Regionalization of fish production in Mexico based on production value data in MXN pesos

Magadán-Revelo, L.D.[1*]; **Escalona-Maurice, M. J.**[1]; **Fernández-Ordóñez, Y. M.**[1]; **Aguilar-Ibarra, A.**[2]

[1] Colegio de Postgraduados, Campus Montecillo, Posgrado en Socioeconomía, Estadística e Informática–Desarrollo Rural, Carretera México-Texcoco Km. 36.5, Montecillo, Texcoco 56264, Estado de México, México.

[2] Instituto de Investigaciones Económicas, Universidad Nacional Autónoma de México, Circuito Mario de la Cueva, Ciudad de la Investigación en Humanidades, Ciudad Universitaria., 04510 Ciudad de México, México.

* Correspondence: magadan.luis@colpos.mx

ABSTRACT

Objective: Generate a fishing regionalization activity in Mexico based on the economic criteria due to the value of fishery production.

Design/Methodology/Approach: Socioeconomic data was taken as well as analyzed from the Statistical Yearbook of Aquaculture and Fisheries of fisheries in Mexico. Subsequently, the findings were organized in a database with geospatial referent reclassified into nominal or ordinal qualitative statistical values. The reclassification process was done through the use of a Geographic Information System, specifically with Arcview 3.2 software, which allowed the generation of geostatistical analysis procedures through the use of the *Kriging* tool.

Results: The results are displayed in a visually referenced database shown on a map constructed by data vectorization. The regionalization map of fisheries in Mexico is based on economic criteria of production value classified in four zones with different fishing priority.

Limitations/implications: The lack of studies and social, economic and productive indexes of the Mexican fishery is a limitation in the work of regionalization of fishing activity.

Findings/conclusions: The efficiency of the use of *Kriging* as a multispecific analysis tool can be proven. The proposed regionalization is based solely on the monetary value, an item that has a greater weight in the decisions made by the institutions, due to its importance in terms of Mexico's Gross Domestic Product. These criteria together with the use of computational tools allowed the geolocalized regional categorization of zones with similar characteristics classified into four fishing regions according to their degree of economic importance: low, medium, high and main.

Keywords: Economic regionalization, Geostatistics, Mexican fishing, Value of production.

Citation: Magadán-Revelo, L.D., Escalona-Maurice, M. J., Fernández-Ordóñez, Y. M., Aguilar-Ibarra A. (2023). Regionalization of fish production in Mexico based on production value data in MXN pesos. *Agro Productividad*. https://doi.org/10.32854/agrop.v16i7.2626

Academic Editors: Jorge Cadena Iñiguez and Lucero del Mar Ruiz Posadas

Received: November 20, 2021.
Accepted: April 17, 2023.
Published on-line: July 26, 2023.

Agro Productividad, 16(6). June. 2023. pp: 135-141.

INTRODUCTION

Regionalization is the set of integration processes that take place effectively within one or more geographical areas. This phenomenon shares the intensification of relations between state and non-state actors in the same region (Molina, 2007). "It is the intensity of

Image by günter at Pixabay

economic interactions that allows us to speak of the existence of regionalization processes, in which both political and economic interests and underlying ideological-cultural elements converge" (Ibáñez, 1999, 3).

Regionalization refers to the interpretation of processes and space-temporal characteristics existing in locatable geographical points. Data analysis allows us to find differences and similarities when extrapolated to a georeferenced visual projection in a geographical space. They allow us to demonstrate established limits and areas that share topographic, cultural, social, political similarities, etc. The regionalization process is a subjective exercise since the characteristics of the variables confronted are submitted to the needs of the researcher.

The marine areas of our country have been worked under the concept of regionalization by several scholars of the matter using as criteria mere biological and geographical aspects. In Mexico the most emblematic studies are those made by Merino (1987), who distinguishes seven coastal areas with clear geographical and fish-population based differentiation. The studies carried out by Arriaga *et al.* (1998) and Botello *et al.* (2000) recognize seven coastal provinces and five oceanic provinces which are regulated by the Mexican State.

Coastal zones thus regionalized in these studies are defined by exclusively marine features such as bathymetry, coastline, seamounts, fish or related species, ocean currents, etc.; but they leave aside the social action that the fishing communities imprint on the development of these regions.

The Mexican National fisheries institute (Instituto Nacional de la Pesca, 1994) developed their own regionalization based on the exploitation of biotic fishing resources (Figure 1). The fishing resources obtained in the areas described by INAPESCA are the classifying variable.

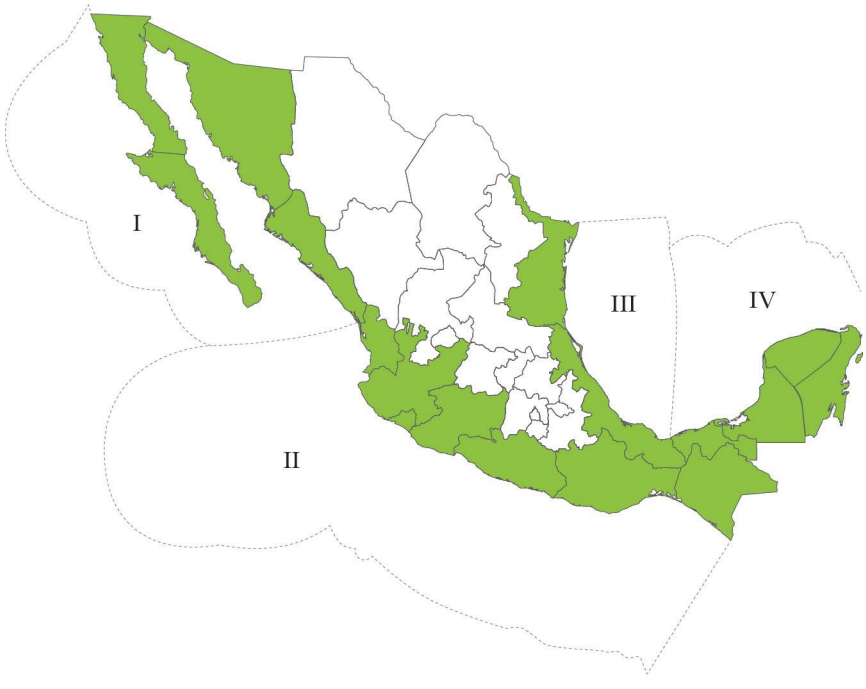

Figure 1. Regionalization of fisheries (INAPESCA, 1994).

Fishing activity is limited to a historical-social context; in which the action of the human being as a transformer agent of the world should be present in the regionalization exercises. However, there are not many proposals for socioeconomic regionalization of fishing localities in Mexico since they are not recognized as an inter sectorial entity in economic terms. They are not based on the actions of organized fishing communities, at least.

An attempt at social-based regionalization is the study by Espejel and Bermúdez (2006) that analyzes basic fishing units and propose 178 coastal units as the regionalization of the local coastal regulations that would be developed in Mexico. They mention that in order to regionalize the Mexican seas and coasts, it is necessary to agree on all the existing information expressed in previous efforts. Inside their methodology of study, they do not show or suggest which tools would be the best to make the crossing of those data that authors used as basis for their proposals.

Espinoza *et al*. (2014) mentioned that in the development of an adequate regionalization, data such as: a) new quality controls of fishery, b) supply and demand of fishery products, c) the use of fishing gear, and d) biological and environmental conditions of the fishing area. Once again, reference is made to multiple factors in the regionalization process, leaving aside the actions of the stakeholders who operate fishing.

The lack of socioeconomic data on fisheries in Mexico has been an important limitation to generate a more accurate regionalization of the Mexican coasts. The institutes in charge of fisheries research in Mexico (INAPESCA and CONAPESCA) have put aside the incorporation of social analyses of the communities, and INEGI has only focused efforts on the incorporation of macroeconomic data on extraction and sale, as it is confirmed in the data of the statistical yearbook "Anuarios Estadísticos de Acuacultura y Pesca" provided by CONAPESCA. So it becomes impossible to have a visible reference about community action in the extraction operation of the fishing in Mexico.

The purpose of our study is then, to give two proposals for regionalization of coastal areas in Mexico under social and economic criteria of fisheries, but assigning data relevance to the fisherman as an stakeholder and central node of the activity.

MATERIALS AND METHODS

As a first study of regionalization of fisheries in Mexico we used the data provided by Mexican National fisheries commission (Comisión Nacional de Pesca) (CONAPESCA, 2015). The official website contains the 2017 production database (Base de datos de Producción Anuario 2017), which was used as the reference source to carry out our first regionalization scenario.

The Anuario estadístico de Acuacultura y Pesca (CONAPESCA, 2017) is the main source of data provided by Mexican institutions. The data presented there were collected by the fisheries offices of the different states in Mexico and these were classified by mere numerical values of production. The data fields with greater representation are: a) Landed weight, b) Live-weight, and c) Market price (MXN pesos).

First, a database was generated where the aquatic aspects were discriminated, since these are not of interest for the purposes of our study. Then, the data of "Market price in

MXN pesos" was classified into conglomerates of subtotals by state. With this, we obtained a quantification of the fishing economic importance for the selected geographical areas.

The classified data were the input, by means of a relational table, of an ArcView 3.2 layer, then georeferenced into a polygonal shape (.shp format).

Values were classified by quartile and reclassified into qualitative variables characterized under the nominal criterion of economic importance (*i.e.* market price), where: 1 = Low, 2 = Medium, 3 = High, and 4 = Main (Table 1).

Table 1. Reclassified market price as estimator of the value of fishing production.

NOM_ENT	VALUE_PROD $	REG_VALOR	Reclassification
Distrito Federal	0	1	Low
Aguascalientes	6,459	1	Low
San Luis Potosí	7,949	1	Low
Zacatecas	38,082	1	Low
Querétaro	109,164	1	Low
Tlaxcala	127,181	1	Low
Hidalgo	271,068	1	Low
México	513,068	1	Low
Puebla	602,282	1	Low
Nuevo León	732,804	2	Medium
Chihuahua	792,149	2	Medium
Durango	1,690,242	2	Medium
Morelos	3,168,984	2	Medium
Coahuila de Zaragoza	15,934,130	2	Medium
Guanajuato	24,619,334	2	Medium
Quintana Roo	158,384,456	2	Medium
Michoacán de Ocampo	188,026,961	2	Medium
Guerrero	202,869,230	3	High
Jalisco	226,496,854	3	High
Oaxaca	337,781,744	3	High
Colima	371,477,498	3	High
Tabasco	420,804,949	3	High
Chiapas	485,354,353	3	High
Nayarit	617,446,533	3	High
Tamaulipas	718,197,218	3	High
Veracruz de Ignacio de la Llave	753,500,229	4	Main
Baja California	837,562,938	4	Main
Campeche	1,021,449,948	4	Main
Yucatán	1,211,490,835	4	Main
Baja California Sur	1,318,499,755	4	Main
Sonora	1,961,426,286	4	Main
Sinaloa	2,906,602,355	4	Main

1 Data from the statistical yearbook (CONAPESCA, 2017).

Once the values were reclassified and entered as fields in the database table of data, we proceeded to convert the visual reference of the polygons of Mexico into central points, with which we generated a display of the values described above as focalized areas of incidence.

Subsequently, the data were analyzed with the *Kriging* geostatistical tool, which offers as results a zoning based on the proximity of similar data in Raster format (information stored by pixel entity), clustering them in specific areas of incidence, and linking the similarity of the data into reclassified and differentiated polygons.

The result obtained from the *Kriging* process must be reconverted into vector data, in order to later make cuts as necessary, based on the limits of the Mexican territory.

RESULT AND DISCUSSION

Regionalization of Mexican fisheries based on economic values reported by CONAPESCA was generated (Figure 2).

A clear difference in the economic importance of fishing can be observed. The most economically important "Main" areas are in the south-east and north-west regions.

The central states of Mexico reported a "Low" economic importance, contrary to common sense speculations, about this region is the basis of a sector of the population dedicated to the capture of aquatic species, an activity carried out in continental waters such as rivers, lakes, lagoons, or dams of Mexico.

The region with "High" economic importance is comprised by states close to the southern Pacific coast, while the "Medium" importance is located in the northern states, without access to the coasts in their political delimitation where fishing is practiced in continental waters.

This regionalization is carried out only under the economic parameters of fishing, it does not differentiate between artisanal or deep-sea fishing. The foregoing is the product

Figure 2. Regionalization of fisheries based on monetary value.

of the deficiency that exists in the databases collected by CONAPESCA, or else, it is due to the lack of disclosure and encryption level of data.

However, analyses like this one offer the opportunity to visualize and analyze the reality of fishing in Mexico, and how it affects the socioeconomic policies of the country.

CONCLUSIONS

Fishing is studied by the institutions in a biased manner; in no official document, social and cultural data of people involved in the development of this activity are considered.

This regionalization proposal is based merely on monetary value (market price), an item that has a greater weight in decisions taken by the institutions, because of its importance in terms of Mexico's Gross Domestic Product (GDP).

Four fishing regions are characterized by their degree of economic importance; this means, by the value obtained from the sale of fishing resources. Those characterized regions are classified as: low, medium, high and main.

The visualization of the results through maps provides greater clarity when analyzing the information. The fishing regions characterized as main and high economic importance are located in the coastal areas of the country. Moreover, fishing in continental waters in these areas is also a substantial part of the activity.

The fishing regions characterized as medium and low are concentrated in products obtained in continental waters such as dams, rivers, lakes and lagoons, which further highlights the importance of these bodies of water.

The regionalization of the economic factors of fishing would be specified, if data at the municipal or local level were taken as the base unit of work. This would lead to a longer and specialized process, which is perfectly achievable.

REFERENCES

Arriaga, L., Vázquez, E., González, J., Jiménez, R., Muñoz, E., y Aguilar, V. (1998). Regiones prioritarias marinas de México. México: Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. http://www.conabio.gob.mx/conocimiento/regionalizacion/doctos/marinas.html

Botello, A. V., Toledo, A., de la Lanza Espino, G., & Villanueva, S. (2000). The Pacific Coast of Mexico. En C. Sheppard (Ed.), Seas of the Millennium: An Environmental Evaluation. Elsevier Science. DOI: 10.1016/S0025-326X(00)00098-9

Comisión Nacional de Acuacultura y Pesca. (2015). Anuario Estadístico de Acuacultura y Pesca Estadística de acuacultura y pesca relativa a los principales aspectos económicos y sociales. https://nube.conapesca.gob.mx/sites/cona/dgppe/2015/ANUARIO_ESTADISTICO_DE_ACUACULTURA_Y_PESCA_2015_(PDF).pdf

Comisión Nacional de Acuacultura y Pesca. (2017). Anuario Estadístico de Acuacultura y pesca. https://nube.conapesca.gob.mx/sites/cona/dgppe/2017/ANUARIO_ESTADISTICO_2017.pdf

Espejel, I., & Bermúdez, R. (2006). Propuesta metodológica para la regionalización de los mares mexicanos. En Ordenamiento ecológico marino: visión temática de la regionalización (p. 226). México. https://www.academia.edu/20985886/Ordenamiento_Ecol%C3%B3gico_Marino_Visi%C3%B3n_Tem%C3%A1tica_de_la_regionalizaci%C3%B3n

Espinoza Tenorio, A., Moreno Báez, M., Pech, D., Villalobos Zapata, G. J., Vidal Hernández, L., Ramos Miranda, J., Espejel, I. (2014). El ordenamiento ecológico marino en México: un reto y una invitación al quehacer científico. *Latin American Journal of Aquatic Research, 42*(3), 386–400. https://www.academia.edu/20985886/Ordenamiento_Ecol%C3%B3gico_Marino_Visi%C3%B3n_Tem%C3%A1tica_de_la_regionalizaci%C3%B3n

Ibáñez, J. (1999) El nuevo regionalismo Latinoamericano en los años noventa. *Revista Electrónica de Estudios Internacionales*. https://dialnet.unirioja.es/servlet/articulo?codigo=826774

INP (Instituto Nacional de Pesca). (1994). Atlas Pesquero de México. México: Secretaría de Pesca. https://www.inapesca.gob.mx/portal/Publicaciones/Libros/1994-Atlas-pesquero-de-Mexico.pdf?download

Merino, M. (1987). The coastal zone of Mexico. *Coastal Management*, (15), 27–42. https://doi.org/10.1080/08920758709362014

Molina, F. (2007). Visiones del regionalismo y la regionalización en América del Sur en el nuevo milenio. *Revista Venezolana de Economía y Ciencias Sociales, 13*(3), 13–32. http://ve.scielo.org/scielo.php?pid=S1315-64112007000300002&script=sci_abstract