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Regionalization of the artisan fisheries in Baja California Sur, Mexico using the social criteria of the fishing cooperatives

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ABSTRACT

Objective: To generate a proposal for regional categorization (regionalization) of fishing villages in Baja California Sur, Mexico, following social and economic fishing criteria.

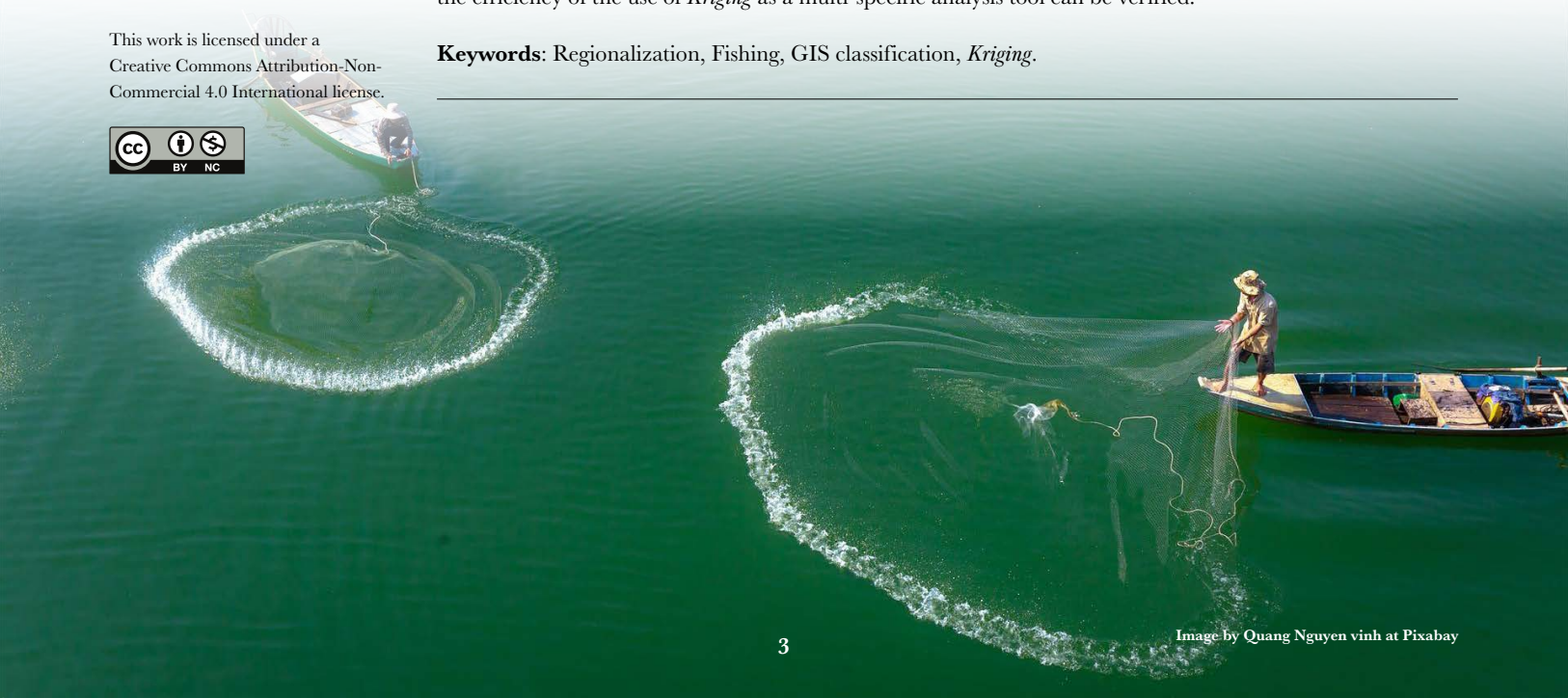
Design/Methodology/Approach: Socioeconomic data on fishing in Mexico are analyzed. This regionalization uses data collected in the field on the conditions of artisanal fishing cooperatives in Baja California Sur, Mexico (BCS). Subsequently a geo-referential methodology linked to a database was applied. Database was re-categorized by nominal or ordinal statistical values, as it was the case for each. ArcView 3.2 Geographic Information System (GIS) was used to obtain the geo-referenced classification. Then, a geostatistical analysis derived from the *Kriging* tool was applied.

Results: We obtained a regional classification of fishing in Mexico, displayed in maps with vector data. The regionalization is of a social nature, it shows a classification of cooperation level at artisanal fishing cooperatives in the fishing towns of northern Baja California Sur (BCS).

Limitations/Implications: The lack of socioeconomic data on fisheries in Mexico has been an important limitation to generate a more accurate regionalization of the Mexican coasts.

Findings/Conclusions: Analyzing the social and organizational factors of fishing is necessary for the understanding of marine socio-ecosystems in Mexico. These criteria joined to the use of computer tools allowed the regional geo-located categorization of areas with similar characteristics. Whit the use of this methodology the efficiency of the use of *Kriging* as a multi-specific analysis tool can be verified.

Keywords: Regionalization, Fishing, GIS classification, *Kriging*.



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INTRODUCTION

The services that nature provides to society can be classified as provisioning, regulation and cultural (Cervantes and Ramírez, 2012). Each of these services is always approached from the utilitarian point of view as human beings, which organically alters the natural biological system of ecosystems to obtain profit and commodities.

The State of Baja California Sur (BCS) is characterized by having the widest coastline in the entire Mexican Republic with 2,131 km in length (INEGI, 2010) which, together with the great diversity of marine fauna, many of them usable in fishing extraction and with a high economic value, give the state a great fishing potential. Fishing and activities that take place at sea are the main economic activity of this state.

The level of social organization in which the fisheries sector operates is a key to make the better management projections and operations that research institutions may offer. The relationship that exists between nature and society is undeniable, since they are not independent entities, but on the contrary, "humanity depends on nature and the supply of services that nature generates" (Cervantes and Ramírez, 2012).

The case-study is delimited to ocean bank fisheries, it aims for a regionalization based on those differences in social organization found among the operative artisanal fisheries in the northern zone of the western and eastern coastlines of the state; to reassess the importance level that social organization generates in the extractive activity of fishery products in the area.

Regionalization criteria in this study is defined by the level of communal organization that artisanal fishing cooperatives (Sociedades Coorperativas de Producción Pesquera - SCPP) show, particularly those found on the coastline of the northern zones of BCS state.

MATERIALS AND METHODS

Regionalization is based on social aspects that have a clear impact on the geographical environment in which the economic population of this sector operates. As they are people who have their lives in common on land, but their job object is at sea, it is necessary to observe the organizational procedures that they perform in order to carry out their common activity.

In the first instance, the entire organization and social life of coastal fishermen is centered on the community, on the land where their daily life occurs. The organization, transfer, marketing, and management of fishery products are made on mainland. Because of that, organizational and community impacts reflect on the infrastructure actually existing in town. This is, the settlement of a given SCPP is a perfectly locatable geographical point on the mainland; where the effects of their organization forms, being legal or informal, will have immediate repercussions on their population settlement, the fishing village.

Socio-economic data of fishing villages were compiled by public participation methodologies, which provide technical certainty and reduce privileged access to the process (SEMARNAT, 2006; Espejel *et al.*, 2006). Likewise, these participatory processes can incorporate the local and traditional ecological knowledges, as complementary sources of information (Espinoza-Tenorio *et al.*, 2010; Moreno-Báez *et al.*, 2010).

Therefore, through an on-site participants survey at each locality in the case-study and a Likert-type questionnaire, the conditions of basic services, road communications, and marginalization degree of housing infrastructure were defined by members of the community.

Likewise, through participant observation processes, data on the human settlement of each port were obtained. Observing the quality of basic services, the apparent wealthy level of the community, the purchasing power that at first glance stands out in the area; as well as the overall standard of living shown by the locality. These data complement those collected through the Likert questionnaire, and together render an accurate image of the cooperative situation in the study area.

Afterwards, the operant fishing cooperatives were located with GPS in each town, to generate a geospatial database compatible to visualize in ArcView 3.2 (Figure 1).

The GIS database input were those field collected data. A questionnaire was applied in order to record 18 cooperative indicators (Table 1) in the SCPP of these localities: Puerto San Carlos, Puerto Adolfo López Mateos, Punta Chale, Punta Abreojos, La Bocana, San Juanico, El Cardón, Estero el Dátil, Guerrero Negro, Punta Chivato, San Juaniquito, El Saucito, Arroyo Hondo, Santa Inés, and La Ventana, among other towns in the BCS state. These indicators are the foundation for the study delimited by fishing cooperatives. They are based on the knowledge, understanding, and practice of cooperative values, as well as on the economic and social impact that the organization has on the community.

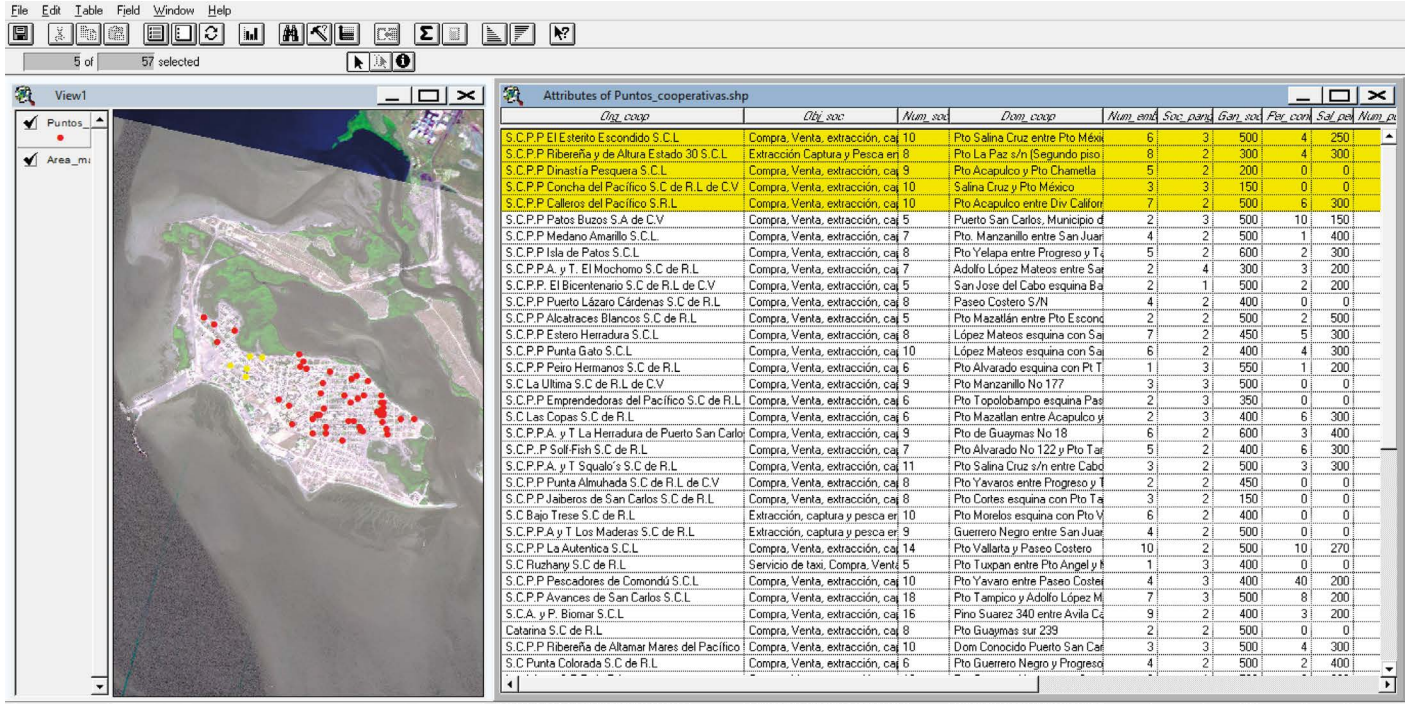

Figure 1. The locality of Puerto San Carlos, BCS, Mexico, georeferenced via its SCPP database.

Table 1. Cooperative indicators collected in the surveys in different towns of Baja California Sur, Mexico.

Organization starting-up	Teamwork
Work plans	Group
Partners	Evaluation of results
Ranked knowledge	Commercialization
Link with institutions	Extraction
Studies / culture	Supports
Management	Increase in infrastructure and equipment
Organization of activities	Individual benefits
Decision making	Community benefits

This study includes cooperative participation as human labor, fair and cooperative, equitably redistributed among all members of the community. This is made to achieve increase in the quality of life of members and extended to the population where the fishing cooperative is located.

The process of value estimation given to each locality was obtained through this formula:

$$V = \frac{\sum_1^n \frac{(P + C + G)}{3}}{n}$$

Where: V=Obtained Value of the level of cooperative participation in each fishing locality, categorized into three classes (high=3, medium=2, low=1); n=The number of cooperatives visited in each of these localities; P=Average value of the knowledge and practice of the cooperative values and principles, as expressed by the cooperative partners; C=Wealthy level, as observed within a range (low, medium, and high), that was classified based on the housing and utilities infrastructure at the locality; G=Average value of profit on the fishing product extracted by fishing partner in each locality.

After obtaining the value of V for each locality, a geostatistical Kriging interpolation methodology (Bosque, 1997) was applied, which acts under spatial delimitation algorithms based on the categorization and prediction of polygons built based on points of similar value (Villatoro *et al.*, 2008) and geospatial proximity assuming a correlated point distribution (García *et al.*, 2010; Murillo *et al.*, 2012; Paredes *et al.*, 2013). Output is then, a regionalization map of the artisanal fishing cooperative participation (Figure 2).

RESULTS AND DISCUSSION

A clear and contrasting difference was found between the fishing communities of the North Pacific region along the western coast of BCS, and the communities located in the southern area of the western coast.

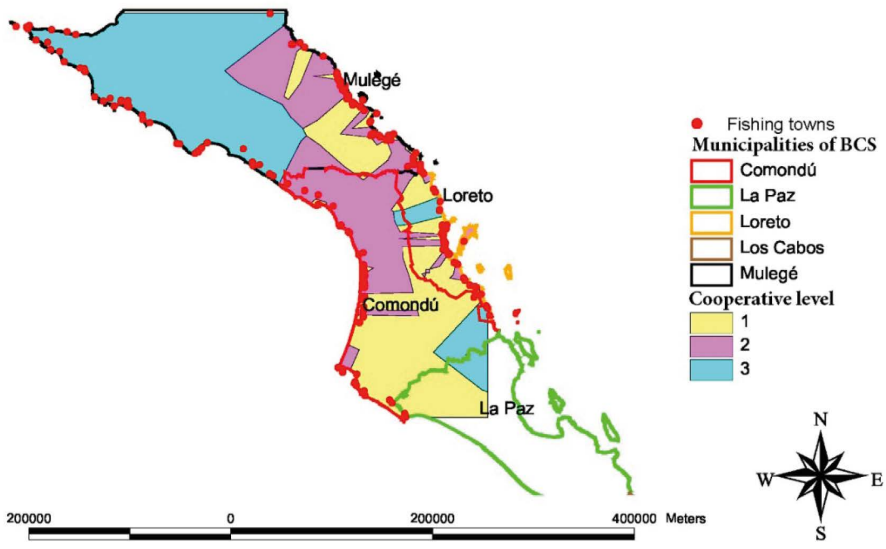

Figure 2. Regionalization by level of cooperative participation in artisanal fishing communities in Baja California Sur, Mexico.

The region classified as **High=3 Cooperative participation** has localities that host a minimum of 1 and a maximum of 3 SCPPs. These are large cooperatives with a large conglomerate of members. The fishing products obtained here are of great commercial value, identified species such as abalone, lobster, shrimp, squid, flake and geoduck. The marketing of these products is carried out directly by the cooperative without the need for intermediaries, and they manage to reach international markets.

The level of infrastructure of the organization is wide, it is shown in large buildings that function as offices and warehouse. They have a large vehicle park with which they deliver to the markets where the international costumer expects the product as fresh as possible to make shopping as living products.

The level of quality of life in the fishing villages in this region is high, they have all basic services, electricity, water, telephone and signal for mobile phones. In addition, housing shows their high value, people's property there is classified as luxury items. But it is this which shows the great economic capacity that a well-organized management, by this type of stakeholders can offer for the fishing community development.

The opposite occurs in the area categorized as **Low=1 Cooperative participation**. In these locations there is a highly concentrated population density, a lot of SCPP are merely family business with little involvement of active partners in each Organization and cooperating participation is nonexistent and decisions are pertaining to the commissariat. There is great competition between existent SCPPs for fishing and sale spots and the product; consequently, fishermen become victims of business intermediaries who buy the product on the beach and devalue the sale.

The localities have a well-structured road network with asphalt layer, basic services are available to the entire population, housing is of medium-scale, and opportunities to obtain a better quality of life through artisanal fishing are less.

In the region classified as **Medium=2 Cooperative participation**, an advanced cooperative organization with community principles and values is shown. The number of cooperatives that appear in each locality ranges from one to two. And access to the community, and the commercialization of the fishing product are undergoing improvement, and certification processes, respectively. That is, they are seeking to trade directly with international markets.

In addition to this, those localities extract certain species targeted as high commercial value without governmental permission. This is relevant because it demonstrates a weak linkage, just emerging with government institutions. This area is undergoing the process of consolidating as high cooperative participation.

CONCLUSIONS

Regionalization of fisheries in the northern coast of Baja California Sur, Mexico, under social and cooperative criteria, allows us to observe the benefits that the good practices of cooperative participation can generate. The main indicators that allowed regionalization were the organizational level; the infrastructure of the locality; the purchasing power of the fishermen; their legal status (species extraction permits and credentials for the boats); the management capacity; and link with the institutions and other organizations; as well as the practice of cooperative values by the organization and coastal fishermen. The high cooperative participation is demonstrated in the communities located northern in the state. Communities such as Guerrero Negro, Punta Abreojos, and La Bocana. It is characterized by levels of extensive management, international marketing, well-grounded housing infrastructure and labor; their cooperative values are well-known and well-practiced by coastal fishermen. The medium cooperative participation is characterized by the coercive capacity of partners, which it has been achieved due to excellent organization. However, the relationship with the institutions, the acquisition of fishing permits, and the credentials of the boats takes more time than which would be expected. It is concluded that management and legal permits processing capacity are impaired. The low cooperative participation is located in the southern part of the study area. Towns like Puerto San Carlos and Puerto Adolfo López Mateos show a lacking sense about cooperative participation. The level of social organization is low because there are many those so-called family cooperatives. They are worked on an individual basis; commercialization of fishing products and marketing are carried out on the beach. In addition, the competition among cooperatives is high. It becomes necessary to set up basis to analyzes with a systemic approach that combine the multiplicity of quantitative and qualitative variables in the fishing operations context.

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