ICES Journal of Marine Science (2011), 68(8), 1611–1614. doi:10.1093/icesjms/fsr089

Short communication

Data collection on the small-scale fisheries of México

Mauricio Ramírez-Rodríguez

Centro Interdisciplinario de Ciencias Marinas, Instituto Politécnico Nacional, CICIMAR – IPN, Avenida IPN Playa Palo de Santa Rita, La Paz, BCS 23090, México; tel:+52 612 1225366; fax:+52 612 1225322; e-mail: mramirr@ipn.mx

Ramírez-Rodríguez, M. 2011. Data collection on the small-scale fisheries of México. – ICES Journal of Marine Science, 68: 1611–1614.

Received 12 October 2010; accepted 28 April 2011; advance access publication 8 June 2011.

To improve data collection and analysis of basic fishery statistics provided by Mexican small-scale fishers, the official fishery-information system was modified by codes for fishing sites and species that facilitate data handling when used for estimating exploitation patterns related to fleet behaviour (zones/seasons) and production (catch and value per species). This is exemplified by analysing the relative importance of 14 fisheries and the dynamics of the black ark fishery in Bahia Magdalena, Baja California Sur, México.

Keywords: fishery-information system, fishery interactions, México, small-scale fisheries.

Introduction

Fishery management within an ecological framework requires information on fish resources, their environment, fleets, markets, and policies (FAO, 2003, 2008). This implies the need of methods for integrating various types of information, and displaying research outcomes in a user-friendly format. The methods may take several years to develop, depending on the complexity of the fisheries, data-collection options, and the available infrastructure (OSB-NRC, 2000).

Data on production (catch per species per fishing area), fishing effort, and capacity (type and number of fishing vessels, fishing gears, and workers) are the basis for a fishery-information system aimed at improving efficiency in the administrative functions of government fishery offices, involving transparency and proper use of information (Flewwelling *et al.*, 2000; FAO, 2001; FAO-OSPESCA, 2006; Coppola, 2007). Further, the present technology for computerized database management and the development of geographic information systems (GISs) allow effective integration of information systems.

In México, fishery statistics are collected through the Integrated System of Aquaculture and Fisheries Registration and Organization (SIROPA) at the National Commission of Aquaculture and Fishing (CONAPESCA), which defines small-scale fisheries as those operating with vessels <10 grt. In 2008, 102 807 boats were recorded, exploiting mainly coastal finfish, sharks, crustaceans, molluscs, and echinoderms.

Mexican fishers are organized into either cooperatives or private businesses known as economic units; they obtain fishing licences that prescribe the number of vessels and types of fishing gear for catching the resource for which they are licensed. One of the licence requirements is that reports on the operation of the fishing fleet should be provided to the fishery offices of the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA). These reports are made using a trip-ticket format known as the "Notice of arrival for vessels under 10 t".

For most small-scale fisheries, the trip ticket is the only source of information for developing fishery statistics yearbooks and technical reports. However, the SIROPA codes for fishing sites and species do not facilitate the integration of data by fishing zone, so precluding spatial analysis of the fisheries. This paper reports the progress made in adaptating the SIROPA to improve the understanding of small-scale fishing operations, including examples of the analysis for the State of Baja California Sur (BCS), one of México's most important fishing regions.

Methods

A trip ticket includes the name of the economic unit, the date, the number of vessels involved, the type of fishing gear, fishing and landing sites, and the catch per species (in kg). Generally, the report is produced weekly by the manager of the economic unit that owns the licence; ideally, one such report should be filed per vessel and trip. The data on vessels with fishing licences are contained in the National Fishery Register (RNP). The key field for the fishery-information system is the RNP number that identifies individual vessels and economic units.

Lists of codes developed by CONAPESCA are used for recording harvest and landing sites, but they do not follow any formal geographic criteria. This led to the development of the Atlas of Mexican Fishing Sites, which locates fishing and landing sites (by latitude and longitude) following a north-to-south order (Ramírez-Rodríguez *et al.*, 2006a). The Atlas allows the use of GIS principles to obtain information for specific fishing regions or areas (Ramírez-Rodríguez *et al.*, 2006b; Carocci *et al.*, 2009).

A major issue when reporting fishery production concerns the names used by fishers for identifying the species exploited. Small-scale fisheries exploit large numbers of species for which fishers use traditional names, local or regional in origin, which often leads to confusion and constraints in monitoring trends in the production of species or groups of species. CONAPESCA has developed guidelines for the identification of rays, sharks, and snappers in its Pacific fisheries, and printed posters that depict the main fish species in the coastal fisheries of three States: Guerrero, Jalisco, and Colima. However, these documents do not fulfil the need to support SIROPA because they only consider fish, and do not show the necessary species codes used in the trip tickets. In an attempt to resolve this issue, a "Catalogue of Commercial Species in the Mexican Pacific" is currently under development, and it will include pictures, drawings, and the scientific and common names for 828 species compiled from publications in both the scientific literature dealing with taxonomy, and marine fisheries in the tropical and subtropical northeast Pacific.

The proposed species-identification code is designed in a manner that enables users to define the integration level of information. It consists of eight digits: two for taxonomic level (algae, crustaceans, fish, etc.), two for type of species (bivalves, demersal fish, pelagic fish, etc.), two for commercial category/family (abalone/Haliotidae, jumbo squid/Ommastrephidae, snappers/Lutjanidae, etc.), and two for species (scientific and common names). For example, 08012501 refers to 08 fish, 01 demersal fish, 25 snappers (pargos)/Lutjanidae, 01 *Hoplopagrus guentheri*, Mexican barred snapper, pargo coconaco, tecomate. The system

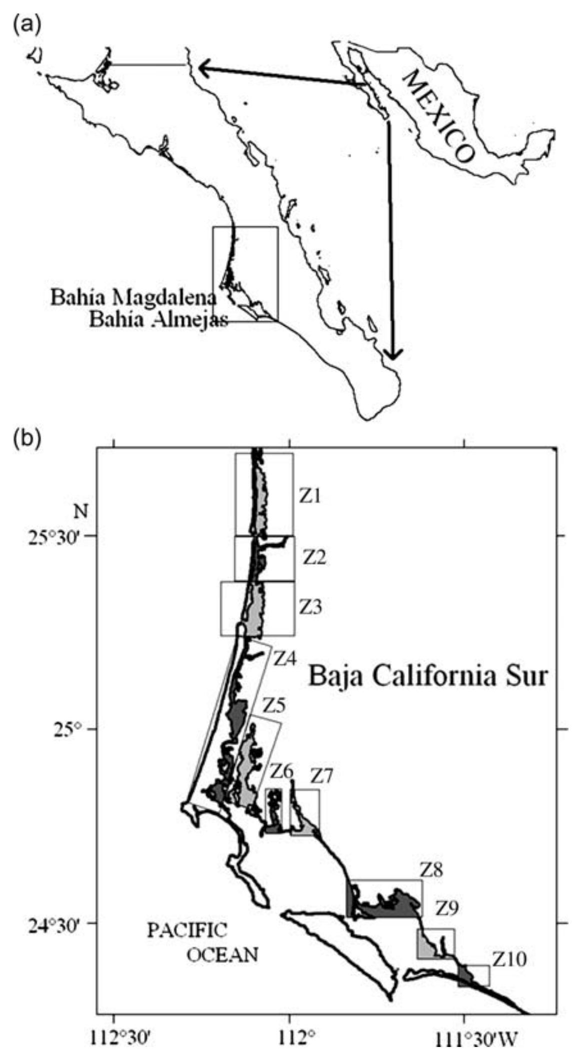

Figure 1. (a) Location of BCS, México, and the BMA area. (b) Fishing zones (rectangles, numbered Z1–Z10) for black ark in the BMA.

includes tables that correlate catalogue codes with other national and international code systems, such as the FAO Alpha3 code (FAO, 2011).

Production in BCS

The State of BCS is located in northwestern México, in the southern Baja California peninsula, and has coasts facing both the Gulf of California and the Pacific Ocean (Figure 1). Its location makes it one of México's most important fishing areas. According to the Fishery Statistics Yearbook, BCS ranks third countrywide in terms of fishery production, averaging 136 541 t year^{-1} (CONAPESCA, 2010).

The fishery information system revealed that, in 2009, there were 418 economic units related to small-scale fisheries registered in BCS, 50% private, and 50% managed by the social sector (cooperatives). In all, 1566 fishing licences were granted, involving 4836 fishing vessels that exploited 20 groups of species. The mean annual production (1998–2008) was 51 000 t, and the mean catch value 528 million Mexican pesos (US$40.5 million). The landings were dominated by jumbo squid (*Dosidicus gigas*), followed by finfish and clams. The catch weight per group of species varies considerably between main regional fishing zones (bays, coastal lagoons, islands), a fact that needs to be the basis for geographically delimiting management zones.

Small-scale fisheries in Bahía Magdalena

The integrated management of fisheries in a given zone requires in-depth knowledge of their operation and performance. In general, the importance of a fishery is valued in terms of its contribution to catch weight, national and regional catch values, and contribution to the use of a specific zone. For example, in terms of mean catch weight per species or group of species 1998–2009, 14 fisheries were identified in the Bahía Magdalena–Bahía Almejas (BMA) area based on their main target species: Pacific scallop (*Argopecten ventricosus*), finfish, shrimp (*Farfantepenaeus californiensis*, *Litopenaeus stylirostris*), sharks (*Carcharhinus* spp., *Mustelus* spp., *Sphyrna* spp.), pen shell (*Atrina* spp.), giant squid (*D. gigas*), blue crab (*Callinectes* spp.), black ark (*Anadara tuberculosa*), rays (*Myliobatis* spp., *Raja* spp., *Rhinoptera* spp.), mullet (*Mugil* spp.), lobster (*Panulirus* spp.), octopus (*Octopus* spp.), abalone (*Haliotis* spp.), and pink murex (*Phyllonotus erythrostoma*).

The Pacific scallop fishery is the most important in terms of its contribution to catch weight (51%) and value (33%) in the zone, followed by finfish (18 and 16%, respectively). Shrimp catches contribute a mere 4% in quantity but 25% of the value.

Dynamics of the black ark fishery in the BMA

In the BMA, the black ark fishery is economically and socially important (Félix-Pico *et al.*, 2009). The fishery information system reveals that catches amounted to 650 t in 1999, but just 280 t in 2008. On average (1998–2008), nine economic units participated in the fishery, involving 21 vessels to transport fishers to various mangrove areas from which the black arks are collected manually.

The analysis of catch records per fishing site, as registered by the fishers, reveals the existence of ten fishing zones (Figure 1b), seven displaying a declining annual catch per vessel over the period 1998–2007; zone 9 was the only one to show an increase (Figure 2a). This trend is related to intensity of use, which drops in some zones but increases in others (Figure 2b). These indicators

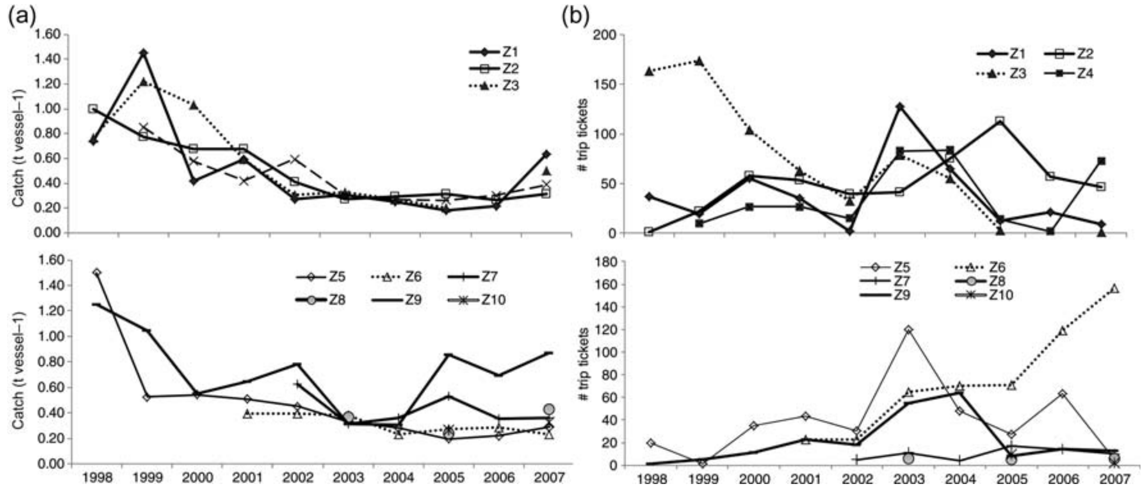

Figure 2. (a) Trends in annual catches of black ark per vessel, and (b) the number of trip tickets in ten fishing zones (Z1 – Z10) in BMA, BCS, México (cf. map in Figure 1b), for the period 1998 – 2007.

of fleet dynamics allow proposals for resource recovery schemes coupled with the rotation of fishing areas, based on both fish abundance and the time taken for fish to reach maturity (1.5 – 3 years). A rotation system is being considered by authorities, but it is complex, because the use of a given area is related to the type of operation in each economic unit.

The case of the black ark fishery in the BMA illustrates the possibilities for monitoring fleet activities and the adoption of specific management measures for each fleet.

Discussion

The example analysis of the BCS black ark fisheries demonstrates how the fishery information system can produce reliable and useful data for the development of fishery performance indicators, based on production per group of species, fishing zones, and fishing seasons. A detailed analysis of these results is not the goal of this paper, however, though it clearly shows the possibility of applying several methods to fisheries assessment.

Analysis of the black ark fisheries in BCS confirms the trends in each zone, indicating the need for managing fishing zones separately. Further investigations will lead to a detailed definition of interactions between fisheries targetting different species in the same area, which will better define integrated management schemes. Data in the fishery information system provide an approximation of the fleet operation zone by reference to coastal localities; however, these are not the type of data required by a GIS designed to make a detailed analysis of the fleet's spatial dynamics. Nevertheless, the data may indicate potential spatial interactions and suggest different management strategies (OSB-NRC, 2006).

Determining the relative importance of each fishery in the BMA allows us to establish management measures in terms of their contributions to total catch weight and value and to the intensity of use of each zone by each fishery. The measurement of interactions between fisheries is currently a poorly explored area, but it is of interest for estimating the intensity of ecosystem use, and the definition of scenarios for spatial and temporal fishery management measures. This is especially true in the context of official recommendations for most fisheries being not to increase fishing effort further and therefore not to grant any new fishing licences (SAGARPA, 2010).

Monitoring the fishing operations in a given zone is an administrative challenge: little factual information on fishing effort exists. It is assumed, however, that given the current restrictions aimed at preventing any increase, fishing effort has remained stable over the past few years. However, the analysis of black ark catches by fishing zone reveals different trends in each. These involve issues related to the interaction between fisheries *per se* and the infrastructure available (or not) for landing, processing, and selling products. The information currently available is insufficient to provide the actual production as an absolute quantity, but the importance of the data lies in the analysis of trends identified in the catches and their use in defining the fisheries that operate in a given zone.

The system developed so far facilitates data retrieval and analysis of indicators, including the status of economic units, the licences used, and production records per species or group of species, by fishing zone and season. The utility of indicators depends on the quality of data recorded in the trip tickets; hence, the importance of developing codes that facilitate the recording of fishing localities and species compositions. This will lead to more-automated procedures to allow faster data analysis and compilation of reports on production, using modern computerized data-processing techniques.

The identification of catch trends depends on the coherence and stability of the data collection and recording procedures over time. This requires setting procedures for data collection, and the maintenance and updating of a computerized database; the use of correct codes is a key factor. The recovery of historical data is an essential part of the work and can involve verifying and recoding information. Options for improving data reliability, accuracy, consistency, and coverage of reported information have not yet been addressed formally, but the follow-up of data retrieved from the fishery information system opens up possibilities for designing validation and data-control routines. The present lack of information on fishing effort needs to be given special attention.

Supplementing the data recorded in trip tickets with fieldwork supported by fishers is an essential step forward to validate point estimates as well as trends in production, fleet behaviour, and markets. Strengthening co-management should translate into better quality and more-comprehensive data through information provided by fishers.

Fishery management needs to ensure that the quantification and control of fishing effort, identification of fishing vessels and gears, licensing procedures, functionality of conservation measures, and regulatory enforcement are fit for purpose. Within this framework, a fishery information system is a valuable tool for the definition and monitoring of control measures, as well as in searching for options to balance the relationships between various types of producer, through actions that will reduce resource overexploitation, increase the participation of fishers, and improve management performance. Progress on all these factors is undoubtedly needed to strengthen fishery management within an ecological context in México.

Acknowledgements

I thank CONAPESCA, SAGARPA, and the Instituto Politécnico Nacional (COFAA, EDI) for support. The information system software was developed by José Clemente Beltrán-Castro.

References

Carocci, F., Bianchi, G., Eastwood, P., and Meaden, G. 2009. Geographic information systems to support the ecosystem approach to fisheries: status, opportunities and challenges. FAO Fisheries and Aquaculture Technical Paper, 532. 101 pp.

CONAPESCA. 2010. Anuario estadístico de acuacultura y pesca 2008. Comisión Nacional de Acuacultura y Pesca, México. 207 pp.

Coppola, S. R. 2007. An adaptive approach for the improvement of fishery statistical systems in Mediterranean countries under FAO projects. General Fisheries Commission for the Mediterranean Studies and Reviews, 79. 54 pp.

FAO. 2001. Directrices para la recopilación sistemática de datos relativos a la pesca de captura. Documento preparado en la Consulta de Expertos FAO/DANIDA. Bangkok, Tailandia, 18–30 de mayo de 1998. FAO Documento Técnico de Pesca, 382. 132 pp.

FAO. 2003. The ecosystem approach to fisheries. FAO Technical Guidelines for Responsible Fisheries, 4(Suppl. 2). 112 pp.

FAO. 2008. Best practices in ecosystem modelling for informing an ecosystem approach to fisheries. FAO Fisheries Technical Guidelines for Responsible Fisheries, 4(Suppl. 2), Addendum 1. 78 pp.

FAO. 2011. ASFIS list of species for fishery statistics purposes. http://www.fao.org/fishery/collection/asfis/en.

FAO-OSPESCA. 2006. Mejoramiento de los sistemas de información y recolección de datos pesqueros para América Central y el Caribe: Informe del Taller FAO/OSPESCA sobre el mejoramiento de los sistemas de información y recolección de datos pesqueros, San Salvador, El Salvador, 23–26 de enero 2006. Volumen 1: Informe del Taller. 41 pp.

Félix-Pico, E. F., Ramírez-Rodríguez, M., and Holguín-Quiñones, O. 2009. Growth and fisheries of the bivalve mollusc black ark in Bahia Magdalena, Baja California Sur, México. North American Journal of Fisheries Management, 29: 231–236.

Flewwelling, P., Cullinan, C., Balton, D., Sautter, R. P., and Reynolds, J. E. 2000. Recent trends in monitoring, control and surveillance systems for capture fisheries. FAO Fisheries Technical Paper, 415. 200 pp.

OSB-NRC (Ocean Studies Board, National Research Council). 2000. Improving the Collection, Management, and Use of Marine Fisheries Data. National Academy Press, Washington, DC. 236 pp.

OSB-NRC (Ocean Studies Board, National Research Council). 2006. Dynamic Changes in Marine Ecosystems: Fishing, Food Webs, and Future Options. National Academy Press, Washington, DC. 160 pp.

Ramírez-Rodríguez, M., López-Ferreira, C., and Hernández-Herrera, A. 2006a. Atlas de localidades pesqueras de México: Libro 2, Baja California Sur. SAGARPA-CONAPESCA, México. 124 pp. http://www.conapesca.sagarpa.gob.mx/wb/cona/atlas_de_localidades_pesqueras.

Ramírez-Rodríguez, M., López-Ferreira, C., and Hernández-Herrera, A. 2006b. Desarrollo de un sistema de información geográfico como apoyo para la administración de la pesca artesanal en México. *In* Memorias Primera Conferencia de Pesquerías Costeras en América Latina y el Caribe. Evaluando, Manejando y Balanceando Acciones, pp. 200–207. Ed. by S. Salas, M. A. Cabrera, J. Ramos, D. Flores, and J. Sánchez. CINVESTAV-IPN, Mérida, Yucatán. 235 pp.

SAGARPA. 2010. Actualización de la Carta Nacional Pesquera y su anexo. Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación México, Diario Oficial, 2 diciembre 2010 (Segunda Sección): 1–94.