

Relations between professional groups in the Atlantic and Mediterranean fishing enclaves of Andalusia (Spain): a personal networks approach with clustered graphs

Isidro Maya-Jariego
Daniel Holgado
David Florido
Universidad de Sevilla

Abstract. This paper proposes a new network-based approach to analyse intergroup relations in fishing ports. The technique of clustered graphs is applied to the case of the Andalusian fishing ports to assess the balance between intra and inter-professional relationships. The patterns of sociability in Mediterranean and Atlantic fishing enclaves in the southern region of Spain were compared, examining their implications for participatory governance of marine resources. The personal networks of 53 fishermen, ship owners or skippers and key individuals of 18 Andalusian fisheries were analysed. The personal networks were compared in terms of fishing ground (Atlantic versus Mediterranean) and port type (by size and form of participation). The data of 45 individuals with whom each respondent usually interacts in the harbour was summarized in clustered graphs of intra-group and inter-group relationships between 8 professional roles in the harbour. Results show primarily that personal networks of Mediterranean ports are overall denser, in comparison with those of the Atlantic, which are more centralised and have a higher average betweenness. Secondly, in the Atlantic a clear difference of roles between ship owners and skippers is observed. A strong link between ship owners and the crew was found, and also between the ship owner and commercial roles in the Mediterranean. Small ports seem to be more apt for the *artisanalisation* of fisheries, as well as for the European Union's Common Fisheries Policy.

Keywords: Clustered graphs, Personal networks, Participatory Governance, Marine resources, Atlantic, Mediterranean, Fishing enclaves, Ports, Andalusia.

Highlights

- Clustered graphs provide efficient description of intergroup relations in ports.
- Large-scale operations are reflected in a more fragmented structure in the port.
- Traditional fishing guilds retain a dominant role in the ports.
- Mediterranean fishing ground is more focused in boat-based sociability.

1. Introduction

European fisheries policy entails a gradual restructuring of the fishing industry, where trawling and large-scale commercial operations are reduced for the benefit of artisanal and traditional fishing gears¹. The Common Fisheries Policy (CFP) is particularly oriented towards conservation of marine resources, setting catch limits and channeling the participation of stakeholders in the fisheries sector through advisory councils. The implementation of both sustainable goals and a participatory approach vary according to the characteristics of fishing communities. The structure of relations in each port can potentially affect the manner in which participation is articulated and also the management of local ecological knowledge. Moreover, reactions to changes in the fisheries sector vary depending on the community context in each site, the degree of organizational complexity and other local dynamics.

This study compares the structure of social networks and attitudes towards new fishing policies in selected Atlantic and Mediterranean fishing sites in Andalusia, south of Spain. First, the changes taking place in the fisheries sector in Europe is summarised; secondly, previous research on the role of social networks in the governance of natural resources is reviewed; and finally, it follows a description of the types of fishing ports and specific features of the fishing grounds in Andalusia, the context of the study.

1.1 Changes in the fisheries sector

The European Commission Green Paper "Towards a future maritime policy for the Union: a European vision for the oceans and seas" (2006) emphasises the importance of seaports as enablers of economic and job creation for the coastal regions, as well as routes to the fishing spots. Maritime and port areas are becoming centres of attraction for recreational navigation, as well as cultural and natural tourism. This process has been reinforced with the European Commission's Blue Growth Strategy, which aims to develop the potential of Europe's oceans and coasts to provide jobs through aquaculture, renewable energy, biotechnology, mineral resources and leisure activities; and it intends to do so in a sustainable manner, consistent with the protection of the environment (European Commission, 2014). The promotion of these activities is associated with the reduction of the dependence of these regions to the traditional economic activities, in particular the fishing industry (Suárez de Vivero, 2007). This political framework has been lightly implemented in southern Spain by the regional government. In specific fishing areas, some initiatives of this kind, as a result of research projects have been launched. However, there is still no evidence showing social and economic

¹ This process has been previously documented for the case of Andalusia (Florida, 2003) and it is part of the assumptions of recent European guidelines. However, this is probably variable in different countries, because it depends in part on specific national policies, and also on the way each state applies regulations. In this regard, it is worth mentioning the REGULATION (EU) No 1380/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on the Common Fisheries Policy, which promotes the preservation of traditional fishing activities in coastal communities and even establishes that "Member States should endeavour to give preferential access for small-scale, artisanal or coastal fishermen" (Art.19, p. 24). See: REGULATION (EU) No 1380/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC.

transformation within local contexts. The reorientation of the extractive sector to tourism activities or services has not been applied determinedly at national or regional level. Although fishing companies and tourist organizations have shown interest in developing such new activities, bureaucracy and red tape remain a major challenge. Recent initiatives include cataloguing of heritage, the creation of ethnographic museums, enhancement of the industrial heritage and sightseeing or reuse of ship for tourists' trips in fishing areas. With all these activities, as well as opening fisheries and marine resources to the general public, regional government try to promote businesses that respect the environment.

In parallel, both regional and state governments have promoted the modernisation of the sector, through new forms of participation and partnership. For example, there have been attempts to start fishing producer organizations, incorporating new management systems. In southern Spain some of these producer organizations are developed by small-scale fishers. The regional government also launched the Groups for Fisheries Development, an entity which aims to enable fishers with a trading role, promoting the economic transformation of the sector. Also, in some cases, the presence of unions was promoted to transform modes of organization, and bring up to date labor relations in the world of fishing. However, participation in ports remains essentially local, centred around fishing guilds, *cofradías*, corporations governed by public law. Fishing guilds strongly resist the changes introduced in the sector, so as to maintain their central role (Alegret, 1990, 1996; Florido del Corral, 2003). In most ports, not only is the presence of unions still limited, but also some polarisation may be observed between the guilds and ship owners' associations (Maya-Jariego, Holgado, Florido & Martínez-Alba, 2016). Groups for Fisheries Development also failed to take roots in the sector.

1.2. Social networks and governance of natural resources

Patterns of communication, knowledge transfer, information exchange, labour relations and collaboration in decision-making among different social partners are essential in the management of natural resources (Bodin & Crona, 2009). Also, power structures and organizational affiliations have an impact on management in fisheries (Prell, Reed, Racin & Hubacek, 2010; Crona & Bodin, 2010). Social network analysis has been applied to examine co-management structures, both to understand the engagement of stakeholders, as well as to describe power/resources sharing and leadership processes (Carlson & Berkes, 2005; Crona & Bodin, 2006).

Previous studies have explored the relationship between diverse structural properties of networks and natural resource management: network ties, network cohesion, bonding and bridging ties, network position and core-periphery configurations (Bodin & Crona, 2009; Crona & Bodin, 2006). Ethnic and occupational affiliations, as well as type of gear used (or even merely being an owner of the gear) are relevant in the development of social circles and the patterns of exchanges to access and extract marine resources (Bodin & Crona, 2011). It seems that heterogeneity (composition) and closure (density and centralisation) dimensions serve to describe the diversity and effectiveness of co-management networks (Carlsson & Sandström, 2008). Homophilia patterns affect the generation and dissemination of knowledge (Crona & Bodin, 2011) and the capacity to obtain resources (Sandström, 2011).

The distinction between bonding and bridging ties has been widely applied in the field (Crona & Bodin, 2011). Bonding ties are associated with the existence of cohesive

groups, exchanges of social support and dynamics of community control. This kind of ties usually provide affective and instrumental resources that are essential to adapt to the environment, cope with stressful circumstances and contribute to psychological sense of community. Bonding ties also entail processes of social control through behavioral norms that are developed in primary groups, which can influence, for example, in the use of certain fishing gears or making captures in certain areas (Crona & Bodin, 2011; Sandström, 2011). Bridging ties connect different groups together, facilitate the dissemination of information and contribute to social innovation. Such ties facilitate social integration in the wider structure, acting as bridges between groups with different resources and information. For fishing, these ties are relevant when exchanging information on natural marine resources and also for managing local ecological knowledge (Crona & Bodin, 2011).

The balance between intergroup and intragroup relationships can be a key element in the differentiation of fishing communities. For example, small-scale, coastal, or artisanal fishermen have traditionally been part of organic communities with comparatively less differentiation than large scale fisheries. In such cases, the crew of a ship share tasks collectively, are informally integrated and take responsibility for all the processes associated with extractive activities. Conversely, industrial fishing and large-scale fishing gears, often involve a more complex division of labor, so that specific roles of management emerge and a greater complexity as a whole is observed. Therefore, it is expected, that differentiation of the relationship between professional groups is higher in the latter, than in the former cases.

Consequently a priori, both the degree of clustering in a group of fishermen, as the structure of relations between these groups, partly determine how a specific community manages marine natural resources, and the way its members participate in governance opportunities and fishing policies. Active interaction between different professional groups or stakeholders in a fishing enclave can facilitate a systemic and integrated vision of local ecological knowledge. It can also determine how a specific port reacts to the transformation of the fisheries sector described above. It is expected that different types of networks emerge in different fishery contexts. Consequently, two elements specific to the Andalusian case are explored, namely: fishing grounds, and types of ports. Both clearly influence the type of inter-professional relationships developed.

1.3. Fishing in Andalusia: two fishing grounds and four types of ports

Two distinctive fishing grounds characterize the region of Andalusia: the Atlantic Ocean and the Mediterranean Sea. The Mediterranean fishing ground, reaching around 600 kilometres of coastline, is about twice the extension of the Atlantic fishing ground. However, the Atlantic has more fishing enclaves: 17 compared to 13 in the Mediterranean (Ictioterm, 2013). The Atlantic has a greater port density, with ports closer to each other, often with areas of shared capture. While, industrial fishing predominates in the Atlantic, in the Mediterranean artisanal fishing gears prevail (Cáceres & Corbacho, 2013; Ríos, 2005). As a result, the volume of catch per boat, tons sold per day and the volume of sales at auction is significantly higher in the Atlantic (Consejería de Agricultura, Pesca y Desarrollo Rural de la Junta de Andalucía, 2014). Atlantic ships are very often integrated in business clusters (i.e., in the postharvest value chain), as opposed to the Mediterranean. Also, the proportion of mollusc and crustaceans, compared with fish, is also higher in the

Atlantic. Fishing in the Atlantic seems to be socially and ecologically more complex than in the Mediterranean.

Habits of participation and sociability patterns are essentially of a local nature in both fishing grounds. Relationships developed by fishermen, skippers, ship owners, managers and other members of the staff are mainly with other members of the local harbour. Social life revolves mainly around boats, docks and auction warehouses. Ship owners' huts, nautical shops and the port's coffee shops are places for forming and developing relationships. Participation is channelled through specific partnerships in each port, and the *cofradías* (traditional fishing guilds) are central in social and political life of fisheries. The *cofradías* have a long tradition in the fishing sector and they are peculiar, in that fishermen and ship owners tend to be members of the same organization. Working relationships overlap with family relationships and informal contacts, such as friends or neighbours. This is one of the main reasons why unions have a comparatively low representation in the fisheries sector studied. With the exception of fleets with more jobs per boat (as in the case of the fence in Barbate or Adra), union presence is almost nonexistent (Maya-Jariego et al., 2016).

However, ports vary in size and complexity, and this can make the fishing guilds have a less central role in the governance of port and a lower relative weight in decision-making. In this context, Ruiz and Valcuende (2001) distinguished four types of fishing ports in Andalusia: (1) ports framed around the fishing guild, (2) ports developed around commercial organizations, (3) medium size ports with polarized representativeness, and (4) large ports with complex associative systems. The first two are usually smaller enclaves, where usually artisanal fishing prevails, as for instance, Tarifa in the province of Cádiz (type 1) or Roquetas de Mar in Almería (type 2). In bigger ports with larger fishing capacity, as for instance, Isla Cristina in the province of Huelva (type 3), there is greater differentiation and distribution of the capacity of influence between guilds and ship owners' associations. Finally, in the biggest ports, fishing usually coexists with the commercial transport of containers, shipbuilding, or even large passenger lines, among other uses. This leads to much more complex labour relations, and a more diversified social structure. This is the only type of port, for example, where some unions have had some influence. This applies, for example, to Algeciras and Cádiz (type 4), where the fishing fleet that is directly linked to the port, is relatively small.

A priori each port, and therefore each fishing ground, is prepared differently for the technological transformation of the sector, the inclusion of tourism, and the promotion of cultural heritage. For example, the largest ports tend to accommodate different types of fishing, with varieties ranging from coastal fishing to middle distance intensive fishing. Natural biological stoppages as well as dismantling those ships with greater fishing capacity have a special impact on such ports. It is also more common to combine fisheries with other commercial activities. As yet, smaller ports are in general more homogeneous and more responsive to changes. The introduction of practices, which respect the environment, incorporate tourism and allow catering activities to flourish (such as, fish restaurants) are easier on a small scale.

This research specifically analyses the diverse reactions to changes experienced in the fisheries sector in Andalusia, depending on the social network, the fishing ground and the types of ports. Using clustered graphs, a novel approach for analysing inter-group and intra-group relationships in the professional networks in the harbours, the aim is to

describe the patterns of sociability in fishing enclaves of Andalusia. For this objective, a survey of personal networks and attitudes towards new fisheries policies was conducted. It is explored how the port types, with different degrees of organizational complexity, and the types of fishing, from artisanal gears to industrial conglomerates, modulate relationships between workers in fishing enclaves.

2. Methods

2.1. Participants

The fieldwork focused in 18 fishing ports (out of 27 fishing enclaves in Andalusia): 9 ports in the Atlantic Ocean and 9 ports in the Mediterranean Sea. Only ports related to the regional government and with at least a minimal organizational complexity were selected, taking as a reference the *Ictiobase* database (2013). That is to say, state-owned ports, as well as fishing bays or informal enclaves formed by small groups of fishermen were not included. In the final sample, all ports dependent of the regional government in Andalusia were included (with the exception of Motril, in Granada). The location of the 18 ports is marked on the map (Figure 1). The Atlantic fishery stretches from the port of Ayamonte to Tarifa. The Mediterranean fishery runs from La Atunara to the port of Garrucha.

In each case, interviews with three different members of staff of the port were planned, to obtain information on their personal networks, as well as their attitudes towards new usages of the port related to tourism, heritage and environment. Finally, 53 personal networks were obtained from 17 crew members, 18 skippers and/or ship owners and 18 prominent individuals. This latter group of key informants was defined from the information provided by crew and ship owners, who indicated people of relevance in the port according to their relationships, their knowledge or their influence. The selection of key individuals relied on a team of anthropologists who in parallel conducted an ethnographic study of the Andalusian fishing enclaves. Among others, managers of fishing guilds, owners of nautical shops, ship owners, workers of the auction, and retired fishermen were mentioned. All the 53 respondents were men and lived in the same city where the port was located, consistent with the sector's profile. Although normally the initial contact was made on the dock, interviews were conducted in many cases at the coffee shop or the bar of the port.

-FIGURE 1 HERE-

2.2. Name generator and instruments

For the data collection, personal interviews were held with participants. The questionnaire included: (1) a question to generate the names of 45 individuals with whom the respondent usually interacts in the harbour (which in the terminology of networks are usually called *alteri*); (2) a brief module on the attributes of the *alteri* mentioned by the respondent; (3) a question on the type of relationship between *alteri*; (4) a scale to evaluate attitudes towards new usages in the port related to tourism, heritage and environment. The interviews lasted between 60 and 90 minutes in total.

Personal networks. The network generator was formulated as follows: "Please give me a list of 45 people to whom you are usually related because of your activity in the harbour.

I am interested in those with whom you have a more frequent and regular contact. They may be co-workers, crew, skippers or ship owners. They may be part of the auction, the port or outside the port. They can be suppliers, dealers, people working in ice factories, representatives of environmental organizations, management personnel and so on". Then, for each elicited name, respondents provided information on the role they played in the port, as well as the organization and the port where they belonged. A long list of 24 different professional roles and activities was obtained and then it was summarised in 8 main role categories: crew, skipper, ship owner, services, market, organization, support and others. Finally, for each pair of *alteri*, respondents valued the relation according to four levels, from 0 to 3, to describe the strength of the relationship: 0, "They do not know each other, they have no relationship or no contact"; 1, "They know each other"; 2, "They have some relationship"; and 3, "They have a strong relationship or they are friends". In this paper, the network was dichotomised taking levels 2 and 3, as an indication of a link between nodes (that is to say, a relationship between actors).

Selecting a fixed number of *alteri* captures the diversity of structures of personal networks, facilitates comparison and processing of data and is generally, a highly reliable sociometric nomination procedure (McCarty, 2002). In previous studies, it has been shown empirically that listing 30 people is the minimum to reflect the diversity of structures of personal networks (McCarty, 2002; Molina, Maya-Jariego & McCarty, 2014). The same procedure was successfully used in the study of immigrant populations and university students in situations of geographical mobility, among others (Domínguez & Maya-Jariego, 2008; Maya-Jariego & Domínguez, 2014; Maya-Jariego & Holgado, 2005; Molina, Maya-Jariego & McCarty, 2014). With a list of 45 people, optimal information on the structural properties of the network is obtained, overcoming the limitations of social support questionnaires, which traditionally have focused on the (small) core of the personal network in which all contacts are often interrelated. The 53 valued and symmetric matrices, with 45x45 actors and 1,980 edges, were processed and analysed using Ucinet 6 (Borgatti, Everett & Freeman, 2002) and visualised with Visone (Brandes y Wagner, 2004). In total, 2,385 *alteri* and 46,310 relations (out of 104,940 potential relationships) were analysed.

Attitude scale. A list of 16 items, of own elaboration, was presented to respondents to evaluate their attitudes toward potential new economic usages in the port. Specifically, the topics evaluated were the incorporation of tourism activities, the exploitation of historical and ethnographic heritage of the harbour, the opportunities for participation and the development of environmental activities in the port. For instance, some of the items used were: "it is very important to address environmental and ecological issues in fisheries"; "fishing vessels could organise activities for tourists in this port"; "in the harbour, we need a museum or a visitor's centre where knowledge and traditions of fishing are explained"; "we should improve councils and other spaces for participation in the port". Respondents evaluated each item with a scale from 1 "strongly disagree" to 5 "strongly agree".

Three items that during the preliminary analysis did not show consistency with the rest of the scale were left outside. Factor analysis showed six factors in the contents of the scale, accounting for 72.4 of the variance. On the one hand, the four areas of contents under which the scale was originally designed were confirmed, namely: attitudes towards *environment*, *tourism*, *participation* and *heritage* in fishing areas. On the other hand, two items reported willingness to accept the implementation of *immediate changes to the port where the participant usually works*, related to tourism promotion; and the last

factor was composed of only one item related to attitudes towards the *promotion of artisanal fisheries* in Andalusia. The reliability of the scale of 13 items was alpha 0.621.

Types of port. The aforementioned four categories defined by Ruiz & Valcuende (2001) were followed to classify the ports. The 18 fishing enclaves included in our study are quite consistent with the original distribution: 9 are comparatively small ports around a fishing guild (Conil, La Línea, Tarifa, Estepona, Fuengirola, Marbella, Caleta de Vélez, Adra and Garrucha), 4 are small ports where buy-and-sell fish companies have the most central role (Chipiona, Rota, Roquetas and Carboneras), 4 are medium size ports with polarised representativeness between a fishing guild and a ship owners' association (Ayamonte, Isla Cristina, Punta Umbria and Sanlúcar de Barrameda), and 1 is a large port with a complex associative system (Barbate).

2.3. Procedure and data analysis

This article follows an ego-centred network approach. Personal networks are formed around a particular social actor, in our case a member at the harbour, and involve all other actors (or *alteri*) with whom ego is related. In addition to the list of individuals with whom a worker of the port interacts daily in the harbour, the relationship of *alteri* amongst each other was analysed, so as to obtain the structure of relationships. A sample of individuals was surveyed to obtain a sample of personal networks, as commonly done in other studies.

This approach is different from analysis of complete networks, which typically is applied to a previously delimited or defined group, in order to comprehensively examine the relationships between each pair of actors. In the second case, the interviewee does not subjectively define the members of the collective, but instead the researchers establish the boundaries of the network in advance. For complete networks, sampling is usually not applied, but a social system (specifically, its structure of relationships) is described in its entirety.

Most previous research utilising network analysis to study natural resource governance is based on complete networks (Bodin & Prell, 2011), with few exceptions (Marín, Gelcich, Castilla & Berkes, 2012). Accordingly, this work is novel in applying personal network analysis in this area, and also in introducing an innovative approach to characterise intergroup communication patterns. The existence of cohesive groups may support unsustainable environmental practices. Also, the prevalence of intra-group relations between fishermen who fish in different locations, makes it difficult to have a holistic and integrated perception of the seascape (Crona & Bodin, 2011). Through a strategy of simplification of personal networks information, the sample of inter-individual networks was reduced to an aggregated graph of the professional groups that compose it, as well as the existing intra-group and inter-groups relations. Now the analytical strategies that were implemented are explained in detail.

Two strategies were combined in this analysis. First, centrality and cohesion measures were computed to compare the structure and composition of personal networks (McCarty, 2002). Secondly, an approach of visualisation, called clustered graph, was used for summarising and comparing personal networks (both individually and in aggregate) (Brandes, Lerner, Lubbers, McCarty & Molina, 2008; Lerner et al. 2007; Molina, Lerner & Gomez, 2008; García Macías, 2013).

In terms of centrality measures, average degree, average betweenness, average eigenvector, average closeness, degree centralization and betweenness centralization were computed. The cohesion measures calculated were cliques, components, and density. The list of indicators to compare personal networks was originally used by MyCarty (2002), where also a definition of each indicator is provided. This selection of centrality measures consists of the most common indicators in describing networks (both in socio-centric and ego-centric approaches), and adequately represent dimensions of integration, fragmentation and cohesion that have recently been described as the principal components of the structure of personal networks (Lozares, Martí, Molina & García-Macías, 2013; Maya-Jariego & Holgado, 2015). The study by Maya-Jariego & Domínguez (2008) is one of the first studies using network average indicators for comparative purposes.

This study also includes as indicators of cohesion both IQV Index and E-I Index. Both are useful for understanding the possible patterns of homophilic relationships between fishing professionals. The IQV index is a standardised indicator that assesses the degree of heterogeneity of a specific attribute of the *alteri*. In this case, the distribution of frequencies of the *alteri* among different professional roles was observed. An index close to 1 indicates a broad representation of all professional roles in the personal network, while a rate close to 0 suggests a concentration of the *alteri* in few professional roles. Secondly, when a network is divided in two or more mutually exclusive groups, the E-I index is “the number of ties external to the groups minus the number of ties that are internal to the group divided by the total number of ties” (Borgatti et al., 2002). This value can range from 1 to -1 and it is also useful to compare inter-group versus intra-group links. The E-Index was applied to the 8 professional groups, and it was systematically applied to each one of them in relation to the other 7 groups.

In network analysis, data is depicted in a graph in which the individuals are represented by nodes and relationships with ties. The clustered graph approach is used for summarizing information and network visualization in which individual nodes in a graph are replaced by nodes representing categories of individuals or classes (Brandes et al., 2008). For example, in our study each individual mentioned in the personal network (i.e., the *alteri*) is included in one of the eight major occupational categories previously identified: crew, skipper, ship owner, services, market, organization, support and others. Each category is a node in the clustered graph. The weight of relationships within each professional category is represented by the colour gradation of each node. The size of each link represents the weight of relationships between professional categories. Finally, the size of the node represents the relative weight of each professional category in the personal network, that is to say, the proportion of each professional role.

There are several ways to build clustered graphs. The first option is to use the number of relationships as an absolute measure of the intra-class and inter-classes link (Brandes et al., 2008). However, with this procedure, larger classes tend to be more strongly connected. Accordingly, it is necessary to normalize relations (Garcia, 2013; Lerner & Brandes, 2007). This normalization may be based on density measures. For this, it was calculated the ratio between the relationships and all possible ties, which allows us to compare the relationship between classes of different size. However, using density neglects the higher opportunities for relationships of higher size classes, as well as the lower number of links required for obtaining a high density in small size classes (Brandes et al., 2008). A partial solution to these difficulties is to weigh the relationships between

two classes, according to the geometric average size of classes, which is less affected by extreme values than arithmetic mean. In this case, this third approach was used to build clustered graphs (for further information about the mathematical formulation of the different options, see Brandes et al., 2008).

In all cases, comparisons of means were performed using Student's t-test and the nonparametric Mann-Whitney U test, depending on the previous normality test.

3. Results

3.1. Professional categories and fishing grounds

A list of 2,385 *alteri* in the personal networks of respondents was obtained; together with the professional roles of each alter. There are three main categories of professional roles in the Andalusian ports that stand above the rest: crew, ship owners and skippers (Table 1). Interestingly, a different distribution of skippers and ship owners in the personal networks of the Atlantic and Mediterranean was observed. There are more skippers in the Atlantic ($Z = -2.971$, $p < .01$), and more ship owners in the Mediterranean ($t = -2.868$, $p < .01$).

On the other hand, the personal networks of prominent individuals have a higher average number of *alteri* in the role of services and the role of organizing, than crew respondents ($Z = -2.729$, $p < .01$ and $Z = -2.726$, $p < .01$, respectively) and skippers or ship owners ($Z = -2.273$, $p < .05$ and $Z = -2.648$, $p < .05$). They also have a higher average number of *alteri* in the commercial role than the crew ($t = -2.194$, $p < .05$). Finally, the crew members mentioned more crew members in their personal networks, than the ship owners ($t = 2.295$, $p < .05$) and the prominent individuals ($t = 3.735$, $p < .05$).

-TABLE 1 HERE-

3.2. Centrality and cohesion measures in personal networks

Table 2 summarises average centrality indicators. Personal networks of respondents tend to be close-knit networks with a relatively high degree centrality and low average betweenness. However, there are some differences depending on the fishing ground. Personal networks of the Mediterranean ports show an average degree centrality significantly greater than the personal networks of the Atlantic ($t = -2.427$, $p < .05$). Average closeness is also significantly higher in the Mediterranean than in the Atlantic ($t = -2.083$, $p < .05$). Coinciding with this trend towards denser personal networks in the Mediterranean, betweenness centrality is significantly greater in the Atlantic ocean than in the Mediterranean ($t = 3.207$, $p < .01$). Similarly, average centralization, both in the case of degree centralization ($t = 2.037$, $p < .05$) and betweenness centralization ($t = 2.185$, $p < .05$), is also significantly greater in the Atlantic.

Consistently, following the classification of Andalusian ports by Ruiz & Valcuende (2001), average betweenness is greater in ports with polarised representation -in which there is a friction between fishermen and ship owners for dominating the associative space- than in ports organized around a fishing guild ($t = -2.081$, $p < .05$).

-TABLE 2 HERE-

Table 3 shows cohesion, composition and homophily measures of the personal networks. Average density indicates that in the sample of personal networks analysed there are 44 per cent of the possible relationships (considering that only the strong ties between *alteri* are counted). The average number of cliques is high ($M = 122.17$), whereas the EI Index ($M = 0.34$) indicates a moderate value of heterophily depending on the roles played by the *alteri*. The IQV index ($M = 0.81$) shows a high representation of all the roles identified among the *alteri*, and therefore overall a significant diversity in professional relationships of respondents.

Systematic comparisons with the E-I index, show that both crew and ship owners are the roles that are less connected externally with other professional groups. On the other hand, skippers have a tendency to have greater intra-group relationships in the Atlantic ($E-I = 0.536$) than in the Mediterranean ($E-I = 0.823$). Skippers have more external relationships in the Mediterranean than in the Atlantic ($F = 5.398$, $p < .05$); and more specifically, skippers and ship owners are less strongly connected in the Atlantic than in the Mediterranean ($F = 3.28$, $p < .05$).

Personal networks of respondents in the Mediterranean enclaves are denser than in the Atlantic ($t = -2.371$, $p < .05$). However, where more differences are observed is in the personal networks of prominent individuals, compared to the other two groups. Prominent individuals in the port have a higher EI Index (ie, closer to 1, indicating no homophilia) than crew ($t = -3.869$, $p < .01$) skippers or ship owners ($t = -2.858$, $p < .01$). Also their personal networks are more heterogeneous in composition. They have an IQV index higher than crew ($t = -4.255$, $p < .01$) skippers or ship owners (3.223 , $p < .01$). Finally, they have significantly more cliques than crew members ($t = -2.163$, $p < .05$).

-TABLE 3 HERE-

In short, the personal networks of the Mediterranean are more dense and cohesive, and reflect a higher average closeness between actors in the network. On the other hand, in the personal networks of the Atlantic, *alteri* tend to be scattered, with a higher concentration of relations in a group of actors who occupy the centre of the network. Mediterranean enclaves are smaller and tend to engage in artisanal fisheries. In this context, it is more likely that professionals know each other, and often share family and friendship relations. In the Atlantic, there are bigger ports where industrial large-scale fishing is frequent, with more differentiated industrial relations.

With regards to the three types of respondents, it is interesting to note that people with a relevant role in the port, often have more heterogeneous networks than crew, skippers or ship owners. These informants were selected for their role in the harbour, as persons with extensive experience in fisheries, either by having a relevant professional position or a central role in the activity of the harbour. Hence, it is logical that their networks show a large relational diversity, and that in their contacts the diversity of professional roles is widely represented. The composition of their personal network transcends one specific work activity or a defined work space in the port. They usually have a key and central role in the daily life of the harbour.

3.3. From personal networks to clustered graphs

The personal network of each respondent was summarized in the intra-group and inter-group relations among the eight different professional roles. Figure 2 illustrates the process with the example of an interviewee. This procedure was followed with all 53 personal networks, which allowed the comparison between ports, fishing grounds and type of respondent. This case serves to illustrate the procedure that was followed in the construction of clustered graphs. In addition, as shown below, it demonstrates that clustered graphs provide a description of intergroup relations in the port, which is less visible (or even impossible to grasp), if observers look only at the inter-individual level. It also allows us to observe the qualitative context of relationships that occur at the port. The consent of the respondent to utilise his network was obtained, although his contacts are presented anonymously.

Paco is a dockworker in the port of Adra (Almería) and a member of an environmental association (PROMAR). He is someone highly involved in problems relating to both port and fishing (as well as in the town in general). He was interviewed as a prominent individual of the port. Paco collaborates with artisanal fishermen and environmental organisations. He has launched a local organisation of artisanal fishermen (El Chorreón), promoting forms of sustainable fisheries and defending the implementation of marine reserves. He criticises the inability of fishermen to articulate themselves politically, but also tries to defend the collective of fishers. Paco wants to search new ways of fisheries management, considering that the established organizations, as the local fishing guilds, must be reoriented in their aims and procedures. He is currently carrying out an inventory of the vessels affected by attacks of dolphins, so as to request compensatory measures to the government. At the same time, he also has to deal with fishermen who still prefer to use expeditious means to kill protected species, such as bottlenose dolphins.

Paco is convinced that a direct dialogue between government and the fishing sector is necessary and crucial to reach a new fishery management regime. Paco is in favour of the co-management model and has participated in a lot of national meetings, where new ways of fishing management have been discussed. Paco is a key person in the implementation of the government system of fishing management, being a public worker in the dock (he works for the Public Agency of Harbours of Andalusia (APPA), which is part of the regional government of Andalusia) and an environment activist, two roles generally feared by fishermen. Paco stands out as a key person in the local realm, because of this dual role: on the one hand, his capacity as a member of an environmental NGO and his direct relationship within the public administration; on the other hand, his ability to meet the needs and expectations of the fishermen. His position as a mediator is therefore essential.

His personal network, on the left side of Figure 2, is diverse in composition and distributed in several groupings. Typical of key informants, his personal network is more heterogeneous and more heterophile than those of crewmembers and skippers or ship owners. The core of his network is composed of ship owners and staff of the organization of the port, both from APPA and the fishing guild. His interest in sustainable initiatives and the political organization of fishermen is reflected in the connection with key players in the administration. At the periphery of his network, there are other actors, such as service roles (nautical store, security staff) and support services to fishing (maintenance of vehicles or boats in the harbour). Crewmembers and fish sales services also occupy a peripheral position.

Meta-representation reduces the networks of 45 alteri to the intra- and intergroup relationships between 8 professional roles (Figure 2, right side). Both in graphic representation and in the data analysis, interpersonal relations are transformed into relations between groups. In this particular case, Paco's network is built around the axis of ship-owners and staff of the organisation of the port. Interestingly, fishermen have a very minor role and skippers do not even appear. Sales, support and other activities in the port are also present, though in a secondary position.

-FIGURE 2 HERE-

3.4. Clustered graphs of Atlantic and Mediterranean

Figure 3 shows two meta-representations of intra and inter-group professional relations in the Atlantic and Mediterranean fisheries. The results highlight the greater functional differentiation of professional roles in fishing contexts, in which modes of industrial organisation prevail over artisanal fishing. In the Atlantic, a clear difference of roles between the ship owner and skipper is observed. The extractive activity in this kind of fishery is associated with larger fleets, where the owner of the ship often has a role of manager and distributes his/her relationships between different professional classes in the port. There is a strong relationship between the skipper and the crewmembers. On the contrary, in the Mediterranean a strong link between the ship owner and the crew, as well as between the ship owner and commercial roles, is observed. In these ports, fishing is artisanal. A ship owner is generally owner of few boats and often goes fishing daily. Despite the strong link with commercial roles (i.e., a management responsibility), fishing remains artisanal. Informal relationships of acquaintances and kin have prevalence over organisational and labour issues.

This description is consistent with specific comparisons of weighted links. First, the connection between crew and ship owners is significantly higher in the Mediterranean ($Z = -2.477$, $p < .05$), where also intra-group density between ship owners is higher ($Z = -2.857$, $p < .01$). In the Atlantic, skippers are separated as having a distinct role in their own right. Accordingly, intra-group density between skippers is significantly higher in the Atlantic ($Z = -2.716$, $p < .01$).

-FIGURE 3 HERE-

3.5. Attitudes towards tourism, heritage and environment in ports

To assess whether the structure of relationships in each fishing enclave is related to the kind of community reactions to the new fisheries policy, respondents' attitudes towards the implementation of tourism activities and the promotion of cultural heritage in the fishing ports were assessed, as well as the encouragement of participatory and sustainable environmental policies in the sector.

Respondents said they are generally open to the incorporation of new social, cultural and economic uses in the sector (Table 4). They are particularly sensitive to new forms of participatory governance. Workers in the harbour want to improve the forums and opportunities for participation in the port, understand the need to revitalise the industry collaboration and are willing to transfer to all citizens the importance of fishing

in Andalucía. They are also aware of the touristic potential of fisheries, as well as the benefits of implementing specialised museums in some cases. However, the expressed willingness is slightly lower when it involves the relationship with environmental or heritage protection groups, or when asked about implementing immediate changes to their port. In ethnographic fieldwork, different stakeholders expressed their interest in incorporating tourist activities in the harbour. However, they noted both security problems on board and formalities as obstacles. Non-fishing companies are also forced to pay high fees for the occupation of public land for non-fishing activities.

Further analysis showed that there is some association between relational patterns and attitudes towards fisheries policy. Specifically, the existence of a strong inter-group link between crewmembers and ship owners is negatively correlated with attitudes that are more open towards environmental and safeguarding heritage organisations ($r = -.286$, $p < .05$). Meanwhile, a stronger inter-group link between skippers and ship owners is negatively correlated with more positive attitudes towards the promotion of artisanal fisheries ($r = -.325$, $p < .05$). In both cases, data should be interpreted with caution, given that both the fishing ground and the complexity of the port are partly overlapping with the above relational indicators.

On the other hand, a strong link between the administration staff of the harbour with crewmembers ($r = .584$, $p < .01$) and with skippers ($r = -.369$, $p < .05$) is negatively correlated with a favourable attitude towards conservation initiatives of the cultural heritage of the port. Again, organisational roles are stronger and have a distinct profile in industrial fishing of more complex ports, more likely in the Atlantic.

-HERE TABLE 4-

4. Discussion

This research uses a novel approach to describe intergroup relations in fishing enclaves that revealed two distinct patterns of professional socialisation in the two existing fishing areas in Andalusia. Specifically, meta-representations showed two patterns of professional sociability in relation to the complexity of fishing activities in Atlantic and Mediterranean grounds. Overall, Mediterranean networks are organized around extractive activities. In the Atlantic, management activities are different from those of strictly extractive character. These differences seem to respond, at least in part, to the organisational complexity of the fishing ports present in each fishery. For example, small artisanal fishing ports usually yield denser networks with less diversity of professional roles. The concentration of interaction spaces on the ship, in the contexts of primary fishing activity, along with the prevalence of informal relations, result in less differentiation of labor relations. This is reflected in personal networks with a less complex structure. This description is consistent with previous studies on social relations in small-scale fisheries, which have also shown the importance of intermediation relationships both in terms of social capital and management capacity (Begossi, 2006; Marín et al., 2012).

This means that different types of fishing ports are more or less prepared for the changes in the fisheries sector. In the context of new European fisheries policies, small ports seem better-prepared overall for the conversion of fisheries in coastal artisanal activities, insofar as they are closer to the kinds of activities and ways of organisation that

European and regional regulations intend to deploy in the ports. On the contrary, bigger and more complex ports are more likely to suffer the impact of the reduction of trawling and large-scale commercial operations, as well as the reorganisation of the fishery. An extensive ethnographic fieldwork conducted in the two Andalusian fishing grounds, found two fundamental dimensions of variability between the fishing ports: the degree of heterogeneity of the fishing systems and the degree of centralisation of participatory processes (Florido, Martínez, Maya-Jariego, Manjavacas, & Suárez de Vivero, 2015). Comparatively speaking, it is more common to find ports with diversified styles of fishing but also with the presence of a hegemonic entity, typically the fishing guild, which is central in the processes of participation and decision making, in the Mediterranean. This is consistent with the characterisation of communities of small-scale fisheries, in which a wide variety of forms of fishing usually occur in very cohesive groups (Basurto, 2008; Crona & Bodin, 2010).

The existence of hegemonic institutions in the harbour could be interpreted as an indicator of community readiness for policies promoting *artisanalisation* in the sector. Both personal relationships and decision-making are facilitated by a kind of “mediating structure” (Berger & Neuhaus, 1977) that integrates the different stakeholders and has a role of relational integration. In this way, artisanal fishing methods are more naturally suited for traditional modes of organisation, particularly the fishing guilds. Indeed, new forms of associations and trade unions have failed to take root in the sector because traditional fishing is difficult to administer in the conventional top-down mode (FAO, 2013). Specific attempts by the regional government to transform the representation of interests in Andalusia in the 1990s failed (Florido, 2008). Despite the interest of the regional government to develop forms of organization and participation that transcend the local space, traditional guilds seem particularly appropriate and prepared to the new context of fisheries in Spain. They seem to be particularly functional in the sector, due to their ability to enhance linking and bridging social capital, which also in other contexts have proved decisive (Chazdon & Lott, 2010; Marín et al., 2012; Maya-Jariego et al., 2016). Currently, traditional guilds seem to be reacting against new forms of organisation designed by the regional government (v. gr. the creation of Groups for Fisheries Development, or previously the attempts to boosting trade unions’ role) claiming that they provide community and environmental value that are needed in the new situation. The results of the attitude scale in our study point similarly.

As we have seen, the structure of social networks, the types of ports and the leadership of sectoral organisations are relevant factors to anticipate the reactions of local communities to fisheries policies. In the case of Andalusia, it has helped us to make a prospective analysis of new economic uses of fishing ports. The fisheries crisis is leading to a major transformation of the organisational map, with new figures of fish producers and the disappearance of guilds in complex ports or in harbours with a commercial orientation, such as Cádiz, Málaga, Almería, Roquetas and Carboneras (Florido et al., 2015). The sector has failed to organise and voice itself, especially at the European level, but interesting organisational experiences are springing at the local level in line with the new values of the European framework: marine conservation and promotion of complementary activities related to cultural and natural tourism in fishing areas. The regional policies of tourism and fishing heritage are consistent with the Integrated Maritime Policy (2007) and the Marine Strategy Framework Directive (2008), an overall framework for the management of the marine environment, as part of a process of deindustrialization and *artisanalisation* of the sector (Florido, 2008; Suárez de Vivero,

Rodríguez & Florido, 2008). There seems to be some implicit contradiction between attempts to integrate the sector's participation at a regional level, or effort of modernisation of fisheries economics and the process of *artisanalisation* previously described. In any case, there remains a tension between the Common Fisheries Policy of the European Union and former efforts of the regional government to reorganise associations in the fisheries sector. The future of fishermen in Andalusia is partially dependent on how this tension is resolved.

5. Conclusions

In this work, it is found that the network of relationships between professional groups of a port is a proxy of the organisational complexity of fishing communities. Network analysis is useful in the identification and description of key players in the port and can be combined with stakeholders' analysis (Maya-Jariego, Florido, Holgado & Hernández-Ramírez, 2016). The relation between network indicators and the attributes of stakeholders is an area to explore in the future, which can lead to evidence-based stakeholders' classifications (Boschetti, Richert, Walker, Price & Dutra, 2012). In our study, heterogeneous and heterophiles personal networks characterized the prominent people in the port, linking different professional sectors. In the case of Andalusia, some interesting conclusions about the artisanalisation and changes in the fisheries sector were drawn, namely:

- Clustered graph technique allows a comprehensive representation of the intergroup relations between different professional groups in fishing ports. In this research, it served to contrast, in aggregate terms, the differences in the informal relations between the Atlantic and Mediterranean fishing grounds.
- The existence of cohesive relationships in small-scale fisheries communities have traditionally allowed to integrate a wide variety of types of fishing, in terms of fishing gear, species and ecological contexts.
- The introduction of large-scale commercial operations seems to lead to a greater division of labor, reflected in a more complex and fragmented structure of relationships.
- The traditional fishing guilds have a unique role of intermediation between different stakeholders. The guild retains a dominant role in the port, facilitating relational integration and the process of artisanalisation.
- Community readiness for the economic transformation of the ports (integrating tourism and heritage activities) appears to be greater in ports that are either small in size, more relationally integrated or have a strong and functional fishing guild.
- Comparison of fishing grounds in Andalusia has allowed us to document ports that focus on coastal fisheries and ports that combine fishing inshore with long range fishing. This difference of fishing styles also involves different forms of relationship with the environment. In future research, it would be interesting to assess the influence of informal relationships in the harbour and the leadership capacity of the guild in the integration of local ecological knowledge,

encompassing different fishing styles, and thus different socio-ecological systems.

Acknowledgments

Support for this research was provided by the Consejería de Fomento y Vivienda de la Junta de Andalucía (the equivalent to the Ministry of Public Works and Housing of the regional government of Andalusia, Spain). The study of networks and stakeholders is part of a wider project on fishing governance in Andalusia: “Dinamización de los enclaves pesqueros en el sistema portuario andaluz. Usos económicos, gobernanza y patrimonialización” [Revitalisation of fisheries enclaves in the Andalusian port system. Economic uses, governance and patrimonialization] (2013-2015) (CP-2043/0073, GGI3001IDI0). Marta Farré and Sandra Poblet participated in the fieldwork, conducting surveys of personal networks. We thank Romina Cachia and the anonymous reviewers of the journal the list of suggestions made to a previous version of this manuscript.

References

- Agresti, A., and B. F. Agresti. 1978. Statistical analysis of qualitative variation. *Sociological Methodology* 9: 204-237.
- Alegret, J. L. (1990). Del corporativismo dirigista al pluralismo democrático: las Cofradías de Pescadores de Cataluña. *ERES: Serie de Antropología*, 2 (1), 161-172.
- Alegret, J. L. (1996). Ancient Institutions Confronting Change: the Catalan Fishermen’s Confrades. In K. Crean & David Symes (Eds.), *Fisheries Management in Crisis*, Oxford: Finishing News Books, p. 92-98
- Basurto, X. 2008. Biological and ecological mechanisms supporting marine self-governance: the Seri callo de hacha fishery in Mexico. *Ecology and Society* 13(2): 20. [online] <http://www.ecologyandsociety.org/vol13/iss2/art20/>
- Begossi, A. 2006. Temporal stability in fishing spots: conservation and co-management in Brazilian artisanal coastal fisheries. *Ecology and Society* 11(1): 5. [online] <http://www.ecologyandsociety.org/vol11/iss1/art5/>
- Berger, P. & Neuhaus, R. 1977. *To empower people. The role of mediating structures in public policy*. Washington, DC: American Enterprise Institute.
- Bodin, Ö., and B. Crona. 2011. Barriers and opportunities in transforming to sustainable governance: the role of key individuals. Pages 75-95 in Ö. Bodin, and C. Prell, editors. *Social Networks and Natural Resource Management: Uncovering the Fabric of Environmental Governance*. Cambridge University Press, New York.
- Bodin, Ö., and B. Crona. 2009. The role of social networks in natural resource governance: What relational patterns make a difference? *Global Environmental Change* 19(3): 366–374.
- Bodin, Ö and C. Prell. 2011. *Social Networks and Natural Resource Management: Uncovering the Fabric of Environmental Governance*. Cambridge University Press, New York.
- Borgatti, S. P. 2011. *Personal networks and whole networks: a discussion (Keynote speak)*. International Seminar "Personal Networks: Methods and Applications", Barcelona, Spain, UAB, 2011 July 6-8.
- Borgatti, S. P., M. G. Everett, and J. C. Johnson. 2013. *Analyzing Social Networks*. London, UK: Sage Publications.

- Boschetti, F., C. Richert, I. Walker, J. Price, and L. Dutra. 2012. Assessing attitudes and cognitive styles of stakeholders in environmental projects involving computer modelling. *Ecological Modelling. International Journal on Ecological Modelling and Systems Ecology* 247: 98–111.
- Brandes, U., J. Lerner, M. J. Lubbers, C. McCarty, and J. L. Molina. 2008. Visual Statistics for Collections of Clustered Graphs. *2008 IEEE Pacific Visualization Symposium*, 47–54.
- Brandes, U., and D. Wagner. 2004. Visone - Analysis and Visualization of Social Networks. In M. Jünger and P. Mutzel (Eds.), *Graph Drawing Software* (pp. 321-340). Verlag: Springer.
- Cáceres, R., and M. A. Corbacho. 2013. Una propuesta para el análisis de la articulación social del litoral andaluz a través de la pesca. *Revista Andaluza de Antropología* 4: 55-78.
- Carlsson, L., and F. Berkes. 2005. Co-management: concepts and methodological implications. *Journal of Environmental Management* 75(1): 65–76.
- Carlsson, L., and A. Sandström. 2008. Network governance of the commons. *International Journal of the Commons* 2(1): 33–54.
- Chazdon, S. A. and S. Lott. 2010. Ready for engagement: using key informant interviews to measure community social capacity. *Community Development*, 41: 2, 156-175.
- Chuenpagdee, R., Pascual-Fernandez, J. J., Szelienszky, E., Alegret, J. L., Fraga, J., & Jentoft, S. (2013). Marine protected areas: re-thinking their inception. *Marine Policy*, 39 (1), 234-240.
- Commission of the European Communities (2006). *Towards a future Maritime Policy for the Union: A European vision for the oceans and seas*. Green Paper SEC(2006) 689. Brussels: European Union.
- Consejería de Agricultura, Pesca y Desarrollo Rural de la Junta de Andalucía. 2014. *Producción Pesquera 2013*. [online] URL: <http://www.juntadeandalucia.es/agriculturaypesca/portal/servicios/estadisticas/estadisticas/pesqueras/publicaciones/index.html>
- Crona, B., and Ö. Bodin. 2006. What You Know is Who You Know? Communication Patterns Among Resource Users as a Prerequisite for Co-management. *Ecology and Society* 11(2): 7.
- Crona, B., and Ö. Bodin. 2010. Power asymmetries in small-scale fisheries: a barrier to governance transformability? *Ecology and Society* 15(4): 32. [online] <http://www.ecologyandsociety.org/vol15/iss4/art32/>
- Crona, B., & Ö. Bodin. 2011. Friends or neighbors? Subgroup heterogeneity and the importance of bonding and bridging ties in natural resource governance. Pages 206-234 in Ö. Bodin, and C. Prell, editors. *Social Networks and Natural Resource Management: Uncovering the Fabric of Environmental Governance*. Cambridge University Press, New York.
- Domínguez, S., and I. Maya Jariego. 2008. Acculturation of Host Individuals: Immigrants and Personal Networks. *American Journal of Community Psychology* 42: 309-327.
- FAO 2007-2013. Small-scale fisheries. Small-scale fisheries. FAO Institutional Websites. In: FAO Fisheries and Aquaculture Department [online]. Rome. Updated . [Cited 10 November 2013]. <http://www.fao.org/fishery/ssf/155791/en>
- Florido, D. 2003. La Virtualidad de las Cofradías de Pescadores en Andalucía. *Zainak. Cuadernos de Antropología-Etnografía* 25: 37-57.
- Florido, D. 2008. Focusing on artisanal fleets in a new scenario: The case of Andalusia (Spain). *Marine Policy* 32(6): 1004–1012.

- Florido, D., Martínez, I., Maya-Jariego, I., Manjavacas, J. M., and Suárez de Vivero, J. L. 2015. *Informe Final: Dinamización de los enclaves pesqueros del Sistema Portuario Andaluz. Usos Económicos, Gobernanza y Patrimonialización*. Agencia de Obra Pública, Junta de Andalucía. [http://www.aopandalucia.es/inetfiles/agencia_innovacion_estructura/29720151_03352.pdf]
- García-Macías, A. 2013. *Capital social relacional en enclaves de la industria del vestido en México*. Doctoral Thesis. Barcelona: Universidad Autónoma de Barcelona.
- Ictieterm. 2013. *Base de datos terminológicos y de identificación de especies pesqueras de las costas de Andalucía*. [online] URL: <http://www.ictieterm.es>
- Lerner, J., and U. Brandes. 2007. *Comparing networks by their group structure with an application to acculturation networks*. XVII Sunbelt 2007 May 1-6. Corfu, Greece.
- Lozares, C., Martí, J., Molina, J. L., and García-Macías, A. 2013. La cohesión-integración versus la fragmentación social desde un perspectiva relacional. *Metodología de encuestas*, 15, 57-75.
- Marín, A., S. Gelcich, J. C. Castilla, and F. Berkes. 2012. Exploring social capital in Chile's coastal benthic comanagement system using a network approach. *Ecology and Society* 17(1): 13. <http://dx.doi.org/10.5751/ES-04562-170113>
- Maya-Jariego, I., and S. Domínguez. 2014. Two Sides of the Same Coin: The Integration of Personal Network Analysis with Ethnographic and Psychometric Strategies in the Study of Acculturation. Pages 153-176 in S. Dominguez & B. Hollstein, editors. *Mixed Methods Social Networks Research*. Cambridge University Press, New York.
- Maya-Jariego, I. and Holgado, D. 2015. Living in the metropolitan area. Correlation of interurban mobility with the structural cohesion of personal networks and the originative sense of community. *Psychosocial Intervention*.
- Maya-Jariego, I., D. Florido, D. Holgado, and J. Hernández-Ramírez. 2016. Combining Network Analysis and Stakeholder Analysis in Mixed-Methods Research. In L. A. Jason & D. S. Glenwick, editors. *Handbook of methodological approaches to community-based research: Qualitative, quantitative, and mixed methods*. Oxford University Press, New York.
- Maya Jariego, I., and D. Holgado. 2005. Lazos fuertes y proveedores múltiples de apoyo: comparación de dos formas de representación gráfica de las redes personales. *Empiria. Revista de metodología de ciencias sociales* 10: 107-127.
- Maya-Jariego, I., Holgado, D., Florido, D. and Martínez-Alba, I. 2016. Redes entre dos mares: relaciones entre cofradías y asociaciones de armadores en los caladeros atlántico y mediterráneo de Andalucía. *Revista Española de Investigaciones Sociológicas*, 155, 113-132.
- McCarty, C. 2002. Structure in Personal Networks. *Journal of Social Structure* 3: 1.
- Molina, J. L., J. Lerner, and S. Gómez. 2008. Patrones de cambio de las redes personales de inmigrantes en Cataluña. *REDES. Revista Hispana para el Análisis de Redes Sociales*: 15(4): 35-60.
- Molina, J. L., I. Maya-Jariego, and C. McCarty. 2014. Giving Meaning to Social Networks: Methodology for Conducting and Analyzing Interviews Based on Personal Network Visualizations. Pages 305-335 in S. Dominguez & B. Hollstein, editors. *Mixed Methods Social Networks Research*. Cambridge University Press, New York.

- Prell, C., M. Reed, L. Racin, L., and K. Hubacek. 2010. Competing Structure, Competing Views: The Role of Formal and Informal Social Structures in Shaping Stakeholder Perceptions. *Ecology and Society* 15(4): 34.
- Ríos, S. 2005. Origen y desarrollo de la industria de conservas de pescado en Andalucía (1879-1936). *Revista de historia industrial* 29: 55-86
- Ruiz, E., and J. M. Valcuende. 2001. *Asociacionismo y representatividad en el sector pesquero andaluz*. Junta de Andalucía, Consejería de Agricultura y Pesca.
- Sandström, A. 2011. Social networks, joint image building, and adaptability: the case of local fishery management. In Ö. Bodin, and C. Prell, editors. *Social Networks and Natural Resource Management: Uncovering the Fabric of Environmental Governance*. Cambridge University Press, New York.
- Suárez de Vivero, J. L. (2007). The European vision for oceans and seas—Social and political dimensions of the Green Paper on Maritime Policy for the EU. *Marine Policy* 31: 409-414.
- Suárez de Vivero, J. L., J. C. Rodríguez, and D. Florido, D. 2008. The paradox of public participation in fisheries governance. The rising number of actors and the devolution process. *Marine Policy*, 32: 319–325.

Table 1. Distribution of professional roles of alteri depending on the professional role of ego and fishing ground

	Crew		Skipper		Services		Ship-owner		Market		Organization		Support		Others		All
	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F	%	F
All	674	28.25	351	14.71	87	3.65	600	25.16	258	10.82	126	5.28	218	9.14	71	2.98	2385
Crew	299	39.08	97	12.68	14	1.83	202	26.41	56	7.32	20	2.61	59	7.71	18	2.35	765
Ship-owner or skipper	218	26.91	150	18.52	21	2.59	225	27.78	93	11.48	27	3.33	57	7.04	19	2.35	810
Key Informant	157	19.38	104	12.84	52	6.42	173	21.36	109	13.46	79	9.75	102	12.59	34	4.29	810
Mediterranean Sea	351	28.89	109	8.97	35	2.88	383	31.52	116	9.55	63	5.19	117	9.63	41	3.37	1215
Atlantic Ocean	323	27.61	242	20.68	52	4.44	217	18.55	142	12.14	63	5.38	101	8.63	30	2.56	1170

F = Frequency of alteri in each professional role, % = Percentage of alteri in each professional role.

Table 2. Centrality measures of the personal networks

	All		Crew		Ship-owner or Skipper		Key Informant		Mediterranean Sea		Atlantic Ocean	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Avrg. Degree	43.90	26.20	41.62	33.58	44.07	26.86	45.87	17.53	52.09	29.33	35.39	19.63
Avrg. Betweenness	1.36	0.89	1.64	1.11	1.17	0.70	1.30	0.80	1.01	0.84	1.73	0.80
Avrg. Closeness	54.13	27.22	54.04	31.66	54.71	28.88	53.62	22.11	61.54	30.10	46.44	21.87
Avrg. Eigenvector	18.12	4.30	18.19	2.57	18.50	2.90	17.68	6.46	17.80	5.86	18.46	1.67
Avrg. Degree Cent.	35.13	16.14	32.80	18.82	34.19	17.41	38.28	10.36	30.83	17.61	39.60	13.37
Avrg. Betw. Cent.	10.36	10.70	13.80	13.29	9.05	10.10	8.42	8.03	7.32	8.95	13.52	11.59

Table 3. Cohesion measures of the personal networks

	All		Crew		Ship-owner or Skipper		Key Informant		Mediterranean Sea		Atlantic Ocean	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Density	0.44	0.26	0.42	0.33	0.44	0.27	0.46	0.17	0.52	0.29	0.36	0.19
N° Cliques	122.17	162.25	59.35	69.74	124.72	136.75	178.94	223.35	93.15	96.46	152.31	207.91
N° Components	2,81	3,96	3.41	4.39	3.00	4.35	2.06	3.13	3.04	4.79	2.58	2.93
E-I Index	0.34	0.22	0.23	0.14	0.31	0.22	0.48	0.14	0.34	0.20	0.34	0.25
IQV	0.81	0.10	0.74	0.11	0.79	0.09	0.88	0.07	0.79	0.10	0.82	0.11

Table 4. Attitudes towards new usages in fishing enclaves by role and fishing ground

	All		Crew		Ship-owner or Skipper		Prominent Individual		Mediterranean		Atlantic	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Scale	4.12	0.52	4.18	0.50	4.15	0.56	4.04	0.51	4.23	0.51	4.01	0.51
<i>Tourism</i>	4.02	1.07	4.12	1.14	4.00	1.057	3.94	1.07	4.17	1.05	3.87	1.09
<i>Environment</i>	3.58	1.02	3.45	1.06	3.69	1.11	3.59	.91	3.62	1.00	3.54	1.05
<i>Changes in my port</i>	3.81	1.32	3.94	1.14	3.94	1.30	3.55	1.50	4.02	1.19	3.60	1.43
<i>Participation</i>	4.62	.55	4.69	.58	4.54	.72	4.65	.31	4.68	.52	4.56	.59
<i>Heritage</i>	4.44	0.89	4.53	.78	4.50	.79	4.31	1.10	4.63	.70	4.25	1.03
<i>Artisanal fishing</i>	4.44	1.03	4.71	.99	4.39	1.19	4.22	.88	4.52	.98	4.35	1.09



Figure 1. Survey of fishing enclaves in Andalusia: Atlantic and Mediterranean ports.

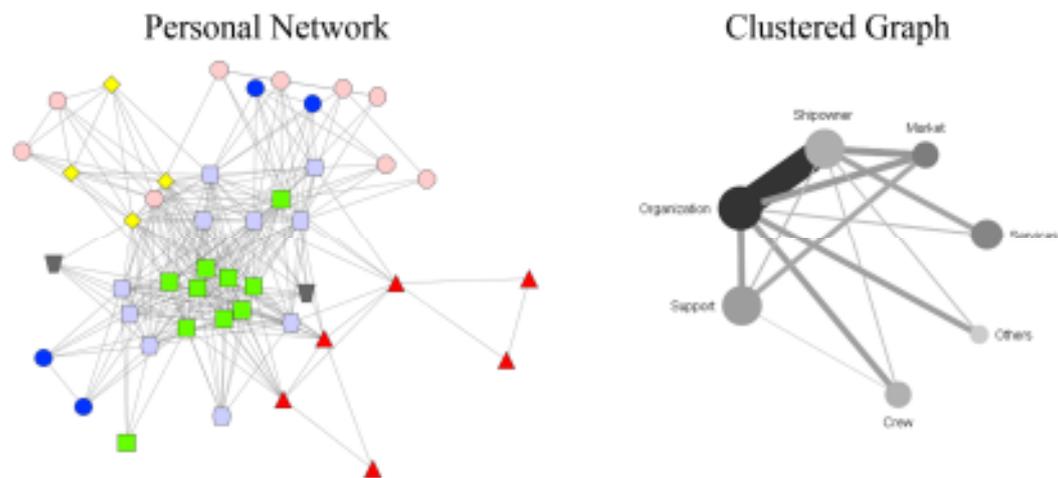


Figure 2. Left, personal network with 45 alteri: Blue: crew; Red: services; Green: ship-owners; Yellow: marketing roles; Grey: management roles (organization); Pin: support roles; Grey: other members of the harbour. Right, clustered graph: Each professional category is a node in the graph. The colour intensity of each node represents the weight of relationships *within* the professional category. The size of each link represents the weight of relationships *between* professional categories. The size of the node represents the relative weight of each professional category in the personal network.

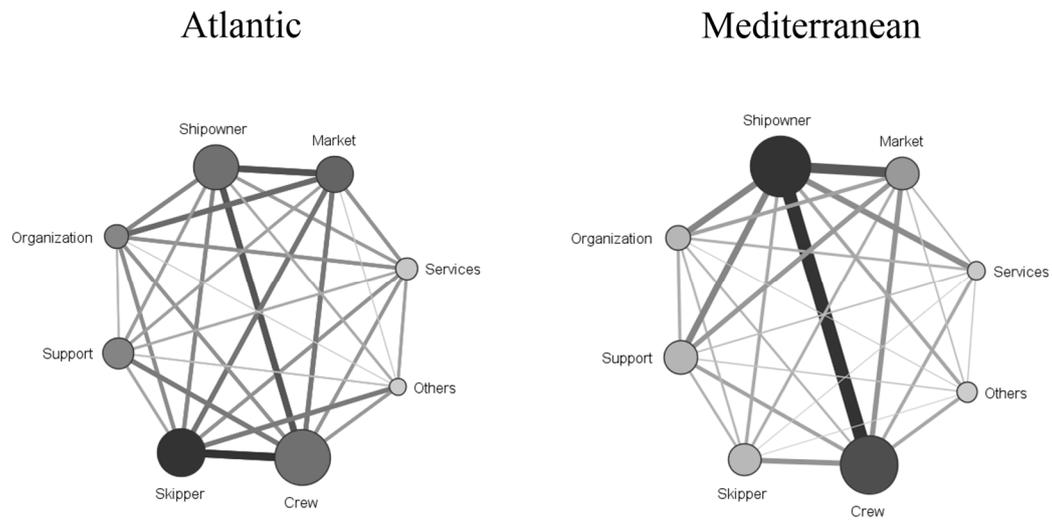


Figure 3. Each professional category is a node in the graph. The colour intensity of each node represents the weight of relationships *within* the professional category. The size of each link represents the weight of relationships *between* professional categories. The size of the node represents the relative weight of each professional category in the personal network.