Social network analysis as a tool to inform sustainable multi-sectoral management in complex marine socioecosystems

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Our case study

In complex marine socioecosystems, where multiple sectoral activities coexist, management can be especially complicated. This is the case of the coupled Guadalquivir estuary - Gulf of Cadiz (Ge-GoC) system. The Guadalquivir estuary (SW Spain) plays a central role in the whole Gulf of Cadiz since many fish species use these waters as a nursery area. Therefore, not only fisheries management is important but also the environmental status of the estuarine waters. The latter will have an effect on the adult populations via recruitment. Human activities that directly or indirectly influence the estuary include fishing, agriculture, shipping, saltworks, tourism or aquaculture among others. Conflict among them are common. In this context, we have used social network analyses as a first step to create an analysis and decision-support framework to achieve balanced socio-ecological ecosystem based management (EBM) to the Ge-GOC.

Material and Methods

We interviewed 55 actors from 11 different sectors related with the exploitation, management, research and conservation in the Ge-GOC. We asked them about the frequency and type (e.g. assidiuity, power dynamics, alignment, etc.) of the interactions between them as well as their particular management goals.
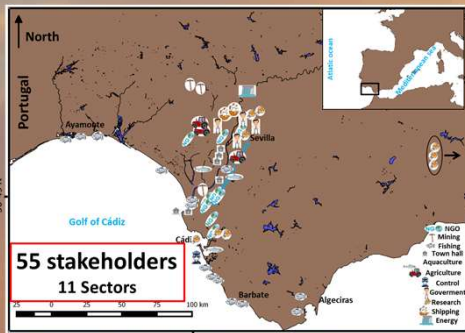

Figure 1: Study area with actors locations by sector

Figure 2: Guadalquivir estuary from Coria del Rio

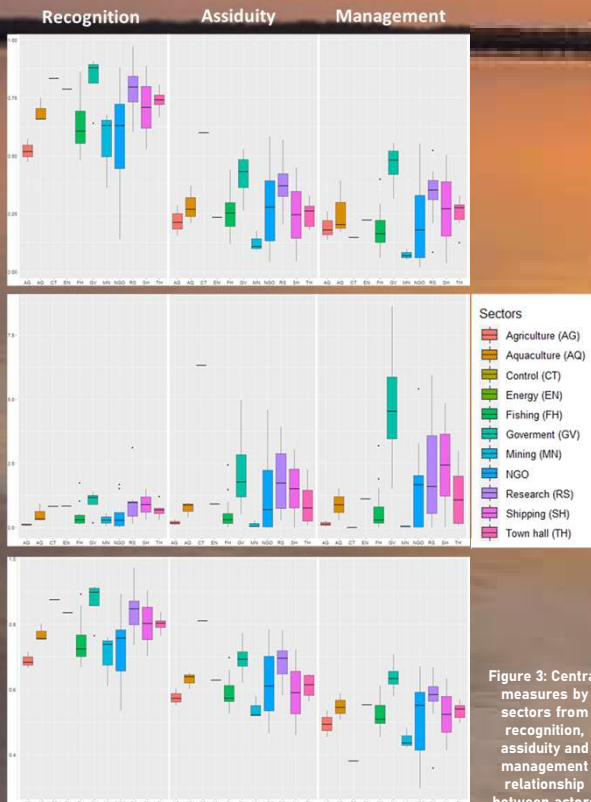| Questions	Scoring
1 - Do you **recognize** this organization?	0,1
2 - **How often** does your organization have contact, participate in events or meetings with this organization?	0…3
3 - Have you participated with any of the following organizations in **management tasks**? And specifically in management tasks of the Guadalquivir estuary?	0…2
4 - Do you consider that the organizations on the list are **aligned** with the objectives of your organization regarding the management of the Guadalquivir River estuary or do you think that they **disagree** with them?	-1…1
5 - How much **influence** do you think the following organizations have on **decision-making** in the management of the Guadalquivir River estuary?	0…5
6 - Are positive or negative the following **management objectives** to you organization?	-4…4

Table 1: Questions used to perform the network analysis

Results

Except for shipping optimization, all actors have similar management goals, where water contamination, invasive species and illegal fishing were flagged as major socioecological problems.

There are significant differences between sectors regarding central measures. For example, government, research and control (enforcement and inspection service) are key sectors of the socioecosystem while mining is quite out. Among the 10 most relevant actors we found a research organization, shipping, government, NGOs, fishermen's guilds and universities. Regarding power dynamics, government, shipping and energy were found to be most influential. Lastly, NGOs control and research are the most aligned sectors regarding the actors goals.
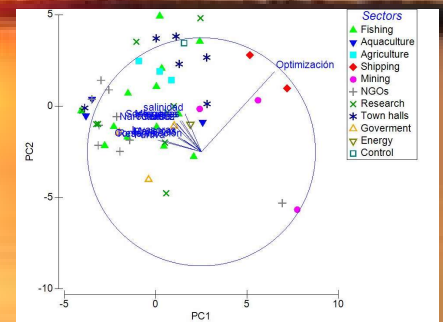

Figure 3: Central measures by sectors from recognition, assiduity and management relationship between actors

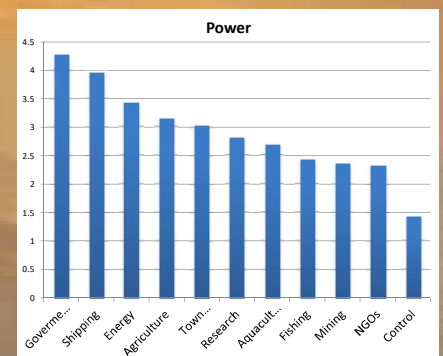Figure 4: management goals PCA analysis by sectors

Figure 5: Power dynamic by sectors

Conclusion

Social network analysis has proven to be a useful tool to promote a rationale of social interaction logics and a political environment suitable for the promotion of participatory processes. In this way, we can offer a framework that can be institutionally translated into more transparent collaborative governance mechanisms, which are based on the knowledge contributed by all the actors within the socio-ecosystem.

Bibliography

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