 2017/03/10–2021/01/04 and collected on 2021/06/21. It should be noted that since the hashtag is not a Trending Topic and points to a local product, the time frame is extensive. An attempt was made to search using the term *#sèpia* (with an accent and as it is called in the area studied), but it was discarded because, in general, users disregard orthographic accents in hashtags. Hence, we performed a manual screening to avoid polysemy (e.g. *sepia color*) and to adjust the search to the region of interest, aided by the contextual data of the photographs, other hashtags, narratives, and geolocation. In addition to Instagram, we

<sup>7</sup> Instagram Hashtag Collector from <https://phantombuster.com/>



screened other social media sites to assess how cuttlefish is presented in the three stages of the value chain: harvesting, sale, and consumption. Using participant observation we collected complementary data from Youtube, TikTok, Twitter, and Facebook about the value of cuttlefish, scenarios of presentation, textual and visual narratives around cephalopods, and recipes, among other issues through which cuttlefish are present in digital life thanks mainly to fishers, distributors, and especially end consumers.

### 2.3. Structured and semi-structured face-to-face interviews

Apart from social media data, additional data from structured interviews was analyzed to characterize marketing channels ([supplementary material](#)). Semi-structured, face-to-face interviews were conducted with key informants (2 alternative distributors, one wholesaler, and one representative of retailers leading the Fishmongers' Guild of Catalonia) to gain a better understanding of the actors' social networks, buying and selling motives, and marketing strategies. The wholesaler and the representative of retailers interviewed were selected on the grounds of their lengthy experience in the sector (more than 20 years). In contrast, key informants representing the "alternatives" correspond to owners of the first such emerged initiatives.

In addition, we conducted two in-depth interviews with two key informants from the fishing sector (55 and 26 years old, respectively) to gather their views on marketing and labeling systems, the state of resources, the use of social media platforms, concerns, and alternatives to meet the challenges. Both are members of the co-management committee. The information was incorporated into an Excel database file to facilitate triangulation with digital ethnography and social network analysis.

## 3. Results

### 3.1. Actors' networks of buying and selling

We have two types of social networks. In the first one ([Fig. 3](#)) we observe the relations between the interviewees (green nodes for Barcelona, red nodes for Girona, and blue nodes for national distributor) and the main customers (yellow nodes). The name generator is "To whom do I sell cuttlefish?". As we can see, the ties are of different thicknesses depending on the level of sales towards one type of customer or another. To obtain this information, we requested an estimation of the business volume over the past 12 months.

The second network ([Fig. 4](#)) presents the relationships between the interviewees: green for Barcelona, red for Girona, and blue for national distributors. It also reflects the places or vendors from which they obtain the cuttlefish for resale (yellow nodes). The name generator is "From whom do I buy cuttlefish?". Likewise, we requested an estimation of the business volume over the past 12 months.

When tracing the actors' network between distributors and buyers ([Fig. 3](#)) we could clearly identify two main nodes, Horeca and fishmongers, as being assorted by retailers but also wholesalers. With greater *indegree*<sup>8</sup> three main nodes: retail consumers that correspond to private individuals (households) (15 nominations), Fishmongers (10), and the Horeca channel (7). We can observe 42 nodes in the actors' network between distributors and suppliers ([Fig. 3](#)), representing 21 distributors that sell cuttlefish and 21 buyers who purchase it.<sup>9</sup> The variation in the number of nodes in the two networks is important.

The reason for this variation is the seasonality of cuttlefish in relation to annual demand. In addition, as the distributors themselves say, there is not enough product to supply all customers and the supply sources

must be diversified: "Cuttlefish is not a product with guaranteed supply, before you could buy everything in the same place and now, I have to go to several places" (Man, retailer, E.1). "Cuttlefish is a product for retailers. In France wholesalers already work (with cuttlefish), and they work very well. In a ranking, cuttlefish is the top product sold. All year. (...)" (Woman, wholesaler, E.5). In this regard, France is an important supplier ([Fig. 4](#)) as it is nominated several times under the label "France Britain", "Wholesaler from France" and "France".

Note that one nomination refers to "artisanal trammel" which refers to a type of supply but not a place. A trammel net is usually used by small-scale fishers when fishing cuttlefish. It is important to highlight that this was the nomination of a distributor that we have categorized as an "alternative" whose value criterion for buying goes beyond the market value. Distributors nominate several buyers, fishmongers, and the Horeca channel in third place, which emphasizes its relative importance. Next, they nominated national and European supermarkets, schools, and cooperatives. While both kinds of supermarkets buy from wholesalers, the other sells to wholesalers, retailers, and "alternative" distributors. The only exception is with cooperatives that exclusively buy from the "alternatives." However, despite the irregular trade volume to schools and cooperatives, the importance given to the proximity of the product should be observed. According to interviews, the criterion for buying from cooperatives is "because it is more sustainable" or "to help fishers."

On the network "Who are my suppliers?", we observe ([Fig. 4](#)) that distributors nominated large consumer groups (represented by single nodes), although each node represents a diversified group of consumers. The most significant and most diversified group belongs to the node of retail consumers, the "private individuals" (households), following different criteria for buying cuttlefish (such as price, origin, ecological awareness), and for where they buy (convenience, proximity, habits, social awareness). Similarly, the Horeca channel covers the everyday menu of one humble bar to the gastronomic creations of the most recognized chefs. The nomination of retail consumers indicates the importance of serving private individuals (household consumption), whether at home or through establishments. 64% of distributors offer the possibility of home delivery via digital platforms, especially WhatsApp, among other kinds of apps. This trend has become popular since COVID-19.

According to data obtained from the questionnaire to the distributors, it can be confirmed that even small fishmongers use WhatsApp and Instagram to contact customers. This is clear in one case that uses WhatsApp Business, a WhatsApp group (client portfolio) through which individuals can place orders. The seller sends photos of the counter, and customers order the product they will receive when the fishmonger closes. The payment is arranged afterward via bank transfer. A similar app for Barcelona markets is called *Manzaning App*.<sup>10</sup>

In [Fig. 5](#) we can see that phone calls and WhatsApp are the most common communication tools (42%) to place orders, 19% email, 12% use Instagram and the web page, 4% Facebook, and face-to-face makes up 37%, although for retailers the presence of customers in the establishment is important because the buying-selling practice is also a social event that increases customer loyalty.

Facebook is the favorite online platform for many fishmongers, wholesalers, and retailers, mainly used as a showcase rather than as a tool for receiving orders. Nevertheless, it is a digital space that hosts customer interactions and suggestions (see [supplementary material](#)). The "fish basket" distribution (originated in agroecological short-circuit chains) is an option aimed at promoting online sales, in addition to an answer to "food disappointment" related to negative perceptions of globalized agri-food systems and the institutions that control, participate, and reproduce them. The "food disappointment" implies a lack of trust towards these systems motivated by ethical, environmental, and

<sup>8</sup> Indegree is the number of edges incident in the node.

<sup>9</sup> One informant did not answer the questionnaire on the name generator about buyers and suppliers

<sup>10</sup> <https://manzaning.com>. This is an App that covers diverse Barcelona's neighbourhoods



of their products at Mercabarna instead of diversifying across different places of buying as distributors from nearby provinces do. This is reflected in the nomination of "Fishers' Guilds of Catalonia" as one node without distinguishing which ones and the trade but differentiating it from Mercabarna and cuttlefish imported from other places like Morocco and France. Retailers from the provinces of Catalonia usually distribute their products to local fishmongers out of the influence of the metropolitan area of Barcelona, mostly in coastal areas. Also, there is a significant concentration of consumers consuming fresh fish from local sources.

Even so, 80% of local fresh fish is consumed in the metropolitan area of Barcelona. Purchases from France correspond to wholesale middlemen with high percentages of buying -between 40% and 90% of the total of cuttlefish-; in contrast to the "Fishers' Guilds of Catalonia" with a percentage of between 30% and 10%. This situation reflects the difference between main markets and complementary markets. In terms of network analysis, we can add that despite networks not being perfectly hierarchical, their accumulative effect distributes goods in a non-uniform way since they distribute scarce resources in a deferential way [52].

The distributors are fundamental agents to communicate and give value to cuttlefish. Despite market interests associated with the volume of trade being a priority, added values are essential to sell the products in established market niches and emerging ones that will need to target new consumptions more aligned with sustainability criteria and responsibility. In order to promote consumption, there are two aspects: first, the initiative and experience of distributors, and second, the needs of consumers in light of their diversity and priorities at the time of purchase. Detecting necessities and priorities enables us to address the research of mechanisms derived from prevailing narratives based on values (proximity, sustainability), economy (price), culinary aspects (taste, versatility), and traditional and alternative ways of selling.

We should also be aware that on social media, we find the aspirational component that undermines what we want to project and only sometimes corresponds with reality as a whole. This is a weakness in the method. In order to understand how these factors operate we must research the discourse and the perceptions of both distributors and buyers as well as the discourses in social media. Before COVID-19, there were a lot of online markets and alternative initiative mechanisms such as "fish baskets" (Gómez & [29]). However, in 2020 we can state that, except for three cases, all actors identified in the study as involved in the market cycle of the cuttlefish are represented on online platforms. Distributors actively display their products and take sales orders through these platforms. The results of 22 interviews with distributors show us the main characteristics identified for cuttlefish, as they have expressed them (Fig. 6). The two most valued characteristics refer to "freshness"

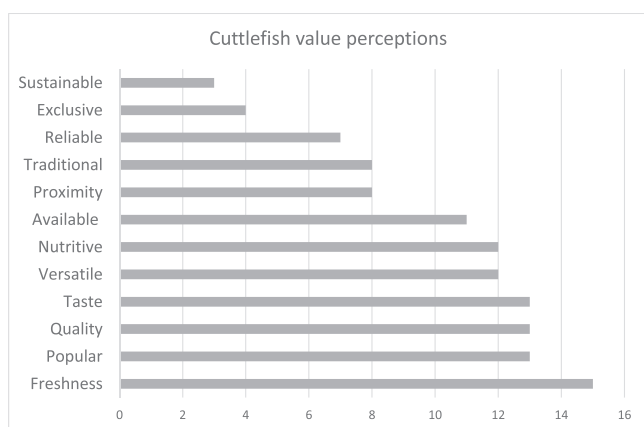


Fig. 6. In the interviews we suggested a series of characteristics attributed to cuttlefish. The informants chose the values that most represent the product according to their perception.

and "quality" followed by "taste" and "popular". As one distributor expresses: "(cuttlefish), it is already known, like bread, and people will eat the bread they can eat" (Woman, wholesaler, E.5). Cuttlefish is a product that is considered "popular" and "traditional" since it is one of the most established cephalopods in the Mediterranean diet. Despite other species having gained ground in daily consumption, cuttlefish is considered a lifetime product: "culturally it has always been consumed, we did not know other cephalopods. It is cuttlefish or squid what was known and consumed, not octopus"<sup>11</sup> (Woman, wholesaler, E.6).

It is noteworthy that the characteristic "sustainability" is the least mentioned. Distributors advertise this, particularly retailers: "Yes, everything must be promoted, but no more catches, it must be sustainable. Diversifying: adapted seabeds and producing reservoirs of controlled production" (Man, retailer, E.17).

As regards artisanal small-scale fishing, one retailer expresses the desire to highlight the contradiction between the annual demand of cuttlefish and the seasonality of this fishing with the need to diversify suppliers to provide for their customers throughout the year: "We lack supply in quantity to make a "small industry" and the price paid at auction is very high except, perhaps, in spring. If we sell fresh cuttlefish, we cannot count on the fishing ports (as suppliers) because you run out. Unless you buy it imported, or from Galicia or Huelva, you are not going to get anything." (Man, retailer, E.1).

The same comment on the final price of the product is also reflected in a fisherman's opinion: "The fishing gear is not valued in the end product (referring to the idea of sustainability often represented by fishing methods). Some end customers value it but most people say: Oh, this is too much! I don't want it! We'll find it cheaper, despite being from Indonesia, or wherever, that doesn't matter" (Fisher, E.27).

Despite the importance of the idea of "sustainability" used in promotional messages, as cuttlefish is demanded all year, distributors manage to always have a supply of cuttlefish regardless of the geography and the fishing methods, two aspects highlighted as definers of sustainability. France and Morocco, followed by the Netherlands, have been identified as potential suppliers when necessary. Also, being supplied from abroad enables more affordable prices, lower than provided by retailers: "There is a demand for cuttlefish all year, another thing is whether or not we find it. Cuttlefish is our top-selling product. They demand it, but they do not know whether it is seasonal or not, you can't always find it. There is always frozen cuttlefish, from other places" (Woman, wholesaler, E.6). "Cuttlefish is a product for retailers, when there isn't (cuttlefish) the price is very high and few competitive and then, you acquire it (cuttlefish) from other places" (Woman, wholesaler, E.5).

On the contrary, we also can find alternative distributors that ensure they receive a supply by using two criteria: seasonal product and product of proximity. They also dictate the criteria of selling to the end consumer: "We mark the availability of the product and customers request when the product is available" (Woman, alternative distributor, E.2).

### 3.2. Visual narratives

The most outstanding aspect of the visual dimension is the vast gastronomic offer around cuttlefish. The consumption of stylized images has consolidated food as a contemporary tool to define social belonging (Taylor and Keating, 2018). Metaphors and symbols such as abundance, pleasure, ethics, and the connection between human beings and culinary transformation processes take part in the digital quotidian showing a whole range of practices, technologies, discourses, and values, that, like the digital environment itself, evolve constantly ([24]; see Fig. 7).

<sup>11</sup> Note that octopus has been popularized thanks to the Galician octopus. It was not until the 60 s and 70 s that octopus (*Octopus vulgaris*) is considered important fisheries in northern Catalonia (for example Cap de Creus) with tourism. Octopus wasn't valued in the local gastronomy or very few compared to other species.

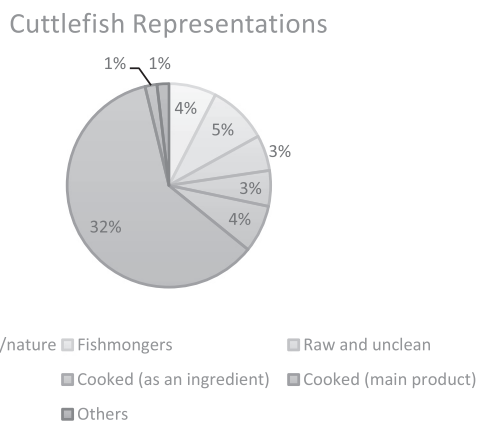


Fig. 7. Percentage of visual presentation of cuttlefish on Instagram.

Many actors are on the digital food space: producers, cooks, suppliers, distributors, restaurants, and hotels. We observed these actors' visual narratives of prepared foods through TV programs, commercial multimedia, YouTube, Instagram, and viral content spread from TikTok among others.

The co-existence of small businesses and amateur stakeholders in the same spaces favors the spread of new ideas about food and the diversification of each stakeholder's message: "Healthy Food," "Innovation," "Proximity," "Home-Cooked meal," "Gastronomic Roots," "Use," "Ecological Products," and "Traceability." All these labels imply a critical shift in the digital consumer, from a passive actor to a culture of exchange and prosumerism.<sup>12</sup>

Furthermore, as expressed by a representative of fishmongers in Catalonia, cuttlefish is a product that fits with today's lifestyle underpinned by social relationships, the worship of the person, the body, and health. All these aspects are represented in social media and contrast with what food represented in earlier times, especially after Franco's dictatorship and later (between the 1960 s and 1980 s) when overeating was a sign of socio-economic well-being and status.

*"Now food is not a priority, now the priority is the attention to the person, the body, health, human relations belonging to collectives, that's what it is. It is a different relationship with food. Social priorities, trends, and comforts move us. Cephalopods is a comfortable product"* (Fishmonger representative, E. 24).

The results of searching for the combination of both hashtags #freshcuttlefish and #cuttlefish tracked in 200 photographs from Instagram according to the *foodporn*<sup>13</sup> concept, show us the predominance of the representation of cooked cuttlefish. Cuttlefish as the dish's principal element, or alone, appears 65 times, prepared following traditional recipes (according to traditional Catalan dishes such as "meatballs with cuttlefish" or "cuttlefish with peas"). Cuttlefish combined or mixed with other ingredients appears on 83/200 occasions, primarily cooked following traditional recipes or combined with other styles: "cuttlefish fettuccine," "cuttlefish tajine with lemon."

Unclean raw cuttlefish appears frequently compared with clean raw cuttlefish because distributors traditionally associate unclean raw cuttlefish with freshness. We have found 25/200 photographs of unclean

<sup>12</sup> Prosumerism refers to the action of being a prosumer. Prosumers are consumers than incentive consumption thanks to the influence they can exert over their digital followers when they generate content related to producers' and sellers' offers. As for the food, the consumer is not the last step of the chain but using exhibition and recreation of foods can start a new cycle of a specific type of consumption (Lewis and Philipov, 2018)

<sup>13</sup> Foodporn is the glamorized visual presentation of cooking, or the presentation of food in advertisements, info-marketing, blogs, and other visual means.

cuttlefish compared to 7/200 of clean cuttlefish. We observe that cuttlefish also appears as part of a set over ice in fishmongers. By tracking the last 100 images on Instagram of those 3/22 interviewed (one retailer, one wholesaler, and one alternative) receiving orders through this platform, we can see that cuttlefish occasionally appear highlighted in front of other popular species, like tuna. There is a single cuttlefish exhibition (1/100) at the counter, together with other species.

As regards wholesalers, cuttlefish only appears twice (2/100) in addition to other species and three times (3/100) as the main product, always raw and unclean, including recommendations about how to consume it following Asian recipes or with additional details about its chromatophore characteristics or the habitat. As regards the alternative distributor's Instagram account, cuttlefish is the protagonist on four occasions (4/100), in images of cooked cuttlefish submitted by customers, always according to traditional styles and popular dishes. Even though cuttlefish is a product with high price variability and constant demand, its image in social media is poor compared to tuna, salmon, and octopus. It is interesting to pay attention to the presence of recreational fishing associated with cuttlefish on Instagram (Fig. 6), which appears alongside images of nature. Recreational fishing for cuttlefish is a growing recreational fishing type that competes with artisanal fishing because of the lack of regulation despite the efforts made in this vein by co-management committees.

Based on the grouping of images traced through different digital platforms, we can see how cuttlefish appears in various scenarios (Table 1). The images and videos show us the product's quality, and importance. However, we also encountered images that do not promote values of care and environmental sustainability by presenting plastic wrappings such as bags and boxes or styrofoam for product transportation and delivery instead of showing good product preservation, freshness, and security. As regards YouTube, we mainly find traditional preparations made by amateurs and promoted by renowned chefs and TV productions that have joined the rise in food exhibitions. The fishing sector is also represented and valued but to a lesser extent.

#### 4. Discussion

Cuttlefish is a top-rated seafood product, particularly in Catalonia, and is part of the most famous cephalopod-based dishes. With roots in traditional Catalan gastronomy, cuttlefish is linked to domestic meals and promoted by chefs. The commodification of gastronomic culture has popularized its consumption, highlighting it as an accessible product: easy to cook, nutritious, tasty, and reasonably priced. In addition, the notion of cultural heritage encapsulated in traditional dishes combines modern food ideas with innovation (with modern dishes or embracing cultural diversity). Nevertheless, the supply of cuttlefish relies on importation. The cuttlefish season in Catalonia is from January to June. Since 2020 a two-month closure (September and October) has been introduced as a preservation measure promoted by the co-management plan<sup>14</sup> to ensure sustainability.

Therefore, local producers cannot supply their year-round demand despite being sold as a local product or, at least, a product rooted in the local culture. Traditional dietary systems based on local and seasonal foods, such as the Mediterranean diet, have been noted as healthy and ecological, addressing sociocultural and socioeconomic aspects by linking consumption with distribution and production [42]. However, while cultural food preference has focused on recipes, cooking methods, and meals, it needs to pay attention to the quantity of consumption and its distribution in daily diets throughout the year.

Defining the seasonality of the product is more complex than it

<sup>14</sup> Official Journal of the Catalan government. ORDER ARP/166/2020, of 1 October, approving the management plan for the professional shellfishing of cuttlefish (*Sepia officinalis*) in the bays of Pals and Roses, and establishing an annual closure, and a limitation on catches in recreational fishing.



**Table 1**  
Ideas and associations of cuttlefish (Facebook, Twitter, Youtube, and TikTok).

Phase in the value chain	Visual narrative	Images	Ideas and associations
Harvesting	Nature	Sea bottom, other marine species, sand, water.	Calm, balance, wellbeing.
Harvesting	Tools and crafts	Fishing gears, fishing vessels	Work, tradition, efforts
Harvesting	Special pieces	Big cuttlefish, important production	Trophy, exception, good product, nature
Harvesting	Preservation and distribution	Ice, water, plastic boxes, package.	Production, processing, industrialisation.
Sale	Offers and posters	Prices, offers, posters, pictures, logos, designs	Opportunity, business, invitation.
Sale	Display counter	Ice, other marine species, sellers, buyers, Markets.	Trust, freshness, quality, variety
Sale	Seafood baskets and orders	Product assortment, other marine species, special orders.	Proximity, offers, variety
Sale	Clean and Unclean cuttlefish	Cleaned and uncleaned cuttlefish	Clean: easy, availability Unclean: quality, seasonality, tasty, pure.
Sale	Storage and distribution	Plastics, polystyrene, ice, freezy	Product cleaning, pollution, barge.
Consumption	Local cuisine	Rice, olive oil, vegetables, aromatic herbs, other marine species	Tradition, homemade, delicious, memories, nutritive.
Consumption	Cooking Processes	Fire, knives, kitchens, pans, plates.	Effort, transformation, skills.
Consumption	Haute cuisine	Innovative and traditional ingredients, culinary techniques	Surprise, curiosity, innovation, gourmet, sophistication, fusion cuisine.
Consumption	Household environment	Fireplace, grill, plats, pans, household kitchen.	Family, meeting, tradition, good meal
Consumption	Gastronomic environment	Professional cooking, design tableware, lighting.	Aesthetics, professionalism

seems. For example, many consumers associate product seasonality with locally produced food, although it only sometimes meets the criteria of a seasonal product. Furthermore, seasonality is associated with fruits and vegetables but not so much with other crops and animals [27]. The de-seasonality of popularized traditional dishes forces the market to supply the availability of this product from other places. As pointed out by Tsounis (2022), the variation in demands according to the dietary preferences of consumers has ecological consequences. As stated by [49]), the homogenization of lifestyles and the shifts in consumption habits may produce ecological instability, affecting fishing activity.

Global-local paradoxes are projected regardless of whether promoters are wholesalers or retailers. On the one hand, as we can see in the results, the idea of local traditional products is reinforced despite not respecting the seasonal value of the product. On the other hand, products from elsewhere with a strong production of wild fish and aquaculture dominate the space.

The need to integrate plurality and divergent values influencing food decisions [21] should be reviewed to prevent large producers from permeating consumer preferences to the detriment of environmental sustainability. Increasing seafood consumption at the expense of depending on imports could reverse the environmental value of fish production low in CO2 emissions. International transportation is one of

the challenges of seafood consumption for the coming years ([33]; Guillen et al., 2019). Consumer cooperatives promote short supply circuits through "basket fish" delivery as "alternative" marketing routes that are environmentally friendly (Gómez & [29]).

This delivery strategy incorporated recently by wholesalers and retailers, particularly during the COVID-19 lockdown, was an opportunity to reach consumers at home. Nevertheless, it is important to attach environmental values to the "basket" to conciliate demand with stock availability. The results in Table 1 show how different ideas are associated with different stages of the value chain, mixing seafood localization values with images of plastic or polystyrene that do not allow for reconciling a clear idea of sustainability. Considering that the industrialization processes identified through packaging images have reduced the global lack of food supply, local food sustainability is questioned [20]. On the other hand, the environmental consequences arising from industrialization may be weaknesses in sourcing as consumers become dependent on global trade, as experienced with the COVID-19 closures. In this vein, Kaiser and Algiers [20] suggest that ethics cannot be assessed through consumer choices or the environmental impacts of one type of production but through all the choices that affect the value chain. Nevertheless, the global-local interaction of the value chain in a sustainable relationship remains complex.

Some scholars point out that markets should be reframed through relational strategies beyond "simple market transactions" (Gutierrez & Morgan, 2015; [45], 2019). Conversely, some others [50] state that local seafood supply chains are not enough to transform sustainable fisheries because of their dependence on global markets. This paper describes how local seafood production chains interact with global seafood systems. The social embeddedness of economic exchange relationships [13] is an essential driver of the seafood market, increasingly diversifying its marketing supply channels. More attention should be paid to the effects social relationship networks may produce on consumers' behavior. Adjusting production to demand by de-commodifying the seafood culture even when food marketing contains non-market or added values. The promotion of added value to seafood must take into account local indicators to ensure fishing sustainability. Whereas the "embeddedness of market" (in the sense of [37]) through different marketing initiatives gaining ground in online platforms can prevent market failure [16], educating the consumption experiences could prevent poor adjustments of demand to local, sustainable production. As [16] stated, "*Institutions, both formal and informal, play a key role in shaping the value chain/production networks in terms of facilitating or constraining growth.*"

Product certification of sustainable indicators has been pointed out as an efficient solution to ensure fishing sustainability that may act as added value [15]. An aspect that should be considered as part of the co-management plan is the certification of the co-managed cuttlefish according to sustainable indicators. We add that fishers must be integrated into the "embeddedness of the market" as a strategy to improve seafood marketing systems and meet sustainability criteria. Data on imported cuttlefish and its fluctuation in price coincide with fishers' concerns regarding the availability of stocks and the final price. Distributors can get supplies from different sources, while fishers must deal with natural resource constraints and fishery regulations.

Although we do not know to what extent distributors can mediate between market demand and fishery production, its influence has been demonstrated in fishers' behavior [12]. Stressors such as environmental change, the state of commercial fish stocks, and market competition mean that distributors have to contend with the availability of resources in trying to shape the consumer behavior of contemporary society in their favor. A consumption culture needs to be further developed to recover the cultural heritage of fishing, its culinary practices, and socioecological embeddedness.

## 5. Concluding remarks

This paper stems from research carried out for practical purposes to

develop a series of suggestions that help the cuttlefish fishing and marketing chain. Therefore, it is an exploratory study investigating various possibilities and seeking a panoramic view. One of this study's weaknesses is that it is confined to a defined space and time and could be improved if it were a longitudinal study that could also better capture the effects of the social and economic changes resulting from COVID. Another weakness could be its exploratory character: although it is a strength to obtain a complete overview of the situation, it needs to further explore both the method and its development and analysis.

Our study points out that it is essential to integrate local fishers in marketing channels and media discourses to ensure more "socio-ecologically embedded market networks," both locally and globally. Fair and equitable consumption with the environment and the producer must also be promoted. Initiatives based on the producer-consumer alliance, like the organic food provisioning networks in agroecology, help to promote the whole value chain from production to distribution and consumption (see: [11]). Promoting the image of cuttlefish through the media (Twitter, Facebook, Instagram, TikTok) can be helpful to echo good practices from fishing to the table. The co-management plan for cuttlefish (*Sepia officinalis*) that includes a socio-economic program should consider using social media to bridge the gap between management and society. Social media is an effective means to influence food choices and reach a wider audience. Likewise, consumer preferences affect fishers' decisions, suggesting that co-management plans should involve both consumers and local producers to achieve sustainability. By publishing information and images about local fisheries and the environmental value of the co-managed species, consumers could incorporate fishers and sustainable local fisheries into their media discourse. A further step should consider the involvement of all actors in the value chain (wholesalers, retailers, alternative channels) in co-management committees, seeking to join forces with the trade fabric in the pursuit of sustainability.

In the sector, digitalization is about more than just product exposure. Thanks to WhatsApp and Facebook, retailers can use new means to market orders and sales based on home delivery and pick-up at specific points of sale. These mechanisms bring global marketing within the local neighborhood and small-town networks. These strategies must be used to integrate sustainable small-scale fishers and fishing culture into these marketing mechanisms to supply unique, socially, and environmentally friendly seafood products. A fair-trade certification that is neither cheap nor expensive should promote the qualities of cuttlefish caught by local, sustainable small-scale fishers as an essential part of the care and respect for environmental conditions.

#### CRediT authorship contribution statement

**Silvia Gómez:** Conceptualization, Investigation, Methodology, Writing – original draft, Writing – review & editing, Funding acquisition. **Beatriz Patraca:** Investigation, Methodology, Social network analysis, Writing – original draft, Writing – review & editing. **José Luis Molina:** Writing – review & editing, Funding acquisition.

#### Declaration of competing interest

The authors declare no conflicts of interest.

#### Data Availability

The data that has been used is confidential.

#### Acknowledgments

The EU (European Maritime and Fisheries Fund) and Climate Action, Food and Rural Agenda Department of the Catalan Government provided funding for this research through the project "Advice to the Co-Management Committee of the cuttlefish of the bays of Roses and Pals

for the implementation of a socio-economic program" under the grant agreement ARP163/21/000023. We acknowledge all fishers and seafood distributors that kindly participated in the project as well as we express our appreciation to all persons who shared with us their valuable knowledge by collaborating. We would also like to thank Eva Visauta, from the public administration and secretary of the cuttlefish co-management committee, who is always available to help and provide information.

#### Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.marpol.2023.105517](https://doi.org/10.1016/j.marpol.2023.105517).

#### References

- [1] N. Akbari, F. Maynou, T. Bjørndal, P. Failler, B. Drakeford, A. Forse, Scenarios of profitability of western Mediterranean demersal fisheries in an effort control regime, *J. Environ. Manag.* 300 (2021), 113794, <https://doi.org/10.1016/j.jenvman.2021.113794>.
- [2] R.I. Arthur, D.J. Skerritt, A. Schuhbauer, N. Ebrahim, R.M. Friend, U.R. Sumaila, Small-scale fisheries and local food systems: transformations, threats and opportunities, *Fish Fish.* 00 (2021) 1–16, <https://doi.org/10.1111/faf.12602>.
- [3] C.J. Barret, et al., Cuttlefish conservation: a global review of methods to ameliorate unwanted fishing mortality and other anthropogenic threats to sustainability, *ICES J. Mar. Sci.* 2022 (0) (2022) 1–18, <https://doi.org/10.1093/icesjms/fsac200>.
- [4] Bastian, M. Heymann, S. Jacomy, M. (2009). Gephi: an open source software for exploring and manipulating networks. International AAAI Conference on Weblogs and Social Media.
- [5] Béné, et al., Feeding 9 billion by 2050 – Putting fish back on the menu, *Food Sect.* 7 (2015) 261–274, <https://doi.org/10.1007/s12571-015-0427-z>.
- [6] P. Ertör-Akyazi, Contesting growth in marine capture fisheries: the case of small-scale fishing cooperatives in Istanbul. *Sustain, Sci* 15 (2020) 45–62, <https://doi.org/10.1007/s11625-019-00748-y>.
- [7] Farnet, FARNET Guide #8: Marketing the local catch. (2014). [https://webgate.ec.europa.eu/fpfis/cms/farnet2/library/guide/farnet-guides-1-10\\_en](https://webgate.ec.europa.eu/fpfis/cms/farnet2/library/guide/farnet-guides-1-10_en) (Accessed 20 June 2019).
- [8] A. Flache, M. Mäs, T. Feliciani, E. Chattoe-Brown, G. Deffuant, S. Huet, J. Lorenz, Models of social influence: towards the next frontiers, *J. Artif. Soc. Soc. Simul.* 20 (4) (2017) 2, <https://doi.org/10.18564/jass.3521>.
- [9] S. Gómez, F. Maynou, Balancing ecology, economy and culture in fisheries policy: participatory research in the Western Mediterranean demersal fisheries, *J. Environ. Manag.* 291 (2021), 112728, <https://doi.org/10.1016/j.jenvman.2021.112728>.
- [10] S. Gómez, F. Maynou, Alternative seafood marketing systems foster transformative processes in Mediterranean fisheries, *Mar. Policy* 127 (2021), 104432, <https://doi.org/10.1016/j.marpol.2021.104432>.
- [11] S. Gómez Mestres, M. Lien, Recovering food commons in post industrial Europe: cooperation networks in organic food provisioning in Catalonia and Norway, *J. Agric. Environ. Ethics* (2017), <https://doi.org/10.1007/s10806-017-9691-6>.
- [12] B. González-Mon, O. Bodin, B. Crona, M. Nenadovic, X. Basurto, Small-scale fish buyers' trade networks reveal diverse actor types and differential adaptive capacities, *Econ. Ecol.* 164 (2019), 106338, <https://doi.org/10.1016/j.ecolecon.2019.05.018>.
- [13] M. Granovetter, Economic action and social structure: the problem of embeddedness, *Am. J. Socio* 91 (1985) 481–510, <https://doi.org/10.1086/228311>.
- [14] J. Guillén, F. Natale, N. Carvalho, J. Casey, J. Hofherr, J. Druon, J. Martinsohn, Global seafood consumption footprint, *Ambio* 48 (2019) 111–122, <https://doi.org/10.1007/s13280-018-1060-9>.
- [15] A.T. Gutiérrez, S.K. Morgan, The influence of the sustainable seafood movement in the US and UK capture fisheries supply chain and fisheries governance, *Front. Mar. Sci.* 2 (2015) 72, <https://doi.org/10.3389/fmars.2015.00072>.
- [16] N. Hamilton-Hart, C. Stringer, Upgrading and exploitation in the fishing industry: contributions of value chain analysis, *Mar. Policy* 63 (2016) 166–171, <https://doi.org/10.1016/j.marpol.2015.03.020>.
- [17] Harris, M. (1998). *Antropología cultural*, second ed. Alianza, Madrid.
- [18] Hu, Y., Manikonda, L., Kambhampati, S. (2014, 1–4 June). What we Instagram: A first analysis of Instagram photo content and user types. In Proceedings of the eighth international AAAI conference on weblogs and social media (pp. 595–598). Ann Arbor, MI: Association for the Advancement of Artificial Intelligence.
- [19] S. Joosse, T. Brydges, Blogging for sustainability: the intermediary role of personal green blogs in promoting sustainability, *Environ. Commun.* 12 (5) (2018) 686–700, <https://doi.org/10.1080/17524032.2018.1474783>.
- [20] M. Kaiser, A. Algers, Food ethics: a wide field in need of dialogue, *Food Ethics* 1 (2016) 1–7, <https://doi.org/10.1007/s41055-016-0007-8>.
- [21] M. Kaiser, S. Goldson, T. Buklijas, P. Gluckman, K. Allen, A. Bardsley, M.E. Lam, Towards post-pandemic sustainable and ethical food systems, *Food Ethics* 6 (2021) 4, <https://doi.org/10.1007/s41055-020-00084-3>.
- [22] R.V. Kozinets, The field behind the screen: using netnography for marketing research in online communities, *J. Mark. Res.* 39 (1) (2002) 61–72.

- [23] T. Lewis, Digital food: from paddock to platform, *Commun. Res. Pract.* 4 (3) (2018) 212–228, <https://doi.org/10.1080/22041451.2018.1476795>.
- [24] T. Lewis, M. Phillipov, Food/media: eating, cooking, and provisioning in a digital world, *Commun. Res. Pr.* 4 (3) (2018) 207–211, <https://doi.org/10.1080/22041451.2018.1482075>.
- [25] I. Lopez-Ercilla, et al., The voice of Mexican small-scale fishers in times of COVID-19: Impacts, responses, and digital divide, *Mar. Policy* 131 (2021), 104606, <https://doi.org/10.1016/j.marpol.2021.104606>.
- [26] C.D. Love, et al., Emerging COVID-19 impacts, responses, and lessons for building resilience in the seafood system, *Glob. Food Sec* 28 (2021), 100494, <https://doi.org/10.1016/j.gfs.2021.100494>.
- [27] Macdiarmid, J.I. (2014). Seasonality and dietary requirements: Will eating seasonal food contribute to health and environmental sustainability? *Proc. Nutr. Soc.* 73:3, 368–375. <https://doi.org/10.1017/S0029665113003753>.
- [28] F. Maynou, Application of a multi-annual generalized depletion model to the assessment of a data-limited coastal fishery in the western Mediterranean, *Sci. Mar.* 79 (2) (2015) 157–168, <https://doi.org/10.3989/scimar.04173.28A>.
- [29] F. Maynou, Trade-offs between employment and profitability in the Mediterranean Sea mixed bottom trawl fishery, *Reg. Stud. Mar. Sci.* 48 (2021), 102020, <https://doi.org/10.1016/j.risma.2021.102020>.
- [30] J.L. Molina, B. Patraca, Análisis de Xarxes Socials, in: A. Canals, A. Díaz-Guilera, J. L. Molina, B. Patraca (Eds.), *Xarxes Socials. Fonaments i aplicacions*, Editorial UOC, Barcelona, 2014, pp. 69–93.
- [31] O.G. Mouritsen, K. Styrbæk, Cephalopod gastronomy—a promise for the future, *Front. Commun.* 3 (2018) 38, <https://doi.org/10.3389/fcomm.2018.00038>.
- [32] M. Ortega, Y. Mascarell, *The Spanish Mediterranean fishing sector and its market reaction to the ongoing coronavirus crisis*, ENT Found. Rep. (2020).
- [33] A. Ospina-Alvarez, S. De Juan, P. Pita, G.B. Ainsworth, F.L. Matos, C. Pita, S. Villasante, A network analysis of global cephalopod trade, *Sci. Rep.* 12 (2022) 322, <https://doi.org/10.1038/s41598-021-03777-9>.
- [34] J. Pascual-Fernandez, C. Pita, H. Josupeit, A. Said, J. Garcia Rodrigues, Markets, distribution and value chains in small-scale fisheries: a special focus on Europe: analysis and practice, in: R. Chuenpagdee, S. Jentoft (Eds.), *Transdisciplinarity for Small-Scale Fisheries Governance*, MARE Publication Series 21, Springer, 2018, pp. 141–162, [https://doi.org/10.1007/978-3-319-94938-3\\_8](https://doi.org/10.1007/978-3-319-94938-3_8).
- [35] Penca, J., Said, A., Cavallé, M., Libralato, S., Pita, C. (2020). Market opportunities for artisanal and small-scale fisheries products for the sustainability of the Mediterranean Sea: Towards an innovative labelling scheme. *Euro-Mediterranean University*.
- [36] Pink, S., Horst, H.A., Postill, J., Hjorth, L., Lewis, T., Tacchi, J. (2016). *Digital Ethnography*, Sage Publications Ltd.
- [37] K. Polanyi, 1922. *La gran transformación: Los orígenes políticos y económicos de nuestro tiempo*. México, Fondo de Cultura Económica, 1944.
- [38] J. Postill, S. Pink, Social media ethnography: The digital Researcher in a messy web, *Media Int. Aust.* 145 (2012) 123–134, <https://doi.org/10.1177/1329878x1214500114>.
- [39] Prell, C. (2012). *Social network analysis: History, theory and methodology*, first ed. Sage Publications Ltd.
- [40] P. Prosperi, J. Kirwan, D. Maye, F. Vartolini, D. Bergamini, G. Brunori, Adaptation strategies of small-scale fisheries within changing market and regulatory conditions in the EU, *Mar. Pol.* 100 (2019) 316–323, <https://doi.org/10.1016/j.marpol.2018.12.006>.
- [41] F. Salladarré, P. Guillotreau, G. Debuquet, G. Lazuech, Some good reasons for buying fish exclusively from community-supported fisheries: the case of Yeu Island in France, *Ecol. Econ.* 153 (2018) 172–180, <https://doi.org/10.1016/j.ecolecon.2018.07.017>.
- [42] Li Serra-Majem, et al., Updating the mediterranean diet pyramid towards sustainability: focus on environmental concerns, *Int. J. Environ. Res. Public Health* 2020 (17) (2020) 8758.
- [43] A. Sloane, S. O'Reilly, The emergence of supply network ecosystems: a social network analysis perspective, *Production Planning & Control: The Management of Operations* 24 (7) (2012) 621–639, <https://doi.org/10.1080/09537287.2012.659874>.
- [44] J.S. Stoll, M. Bailey, M. Jonell, Alternative pathways to sustainable seafood, *Conserv. Lett.* 13 (2019), e12683, <https://doi.org/10.1111/conl.12683>.
- [45] J.S. Stoll, P. Pinto da Silva, J. Olson, S. Benjamin, Expanding the 'geography' of resilience in fisheries by bringing focus to seafood distribution systems, *185e192*, *Ocean. Coast. Manag* 116 (2015), <https://doi.org/10.1016/j.ocecoaman.2015.07.019>.
- [46] J.S. Stoll, H.L. Harrison, E. De Sousa, D. Callaway, M. Collier, K. Harrell, B. Jones, J. Kastlunger, E. Kramer, S. Kurian, M.A. Lovewell, S. Strobel, T. Sylvester, B. Tolley, A. Tomlinson, E.R. White, T. Young, P.A. Loring, Alternative seafood networks during COVID-19: implications for resilience and sustainability, *Front. Sustain. Food Syst.* 5 (2021), 614368, <https://doi.org/10.3389/fsufs.2021.614368>.
- [47] Titcomb, J. (2015, September 23). Instagram reaches 400 million users to surpass Twitter. *The Telegraph*. Retrieved from <https://www.telegraph.co.uk/technology/social-media/11885738/Instagram-reaches-400-million-users-to-surpass-Twitter.html>.
- [48] S.A. Trivette, The importance of food retailers: applying network analysis techniques to the study of local food systems, *Agric. Hum. Values* 36 (2019) 77–90, <https://doi.org/10.1007/s10460-018-9885-1>.
- [49] L. Tsounis, A. Iliadi, G. Kehayias, Food and ecology or how dietary alterations can affect an aquatic ecosystem, *J. Ethn. Food* 8 (2021) 22, <https://doi.org/10.1186/s42779-021-00098-0>.
- [50] T. Van Holt, W. Weisman, Global production network mapping for transforming socio-ecological system, *J. Environ. Sustain.* 20 (2016) 61–66.
- [51] S. Villasante, A. Tubío, I. Gianelli, P. Pita, A. García-Allut, Ever changing times: sustainability transformations of galician small-scale fisheries, *Front. Mar. Sci.* 8 (2021), 712819, <https://doi.org/10.3389/fmars.2021.712819>.
- [52] B. Wellman, El análisis estructural: del método y la metáfora a la teoría y la sustancia, *Polit. Y. Soc.* 33 (33) (2000) 11–40, <https://doi.org/10.5209/POSO.25732>.