

## FISHERIES ACTIVITIES IN THE GULF OF CALIFORNIA, MEXICO

JOAQUIN ARVIZU-MARTINEZ  
Centro Interdisciplinario de Ciencias Marinas, IPN  
Apartado Postal 592  
23000 La Paz, Baja California Sur  
México

### ABSTRACT

The Gulf of California fisheries are of great economic importance to Mexico. In 1981, 500,000 metric tons (MT) were taken in the gulf, representing 33% of the total catch of Mexico. Of the total catch in the gulf, 94% is landed in the ports of Sonora and Sinaloa; 6% is unloaded in Baja California. Of the 31 ports where fish are unloaded, only Guaymas in Sonora and Mazatlán in Sinaloa are equipped with adequate fishing infrastructure. The humble fisheries development on the western coast of the gulf is due to the scarcity of drinking water. In this paper, mention is made of the development of the fishing fleet, the processing plants, fishing arts, and main species exploited in the zone. Sardines are, by far, the most important group, because of the size of the catch (360,000 MT in 1981). It is estimated that the catch of neritic species will not increase significantly in the near future, and therefore any fishing increases will depend on the exploitation of species that have not traditionally been fished in Mexico.

### RESUMEN

Las pesquerías del Golfo de California son de gran importancia económica para México. En 1981, se pescaron 500,000 TM en el golfo representando 33% de la captura total de México. Un 94% de la captura total del golfo proviene de los puertos de Sonora y Sinaloa, y un 6% de Baja California. De los 31 puertos de descarga de pesca, sólo Guaymas en Sonora y Mazatlán en Sinaloa tienen una infraestructura pesquera adecuada. El bajo desarrollo de las pesquerías en la costa oeste del golfo se debe a la escasez de agua potable. En el presente trabajo se menciona el desarrollo de la flota pesquera, las plantas procesadoras, las artes de pesca y las principales especies explotadas en la zona. Las sardinas son claramente el grupo más importante dado el tamaño de la captura (360,000 TM en 1981). Se estima que la captura de especies neríticas no aumentará significativamente en un futuro cercano y, por lo tanto, un incremento en la pesca dependerá de la explotación de especies no pescadas tradicionalmente en México.

### STATUS OF FISHERIES DEVELOPMENT

Mexican fisheries have shown a great increase in the last few years. However, the increases have not been of the same magnitude in the Gulf of Mexico as in the Pacific Ocean: the catch in the gulf reached a little more than 300,000 MT in 1981; the catch in the Pacific reached about 1,000,000 MT in 1984 (Figure 1).

Considerable increases are reported for the northwestern region of the Mexican Pacific coast (Figure 2). In 1973 a little over 220,000 MT were landed, in contrast with 900,000 MT in 1981.

The greatest increases were observed in the Gulf of California, reaching up to 500,000 MT in 1981 (Figure 3), and representing 33% of the total catch of Mexico for that year. Thus, the Gulf of Califor-

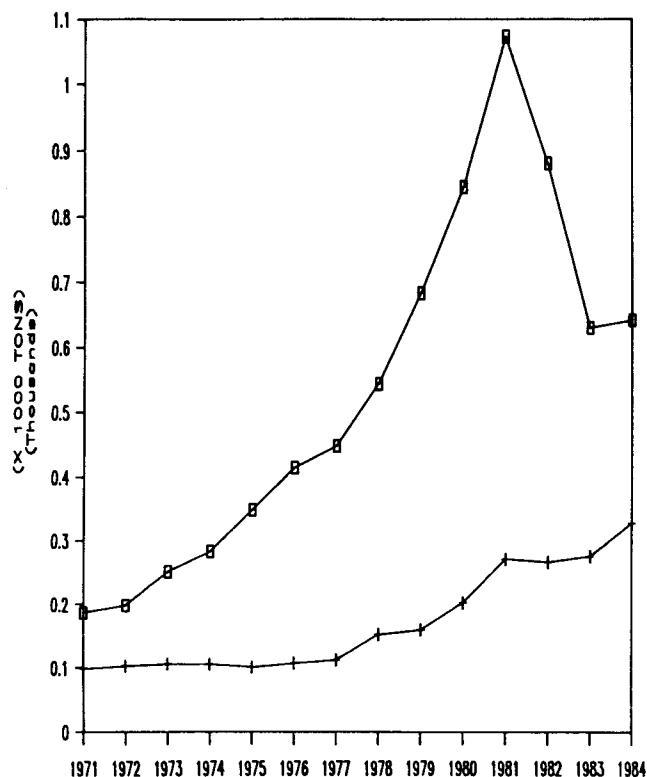


Figure 1. The trend in total catch of fish in the Mexican eastern Pacific (top) and the Gulf of Mexico (bottom), 1971-84.

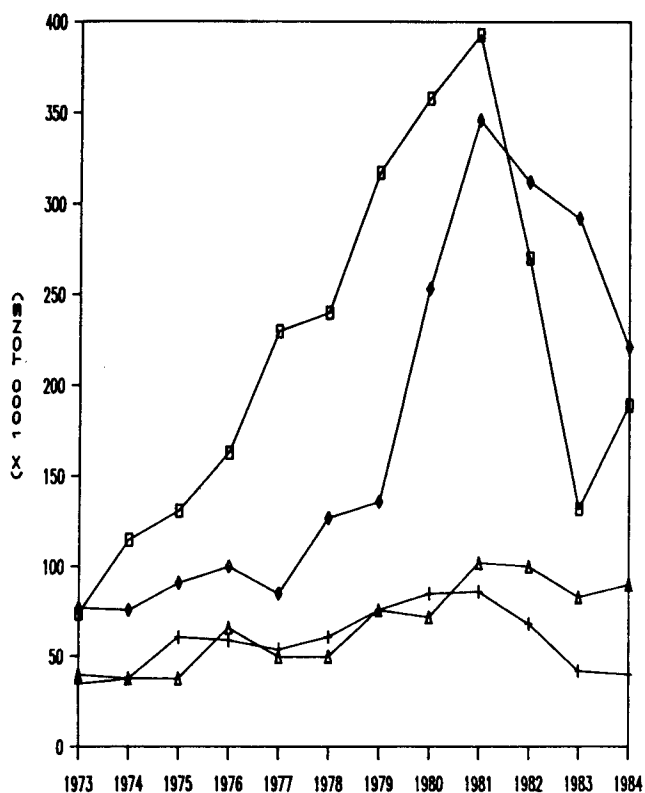


Figure 2. Total catches for the northwestern Mexican Pacific coast, 1973-84. □ = Baja California Norte; ◇ = Sonora; △ = Sinaloa; † = Baja California Sur.

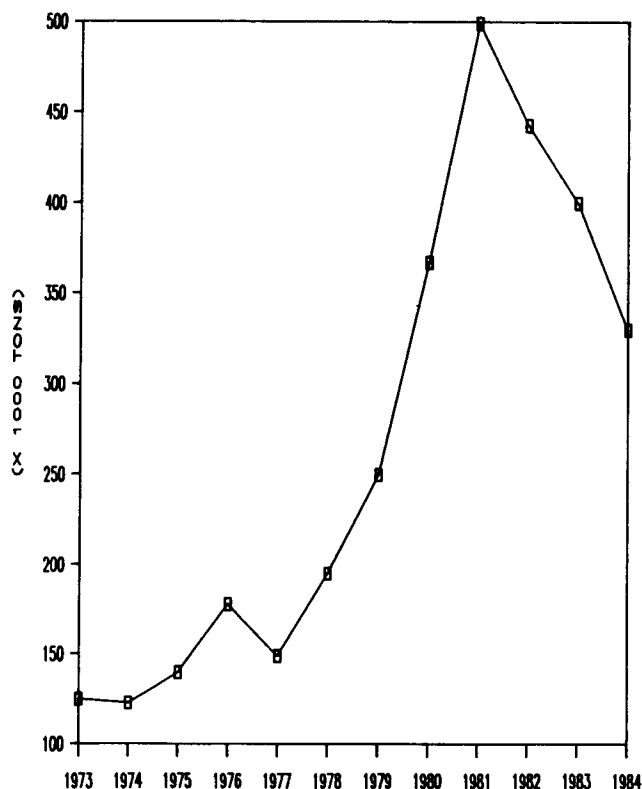


Figure 3. Total catch in the Gulf of California, 1973-84.

nia has become the most important body of water in Mexico for fisheries.

Although the fishermen and most of the boats are distributed along the length of the gulf coasts, the delivery and unloading of the fisheries products is carried out in 31 ports, of which only Guaymas in Sonora and Mazatlán in Sinaloa have sufficient infrastructure to receive and process large volumes. However, the existing infrastructure on the eastern coast of the gulf is underused; e.g., the Port of Guaymas uses only 12.5% of its freezing capacity.

The unevenness of the fisheries development could suggest that concentrations of marine products are greater along the eastern than the western coast of the Gulf of California, especially if we consider that 94% of the total catch reported for the area is delivered to ports in Sonora and Sinaloa. The low volumes unloaded in the ports of Baja California Norte and Sur are due to the scarcity of water, which has limited the development of towns and fishing ports on the western coast.

The neritic species of the Gulf of California are characterized, among other things, by their high species diversity, low volumes, and high economic

value. The pelagic species are characterized by low species diversity, high volumes, and low price.

## HISTORY OF THE FISHERIES

Fishing activities in the northern part of the Gulf of California date back to the exploitation of the totuava (*Totoaba macdonaldi*), which started at the beginning of the century. These fish were caught mainly for their stomachs, which were in demand among the Chinese population. As a result of this activity, three ports were established: San Felipe; el Golfo de Santa Clara; and Puerto Peñasco. During the 1940s the demand for sharks increased because their livers are rich in oil. Therefore the demand for the totuava increased, since its liver is also a source of oil. In the middle 1940s the exploitation of shrimp, (*Penaeus stylirostris*, *P. californiensis*), began (this fishery is discussed by Magallon in this volume). The shrimping activity within the totuava's area of reproduction takes many young totuava, and this may affect recruitment. However, incidental capture continues. When the catch of this species decreases, fishing activities tend to stabilize, since in this zone other resources are not abundant. At the end of the 1960s the three ports experienced a sharp increase

in tourism, and fishing activities began to take second place.

In the central part of the Gulf of California, fisheries exploitation is further supported by the capture of turtles (*Lepidochelys olivacea*), especially in the Bahía de los Angeles and at the ports near Isla Tiburón (a Seri Indian settlement), where this species is the principal fishing target. To date, Desemboque and Kino are ports that still handle mainly sharks.

In contrast with the ports of San Felipe, Puerto Peñasco, and Golfo de Santa Clara, those of Baja California Sur were established for reasons that have nothing to do with fishing. Loreto, Mulegé, and La Paz were missions founded by friars who colonized the Baja California peninsula. These towns have never been prominent in fishing activities, but in the middle of the nineteenth century La Paz was one of the principal pearl markets of the world. Commercial activity began in 1615 and developed up to 1938, when a high natural mortality of the stocks of mother of pearl (*Pinctada mazatlanica*) occurred in few months. Total production at that time was about half a million oysters during the eight-month fishing season. With present-day stocks it is not possible to obtain more than 20,000 oysters, consequently exploitation is prohibited.

The port of Santa Rosalía, Baja California Sur, was founded as a result of mining activities that developed in the beginning of the nineteenth century and continued up to 1980. The appearance of high volumes of Spanish mackerel (*Scomberomorus* spp.) in the years 1978, 1979, and 1980 supported the initial fishing activities, which continued during 1981, 1982, and 1983 for the squid fishery.

In the port of Guaymas, Sonora, before the mid-1940s, fishing was only for totuava and shark. Later the shrimp fishery and, since 1968, the sardine fishery began. Other fish landed in Guaymas are dogfish (*Mustelus* spp.), mullet (*Mugil* spp.), snapper (*Lutjanus* spp.), and giant squid (*Dosidicus gigas*), which are exploited in the years when they are abundant close to the coast. Shrimp (*Penaeus* spp.) and lobster (*Panulirus gracilis*) are species of the highest economic value.

#### PRESENT STATUS OF FISHERIES

Sardines are the most important pelagic species exploited in the Gulf of California. This fishery consists of small epipelagic species: the Monterrey sardine (*Sardinops sagax caerulea*); the thread herring (*Opisthonema libertate* and *O. bulleri*); the Japanese sardine (*Etrumeus teres*); mackerel (*Scomber japonicus*); the anchoveta (*Cetengraulis*

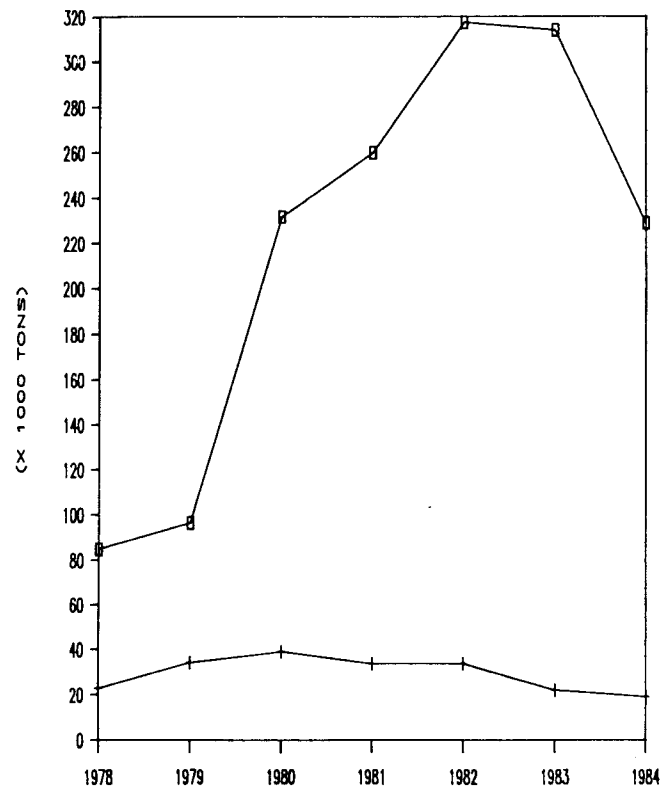


Figure 4. Landings of the six most important species at Guaymas, Sonora, 1978-84. □ = sardine; † = other fishes.

*mysticetus*); the pineapple sardine (*Oligoplites* spp.); and the Spanish mackerel (*Scomberomorus* spp.). During cold years the Monterrey sardines and mackerel (*Scomber*) predominate the catches; during temperate years the thread herring and other species dominate.

If we contrast the sardine catch unloaded at Guaymas with the catch of other species, the difference is considerable (Figure 4).

Mazatlán and Topolobampo stand out as the fishing ports of importance in the state of Sinaloa. Volumes unloaded in Mazatlán are not as great as those of Guaymas. In 1981 Mazatlán reported a decrease (in contrast with other ports of the gulf, which reported high increases), but in 1984 Mazatlán's volume increased. The catch of six principal species—thread herring (*Opisthonema libertate*, *O. bulleri*, *O. medirastre*); anchoveta (*Cetengraulis mysticetus*); Spanish mackerel (*Scomberomorus* spp.); and corvina (*Cynoscion* spp.)—surpass all the other species. In 1981 many uncommon species began to be sold as part of the commercial catch. These species are normally found in the southern part of the area.

Sardine fishing in the Gulf of California was initiated on a massive scale in 1971. Rapid development made it possible to capture 50,000 MT in

1976, 263,000 MT in 1980, and 381,000 MT in 1982. At first it was intended that fishing should be directed in a large part toward canning, but the great tendency toward reduction to fish meal forced federal authorities to obligate fishermen to process a certain percentage of the catch for canning. A point of equilibrium appeared reachable by using the Monterrey sardine mainly for packing, and the thread herring (*Opisthonema* spp.) mainly for meal. At present, this concept has been modified, and now any one of the species is canned.

In 1978 sardines were reduced to fish meal in 31 plants and canned in 13. In 1984 reduction occurred in 40 plants and canning in 14, an increase of almost 30% in reduction and 7% in canning.

The Monterrey sardine concentrates in summer months near the large islands of the Gulf of California (Ángel de la Guarda and Tiburón), and moves along the coast of Sonora during the winter. The southernmost penetration was reported in 1972, when the Monterrey sardine was caught in the port of Mazatlán, Sinaloa. From 1984 to 1986 Monterrey sardines were distributed from Tepopa Bay, Sonora, to Bahía de Santa María, Sinaloa, and from San Luis Gonzaga, Baja California, to Punta Chivato, Baja California Sur. Sizes ranged from 120 to 181 mm with a mean size of 147.5 mm. This size class constituted 15.8% of the total catch.

The Monterrey sardine has a characteristic yearly migratory pattern. Spawning occurs during the winter months south of Sonora, and eggs and larvae are dispersed by currents to the area between Bahía Concepción and Isla San Marcos. The juveniles move along the coast to Isla Ángel de la Guarda, arriving there around August. In September–October juveniles arrive at the “blue zone” off Isla Tiburón, and then in October–November, juveniles and adults move to southern Sonora. After spawning, adult fishes are dispersed along Sonora and northern Sinaloa; in April–May they return to the islands of the Gulf of California.

In the period 1984–86, distribution of this species on the western coast was from San Luis Gonzaga, Baja California, to Bahía Santa Ines, Baja California Sur, and on the eastern coast to El Datil river in Teacapan. Sizes varied from 71 to 245 mm, with a mean of 152.5 mm; this size class constituted 24% of the catch.

Mackerel (*Scomber japonicus*) for the period 1984–86 presents a similar distribution to that of the Monterrey sardine, but in smaller volumes. On the eastern coast of the gulf it is caught between Bahía Tepopa, Sinaloa, and Bahía Santa Maria, and on the western coast from Bahía de las Ani-

mas, Baja California, to Isla San Marcos, Baja California Sur. Sizes of mackerel ranged from 131 to 300 mm, with a mean size of 157.5 mm; this size class constituted 17% of the catch.

During 1984–86 fishing for round herring (*Etrumeus teres*) occurred between Bahía Santa Barbara and Santa Cruz, Sinaloa, which means that this species is primarily caught by the Mazatlán fleet, although it is also captured near Isla San Marcos. The length varied from 86 to 195 mm during brief periods, but for most of the season it varied from 106 to 170 mm, with a mean of 122.5 mm. This size class constituted 41% of the catch.

The future of the sardine fishery seems to point toward a stabilization of volumes taken within the Gulf of California; if an increase should occur in these fisheries, it would come from the region to the south of Mazatlán or from the exploitation of other species that coincide geographically with sardines.

Among the neritic species, the coastal species are submitted to the greatest fishing pressure. The volume does not exceed 5,000 MT. Mullet (*Mugil* spp.), sea bass (*Serranidae*), snapper (*Lutjanidae*), porgies (*Sparidae*), and sierra (*Scomberomus* spp.), are caught by fishermen in *pangas* (small boats) along the coasts of the gulf.

Another neritic component, which is presently being caught and used in very low quantities, is the fauna that accompanies the shrimp catch. Volumes varied between 130,000 and 250,000 MT: it is estimated that 109,000 to 152,000 MT are fish; the remainder are invertebrates. The shrimp fishermen take a small part of this volume and sell that which has some market value as fresh fish. The remainder of the fish, perhaps 100,000 MT, are of no value because the fishes are small and weigh very little; the product is not homogeneous, either in size or species; the meat content is generally very low; the meat is of poor quality; and some species are toxic.

The unprofitable fish are dumped into the sea. Undoubtedly, this fauna has a potential use that is now wasted. It would be desirable to take advantage of the entire catch, but the cost is, at present, prohibitive. Nevertheless, fishing statistics show that the volume of by-catch landed reached 25,000 MT in 1976. This was mostly transformed into fish flour and, in smaller quantities, into fish pulp with different commercial uses. This year, with Japanese investment, an attempt will be made to produce *surimi* from the fishes of the shrimp by-catch. The problem is that fishes must be at least 20 centimeters long to be useful for *surimi*, but 80% of the fishes in the catch are less than 15 cm long.

Another fishery that may be exploited in the future is that below 50 fathoms. This is suggested by the fact that the Mexican-Korean trawlers in the Gulf of California capture a good number of species that are the normal components of the shrimp catch, but of a greater size, which would make it possible to obtain a greater amount of fish pulp to make *surimi*. For the time being, however, the magnitude of this resource is unknown, and therefore it is not possible or advisable to make predictions.

Apart from what has been stated previously, it does not seem probable that volumes in the future will rise considerably, especially if we consider the structure of the present fisheries.

The fleet in the Gulf of California fell into four main classifications in 1984. First were the numerous *pangas* (dories and rowboats) dedicated to fishing along the coast or in lagoons or streams. These boats are most numerous in Sinaloa, where there are many lagoons and streams. Second were the sardine boats, designed especially to capture

large volumes of fish in the epipelagic zone along the coast. Third were the boats designed to capture shrimp. Finally there were the ships dedicated to the capture of "scaley" fish (some are old shrimp boats and others were designed especially for this activity).

The Mexican government has tended to increase the volume of total catch to levels close to 6.3 million MT per year. However, the government has not taken into consideration the cost represented by these increases, especially with respect to the 1.9 million MT of mesopelagic fish. To date, there is a lack of research on the magnitude of the resource and the size of the fleet necessary to achieve that goal.

On some of the expeditions carried out in the Gulf of California by U.S. research ships, a high number of mictophids, such as *Triphoturus mexicanus*, have been found, raising the possibility that they may become an exploitable resource in the future.