

Point Jiguero. The swell is generally confused about the latitude of 18°15'N. It is in this area that the northern swell meets with the swell from the south.

#### DISCUSSION:

The Mona Passage is not apparently rich in tuna resources. The largest concentrations are blackfin and skipjack tunas which may be taken on trolling gear, but not on long lines. Since these two species are rather small, it is assumed that the hooks and bait used were too large to effect their capture. The larger tunas, such as the bigeye, yellowfin, and albacore, are apparently absent from the Passage or may be occasional migrants through the area. The rather deep discontinuity layer may have an inhibiting effect on tunas, but there is no adequate evidence.

Tunas and other pelagic fishes landed at Aguadilla over a period of one year were recorded by one fish buyer and have been made available for this study through the Puerto Rico Department of Agriculture. Those data were compared with the average monthly surface temperatures and no correlation was noted: yellowfin  $r = -.150$ , blackfin  $r = -.205$ , and skipjack  $r = -.196$ . Although the temperatures are not directly related with the months of the year, the data clearly show that more tunas were landed during the months of May, June, and July than during the rest of the year. No catch per unit of effort data are available, but the Crashboat Beach fishermen claim that the fishing effort is rather consistent throughout the year.

#### LITERATURE CITED

- ERDMAN, DONALD S.  
1956. Recent fish records from Puerto Rico. *Bull. Mar. Sci. Gulf Caribb.* 6 (4): 315-340.
- NICHOLS, JOHN T.  
1929. The fishes of Puerto Rico and the Virgin Islands. Branchiostomidae to Sciaenidae. In: *Scientific survey of Puerto Rico and the Virgin Islands*, 10 (2): 159-295. N.Y. Acad. Sci.

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## The Benefits of Research and Training to Mexican Fisheries

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#### Abstract

The Mexican fishing industry is an important revenue producer. About 38,500 fishermen and ten thousand boats are utilized by this industry. Ten per cent of the fishing boats are motorized, represented almost entirely by the shrimp fleet which operated 777 boats in the Pacific and 397 in the Gulf of Mexico in 1962.

Only a few resources such as commercial shrimp, some lobsters, and snappers are being fully exploited. Other marine resources, especially fish are not being exploited intensively.

Until recently, most research conducted on marine fishery resources in Mexico was descriptive and qualitative in nature. The present trend is to actively participate in fishery development through exploratory and experimental fishing, establishing pilot installations, and improving research efforts.

Research aimed at studying the biology, habits, behavior, size, and dynamics of marine populations of commercial value, combined with exploratory fishing, gear adaptation, and the introduction and study of processing and preservation methods would benefit the fishing industry directly by providing information as to when, where, and how to fish and preserve the catch most efficiently for marketing and indirectly by providing government agencies with sound knowledge of the resources to base legislative and conservation measures. Marketing research to discover the reasons behind lack of demand for some fishery products would also be valuable. Efforts to lower production costs and improve quality could increase local and foreign demand for these products.

Training of personnel at college and other levels would be of direct benefit to the fishing industry and would also provide needed personnel for research organizations. There are three educational institutions offering training in marine sciences in Mexico and three others offering training in related fields.

Educational institutions should participate in fishery research. They have personnel trained in related disciplines which could cooperate with marine science departments within the institutions. Research programs would allow students to participate in some aspects of investigation and enhance their training.

Student registration for the first semester in marine science at the Technological Institute of Monterrey reflects the interest felt in Mexico for the exploitation of marine resources.

THE FISHING INDUSTRY IN MEXICO occupies an important place among foreign revenue producing activities. The total value of the catch in 1962 was over US\$57 million. Exports contributed more than 97% of this value, about US\$56 million. This constitutes a considerable increase over 1958, when fishery exports produced only US\$36 million. Frozen shrimp is by far the most important fisheries commodity, with a value of close to US\$26 million, followed by canned abalone, spiny lobsters, and tuna, with values of US\$2 million, US\$880 thousand, and US\$456 thousand respectively.

The industry employs about 38,500 fishermen and utilizes close to 10,000 boats. Only 10% of the boats are motorized. This includes mainly the boats belonging to the shrimp fishing fleet. There were 777 shrimp boats operating in the Pacific and 397 in the Gulf of Mexico during 1962 (Cobos, 1963). The Pacific shrimp catch is composed mainly of *Penaeus stylirostris*, *P. vannamei*, *P. californiensis*, and *P. brevirostris*; and the Gulf catch of *P. setiferus*, *P. aztecus*, and *P. duorarum* (Carranza, 1963; Berdegué, 1960; Ramírez, 1963).

The Mexican fishery resources include not only shrimp, spiny lobster, abalone, and tuna, but also snappers, sardines, oysters, mackerel, sharks, anchovies, crabs, mullet, grouper, snook, and many others (Sevilla, 1956; Berdegué, 1956, 1960; Carranza, 1957, 1959, 1963; Chapa, 1956, 1963; Ramírez and Sevilla, 1963; Ramírez, 1963; Lindner, 1944, 1948).

At the present time, shrimp (Lindner, 1958; Carranza, 1963), California spiny lobster, and Campeche red snapper (Carranza, 1963) are intensively exploited and believed to have reached maximum production. Most other resources, with the possible exception of oysters, can probably be exploited to a fuller extent (Berdegué, 1960; Carranza, 1963; Ferreira, 1963).

That segment of the fishing industry dedicated to the exploitation of resources

subjected to heavy fishing pressures would probably benefit from research aimed at clarifying the biology, habits, behavior, and dynamics of these populations. The benefits may be direct, by providing fishermen with information about when and how to fish more effectively, and indirect, by providing government agencies with correct information to legislate and control fishing and manage the resources efficiently. Exploratory fishing and the adaptation and improvement of successful fishing gear and methods to local conditions would provide the industry with the location of new resources and with improved methods of capture.

Training of personnel at college, intermediate, and basic levels would furnish the fishing industry with valuable workers, trained to avail themselves of recent developments and thus maximize the efficiency of capture, handling, and processing operations. This same type of personnel could also be of invaluable help to research institutions as research aides. College graduates could form a nucleus of researchers at these institutions after receiving additional training at the graduate level.

Research programs aimed at determining the magnitude, geographic distribution, migratory habits, dynamics, biology, and behavior of underexploited and nonexploited marine resources would be of value to the fishing industry. This would allow fishermen and industrialists to plan the expansion of their activities on a realistic basis to prevent costly errors, such as locating processing plants where there are no adequate resources or installing plants with capacities beyond the production potential of the resources present.

Some resources may be underexploited at the present time because there is a lack of demand for the product. Marketing research aimed at improving existing local and foreign markets and developing new markets for Mexican fishery products might help in increasing the demand. Experience has shown that there is a demand for fishery products in Mexico when prices are low (Cobos, 1963). Greater efficiency in fishing operations, handling, distribution, and marketing of fishery products will tend to lower prices. Low cost processing and preservation methods will help reach this goal. The production of fishery goods at reasonable prices would benefit the fishing industry in Mexico by providing additional sources of revenue from resources not yet fully exploited. At the same time it would provide the population with cheaper sources of animal protein, improving nutritional standards. Cost of production and quality control are very important in establishing new and improving existing markets, since our products enter into competition with those of well-established fishing nations.

Until recently, most studies of Mexican marine resources were carried out qualitatively, that is, most species present along the different coastal areas are known. Publications such as "The Commercial Marine Fishes of the West Coast of Mexico" and "The Fisheries and Fishery Resources of Mexico" by M. J. Lindner (1944, 1948), "The Fishery Resources of Southeastern Mexico" by M. L. Sevilla (1956), "Fishes of Commercial Importance on the Northeastern Coast of Mexico" by J. Berdegué (1956), "Preliminary List of Freshwater and Marine Fishery Resources of Mexico" by R. Ramirez G. and M. L. Sevilla (1963), "The Geographic Distribution of Shrimp in the Mexican Pacific" by Chapa (1956), and others, have contributed significantly to this end.

The magnitude of the marine resources of Mexico remains unknown (Carranza, 1963), but they are believed to be vast. Berdegué (1956) reports

over 190 species of fish of commercial importance in the northwestern coastal waters of Mexico. Later (1960), he emphasizes that large numbers of species are common to tropical waters and are not necessarily an indication of large exploitable populations.

The habits, biology, and dynamics of important resources such as shrimp are practically unknown in Mexico (Berdegué, 1960; Carranza, 1963). Existing publications on shrimp cover mainly their geographic distribution and some biological aspects.

Shrimp research was begun mainly by Mr. M. J. Lindner of the U. S. Fish and Wildlife Service and his coworkers during the early 1940's. Later, Nuñez, Chapa, and Avila of the Pacific Fisheries Institute published some of their findings during the short life of the Institute, from 1947 to 1952. These studies were carried out on shrimp biology in estuarine waters of southern Sinaloa and northern Nayarit. Other interesting studies on shrimp were carried out and published. Among these are Cardenas' "Contribution to the Knowledge of the Biology of Penaeids of Northwestern Mexico;" "The Geographic Distribution of Shrimp in Northwestern Mexico," and "Generalities about Shrimp Fisheries and Biology (Genus *Penaeus*)" by Chapa, 1956 and 1963; and "A Preliminary Study of Commercial Shrimp Populations of the Campeche Sound" by Ramírez, 1963.

To improve fisheries research, Berdegué (1960) pointed out the need for a fisheries research center. In 1962, the National Fisheries Research Institute was established and placed under the direction of Mauro Cárdenas (Mimeo., 1963). During meetings on problems of the fishing industry, held in November, 1963, at the Mexican Institute for Natural Renewable Resources in Mexico City, the assistant-director of the Fisheries Department, Rodolfo Ramírez, stated that his department had passed from a purely descriptive phase of Mexican fisheries to one of active participation (Ramírez, 1963). To this end, several marine biological research stations have been built, two eighty-foot research vessels, YOLANDA and GRACIELA, are operating in the Pacific and a smaller vessel, EL EXPLORADOR, is operating in the Gulf of Mexico (Gutiérrez, 1963). Dragging operations to reopen sand-logged bars and increase areas available to shrimp for growth have begun (Cárdenas, 1963). The National Fisheries Consultative Council is determining the location, population size, and availability of species that may be used in fish-meal and fish-oil production. This study is being carried out through aerial observation combined with surface vessel studies and biological and morphological studies by the National Fisheries Research Institute (Ferreira, 1963).

Other government institutions, such as the Banco de Fomento Cooperativo, are contributing with their own efforts to those of the Fisheries Offices. This institution is carrying out ambitious research and development programs, including exploratory fishing, and introduction and adaptation of efficient capture and preservation methods. To this end, a "pilot" fishing port in Alvarado, Veracruz, complete with several multiple gear fishing vessels, shore installations to service boats with repairs and ice, and equipment to preserve fishery products by different methods such as salting, smoking, freezing, canning, dehydrating, and refrigeration was established.

The efforts of the Mexican government are already beginning to bear fruit. Carranza (1963) reported tuna catches of up to 50 fish per 100 hooks with long lines in the Gulf of Mexico. At the present time, Dr. Carranza is on leave

from the Technological Institute of Veracruz and engaged in operating the Banco de Fomento Cooperativo's fleet. These vessels are conducting exploratory and experimental fishing, and bottom mapping, by echo sounder, of the areas adjacent to Port Alvarado.

Educational institutions in Mexico should participate in research aimed at solving problems of the fishing and fish processing industries. These institutions have faculty members trained in different disciplines that could be of great value in carrying out fisheries oriented research. In this way, a marine science department within a university could obtain the cooperation of faculty members from other departments, such as chemistry, physics, engineering, biology, and mathematics. The active participation of college students, as aides in research work, would at the same time enhance their training.

There are three educational institutions offering training in Marine Sciences in Mexico: The University of Baja California, The Technological Institute of Monterrey, and the Technological Institute of Veracruz. The first two offer this training at the university level and the latter at the intermediate or technician level.

Three other institutions offer training in related fields. The Universities of Mexico and Nuevo León offer university training in biological sciences, and the National Polytechnic Institute offers training in biological and food sciences.

The interest that the exploitation of marine resources has awakened in Mexico was shown this fall, when 47 students registered for the first semester in marine science at the Technological Institute of Monterrey.

The origin of these students seems to indicate that the interest in marine science exists not only among people with close contacts with the sea, but is also shared by many from heavily industrialized areas of Mexico. The incipient growth of our Institute and the continued growth of other organizations dedicated to training and research in marine science augurs a continued improvement of Mexico's fisheries.

#### REFERENCES

- AGUILAR I., FREDERICO  
1963. Notas sobre las investigaciones del camarón en el noroeste y los resultados prácticos obtenidos. *Trab. Div., Inst. Nac. Inv. Biol.-Pesq.*, 6 (57), 4 p.
- BERDEGUÉ, JULIO  
1956. Peces de importancia comercial en la costa nor-occidental de México. *Dir. Graf. Pesc. Ind. Con., Sría. Mar. México*.  
1960. Perspectivas de desarrollo de los recursos Acuáticos. *Mesas redondas sobre problemas demográficos de México. Inst. Mex. Rec. Nat. Renov.*, 1960: 341-411.
- CARDENAS, MAURO  
1963. Los recursos marinos de México y su aprovechamiento. 1a. Mesa redonda sobre problemas de la industria pesquera. *Inst. Mex. Rec. Nat. Renov.*, 1963: 59-61.
- CARRANZA, JORGE  
1957. Marine Fisheries of the Yucatán Peninsula México. *Proc. Gulf Caribb. Fish Inst.*, 9: 145-150. 1956.  
1959. Los recursos naturales del sureste y su aprovechamiento. *La pesca, Inst. Mex. Rec. Nat. Renov.* 2nd Part, 3 chapter 5: 151-238.  
1963. Los recursos marinos de México y su aprovechamiento. 1a. Mesa redonda sobre problemas de la industria pesquera. *Inst. Mex. Rec. Nat. Renov.*, 1963: 3-41 and 64-69.

- CHAPA, HÉCTOR  
 1956. La distribución geográfica de los camarones del noroeste de México y el problema de las artes fijas de pesca. Dir. Gral. Pesca Ind. Con., Sría. Marina México.  
 1963. Generalidades sobre la pesca y biología de los camarones (Género *Penaeus*). (1) Trab. Divulg., Inst. Nac. Inv. Biol. Pesq., 4 (33), 32 p.
- COBOS, JOSÉ A.  
 1963. La industria pesquera en México, 5a. Mesa redonda sobre problemas de la industria pesquera. Inst. Mex. Rec. Nat. Renov., 1963.
- FERREIRA, HÉCTOR  
 1963. Los recursos marinos de México y su aprovechamiento. 1a. Mesa redonda sobre problemas de la industria pesquera. Inst. Mex. Rec. Nat. Renov., 1963: 42-51.
- GUTIERREZ, TONATIÚH  
 1963. Los recursos marinos de México y su aprovechamiento. 1a. Mesa redonda sobre problemas de la industria pesquera. Inst. Mex. Rec. Nat. Renov., 1963: 56-59.
- LINDER, MILTON J.  
 1944. The commercial marine fishes, crustaceans and molluscs of the West Coast of Mexico. Trans. Amer. Fish. Soc. 74: 71-80.  
 1948. The fisheries and fishery resources of Mexico Comm. Fish. Rev., F.W.S., 10 (8): 23-30.  
 1958. The shrimp resources of continental Latin America Proc. Gulf Caribb. Fish. Inst., 10: 28-33. 1957.
- RAMIREZ, RODOLFO  
 1963a. Estudio preliminar sobre las poblaciones de camarones comerciales en la Sonda de Campeche. Trab. Divulg. Inst. Nac. de Inv. Biol. Pesq., 7 (65), 13 p.  
 1963b. Los recursos marinos de México y su aprovechamiento. 1a. Mesa redonda sobre problemas de la industria pesquera. Inst. Mex. Rec. Nat. Renov., 1963: 61-63.
- RAMIREZ, RODOLFO AND MAURO CARDENAS  
 1963. Instituto Nacional de Investigaciones Biológico Pesqueras. Mimeo. Inst. Nac. Inv. Biol. Pesq., June 20, 1963.
- RAMIREZ, RODOLFO AND M. L. SEVILLA  
 1963. Lista preliminar de recursos pesqueros de México, Marinos y de agua dulce. Trab. Divulg. Inst. Nac. Inv. Biol.-Pesq., 5 (42), 42 p.
- SEVILLA, M. L.  
 1956. Los recursos pesqueros del sureste de México. Sría, Rec. Hid. Memo. Tec. (111), 2 p.

## A Review of the Investigation and Increasing Exploitation of the Fishery Resources of Venezuela

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### Abstract

Venezuela has relatively productive seas along its 2,800 km of coastline and over its 90,000 km<sup>2</sup> of continental shelf; this productivity is promoted by the trade winds. About 40,000 Venezuelans earn their living by fishing, and 200,000 fish part-time for subsistence.

In western Venezuela there is a trawl fishery for shrimps, corbinas, croakers, and mullets. In central Venezuela, which has little continental shelf, there is

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