

# The Oyster Industry of Eastern Mexico

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## Introduction

Mexico has an oyster industry of substantial size, ranking about sixth in the world. In 1993, among the top ten oyster producers, Korea, Japan, the United States, China, and France ranked ahead of Mexico, while the Philippines, Australia, Canada, and New Zealand trailed it (Fig. 1). On its east coast, the species landed is the eastern oyster, *Crassostrea virginica*, while on its west coast *C. corteziensis*, *C. iridescens*, and the Pacific oyster, *C. gigas*, are landed. During the last 10–15 years, annual production often was at least 50,000 t of shelled oysters, or nearly 1.5 million bushels (Anonymous, 1995), with the great preponderance (90%) coming from a series of lagoons connecting with the Gulf

of Mexico along the east coast (Fig. 2) and the remainder produced on the west coast.

On the east coast, fishermen in most lagoons intersperse oystering with catching shrimp and fish, though oys-

tering is economically most important (Galvan<sup>1</sup>). The oysters are harvested with tongs and by hand. All the east

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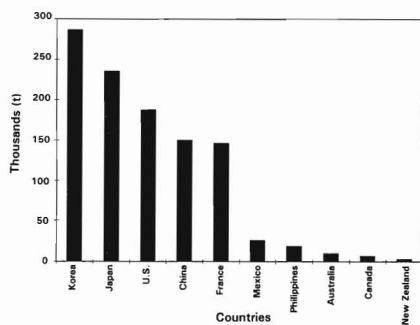


Figure 1.—Oyster production of the ten leading countries of the world in 1993 (FAO, 1993).

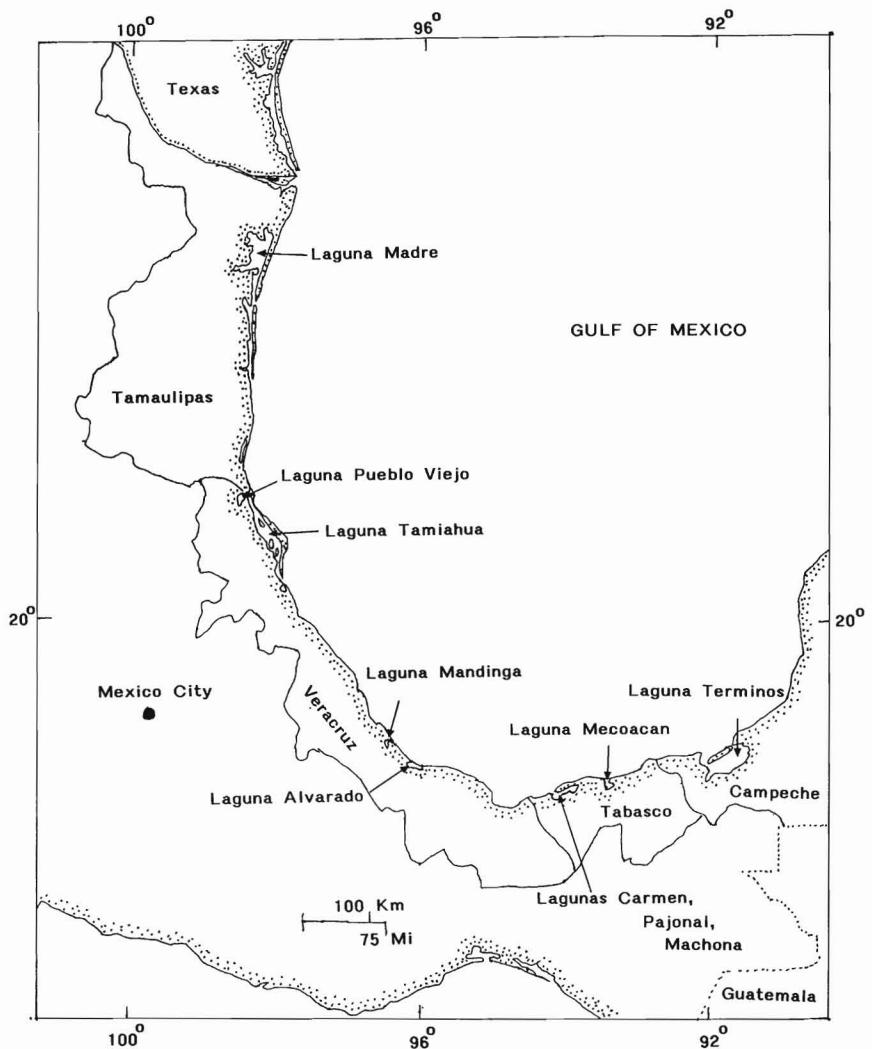


Figure 2.—The east coast of Mexico with the principal oystering lagoons identified.



Figure 3.—Mayan ruins at Comalcalco, Tabasco. Oyster shells were used in the cementing materials to bind the building blocks together.

coast production is consumed in various towns and cities within Mexico, where a long-standing tradition, mostly among men, exists for eating oysters. At least 90% are prepared in cocktails, while some are served raw on the half-shell, and small quantities are cooked. Oysters are eaten year-round, but fewer are eaten in the warmest months when some beds are closed to allow oyster seed to grow. The strongest demand period is during the 40 days of Lent, February–April.

Little has been written in international journals about the Mexican oyster industry, and it is little known outside of Mexico. This paper describes the oyster boats and gears, and harvesting, culture, processing, and marketing methods, and consumption of oysters in eastern Mexico. Most of the information was obtained on surveys during 8–17 November 1996 and 29 January to 5 February 1997. They covered the full extent of the oyster-producing region from Laguna Madre just south of the U.S. border to Laguna de Terminos in the southeast, and included interviews with about 50 government officials, fishermen, processors, trucking owners, managers of cooperatives, and restaurant owners, as well as observation and photography. Prices are reported in U.S. dollars.

### Early Uses of Oyster Shells

Several centuries ago, the Mayans living near the southern coast of the Gulf of Mexico used ground shells of oysters and other mollusks to make lime and mixed it with sand as material to construct their homes. In addition, they used oyster shells as one of the binding materials to hold together large blocks in constructing many of their large temples and other structures. For example, the Mayan ruins at Comalcalco in Tabasco are constructed with the use of oyster shells (Fig. 3). In the early years of this century, oyster shells were used to fill hollows in the ground when homes were constructed, and the shells were burned to make lime for painting houses and trees (Rodriguez<sup>2</sup>). Few shells were returned to the oyster beds as cultch for oyster larvae. Shell mounds left by ancient Indians (middens) are rare or do not exist in eastern Mexico.

### Oyster Landing Statistics

The Mexican government collects statistics on landings of all its fishery products. In the 11 years from 1985 to 1995, annual oyster production in east-

<sup>2</sup> Ruben Rodriguez Navarro, Chief of Aquaculture Department, SEMARNAP, Juan De La Luz Enriquez #8, Colonia Adolfo Ruiz Cortinez, Tuxpan, Veracruz, Mex.

ern Mexico ranged from 22,821 t to 52,131 t, with an average of 37,548 t or about 1 million bushels of shelled oysters. Production for the 4-year period, 1992–95, with an average of 28,259 t/year was about one-third less than the average of 44,482 t/year for the previous 7 years (Fig. 4). Production dropped mainly because the demand for oysters fell, while the supplies in the estuaries did not decline except in 1993 when the flatworm, *Stylochus* sp., population exploded and the worms killed many oysters (Rodriguez<sup>2</sup>).

East coast production comes from four states. The State of Veracruz usually led the other three with production mainly from Lagunas Pueblo Viejo and Tamiagua and a small amount from Lagunas Mandinga and Alvarado. The second leading State in production was Tabasco, with oysters coming mainly from Lagunas El Carmen, Pajonal, Machona, and Mecocan. The States of Tamaulipas, with most production from Laguna Madre, and Campeche, with most production from Laguna de Terminos, combined to produce about one-sixth as many oysters as the total of the other two states (Fig. 5).

Oysters are landed in every month, but slightly more than twice as many are produced in the six cooler months (December through May when production averages 3,655 t/month) than in the six warmer months (June through November when production averages 1,649 t/month)(Fig. 6). The highest production is in April and May when oysters are the largest (Corripio<sup>3</sup>). The monthly production data include both Atlantic and Pacific coasts. A reason for less production in the warm months is that oystering in some lagoons is closed by the Federal Government for periods of 2.5–3 months then.

The oyster species *Crassostrea corteziensis*, *C. iridescens*, and *C. gigas* are landed in 9 of the 11 states on the Pacific coast. In recent years, the States of Baja California, Baja California Sur, Guerrero, Sinaloa, and Sonora have been the leading Pacific coast producers (Anonymous, 1995).

<sup>3</sup> Ernesto Corripio, Chief of Cooperative, Tuxpan, Veracruz, Mex.

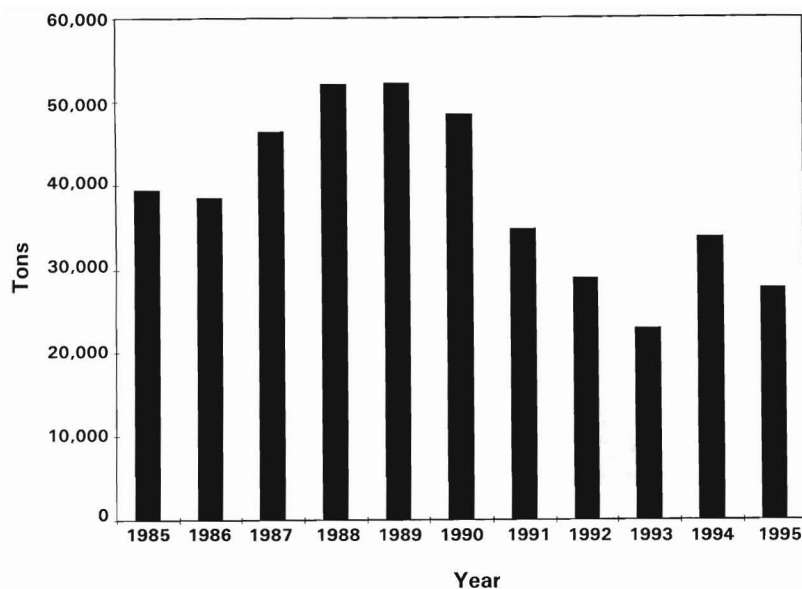


Figure 4.—Annual oyster landings in eastern Mexico, 1985–1995 (Anonymous, 1995).

### The Oyster Lagoons

Oysters are present in nearly every lagoon along the east coast from Laguna Madre to Laguna de Terminos. The lagoons are relatively large but shallow. Total lengths (and depths where most oysters are harvested) of the major oyster-producing lagoons from north to south are: Laguna Madre, 220 km (40 cm–1.5 m); Laguna Pueblo Viejo, 15 km (1–1.8 m); Laguna Tamiahua, 107 km (1.5–3 m)(Fig. 7); Laguna El Carmen, 15 km (40 cm–2 m); Laguna Machona, 14 km (40 cm–2 m); Laguna Mecoacan, 11 km (40 cm–2 m)(Fig. 8); and Laguna de Terminos, 77 km (40–60 cm)(Fig. 9). Between them lie several smaller estuaries where fishermen harvest oysters, and there are 1–2 estuaries containing oysters that are too far from population centers for harvesting.

In the past, the openings in the sand bars between Laguna Madre and the Gulf of Mexico closed, and the lagoon became a saline lake. The Federal Government had to take actions to reopen them (Hildebrand<sup>4</sup>).

The salinities are 31–34‰ in Laguna Madre, 18–21‰ in Laguna Tamiahua,

<sup>4</sup> Henry Hildebrand, Professor Emeritus, University of Corpus Christi, Tex.

and about 23‰ in Laguna de Terminos (Yanez-Arancibia et al., 1985). Laguna El Carmen has had a history of becoming too fresh for oysters during extended periods of heavy rainfall (Hildebrand<sup>4</sup>). The oysters from Laguna Tamiahua with its moderate salinity may have the best flavor of those along the east coast (Ramirez<sup>5</sup>). In Lagunas El Carmen,

<sup>5</sup> Ricardo Ramirez Mendoza, Technician, SEMARNAP, La Laja, Veracruz, Mex.

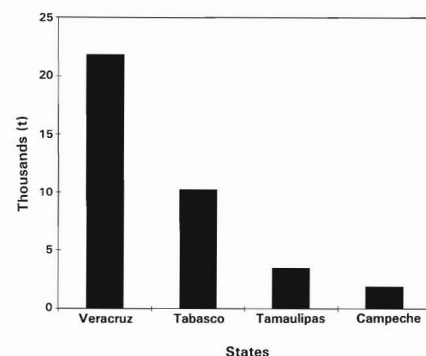


Figure 5.—Comparison of oyster landings from each of four states of eastern Mexico, average for 1985–95 (Anonymous, 1995).

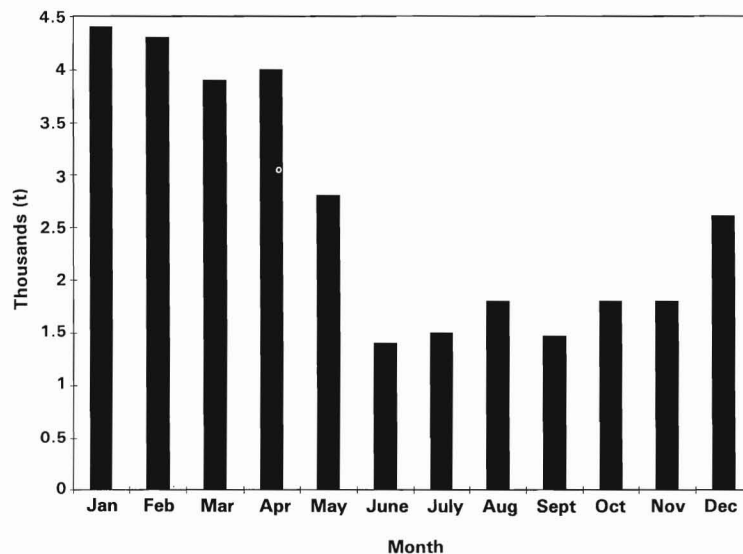


Figure 6.—Mexican oyster landings by month (Atlantic and Pacific coasts combined)(Anonymous, 1995).

Pajonal, and Machona, the salinity ranges from 10–30‰ during the dry season and 0 (near river mouths) to 25‰ during the wet season, while the average annual temperature is 30°C (Antoli and Garcia-Cubas, 1985). Temperatures range from 20°–32°C in Laguna de Terminos (Amezcuca-Linares and Yanez-Arancibia, 1980; Alvarez Guillen et al., 1985). The range of tide in the lagoons is small. The maximum is about 50 cm.

The oyster beds occupy relatively small areas in most lagoons. Perhaps the smallest percentage of bed area to lagoon area is in Laguna de Terminos

where the oyster beds occupy about 1% of its area. At the other extreme are Lagunas El Carmen, Pajonal, and Machona, where the beds occupy about

10% of their areas; the bottom between the beds is muddy (Galvan<sup>1</sup>). The bottom of sections of some lagoons such as Laguna Madre is hard sand covered in some areas with tiny clam shells.

### Oyster Biology and Ecology

The eastern oyster (Fig. 10) grows in clusters and, from Laguna Madre southward through at least Laguna Tamiahua, in two forms. A relatively long, narrow form grows on soft bottoms and locally is called a "huarache" (shoe) or "lengua de vaca" (cow tongue), while a more oval form, similar to most oysters grown in the estuaries of northeastern United States, grows on hard bottom commonly covered with tiny shells and is called a "bola" (ball)(Fig. 11). The two forms can be present on the same oyster cluster. The huaraches lie against the bottom, whereas the bolas are attached to the top shells of the huaraches. The huaraches, which tend to grow larger than the bolas, sometimes are used in cooking. Nearly all oysters are bolas in Tabasco (Cruz<sup>6</sup>). Some Tabasco oysters might take the form of huaraches if they could grow to larger sizes.

Abundant oyster spatfall occurs every year. In the Tabasco lagoons, there are two peaks of setting, in March–April and September–October (Galvan<sup>1</sup>).

The oysters grow to market size within 6 to 12 months in all lagoons (Galvan<sup>1</sup>; Hernandez<sup>7</sup>). In Laguna Madre, huaraches grow to 13 cm and bolas to 10 cm in less than a year. In Tabasco, oysters grow about 1 cm/month and are 70–75 mm long within 7.5 months. Oysters grow faster in winter than summer (Galvan<sup>1</sup>). The fishermen retain oysters at least 70–75 mm long for sale.

Oysters have several animal pests. They include the flatworm, *Stylochus* sp., which when abundant can kill large numbers of oysters in Laguna Madre, Laguna Pueblo Viejo, and other lagoons, but they usually do not cause substantial mortalities. A minor preda-

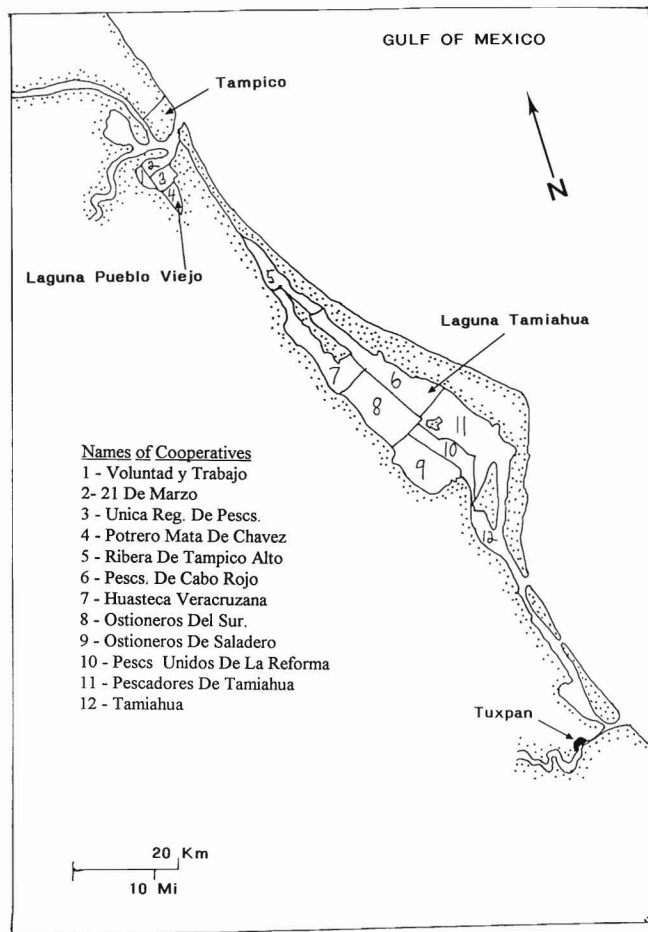


Figure 7.—Lagoons Pueblo Viejo and Tamiahua showing the areas where fishermen belonging to individual oyster cooperatives harvest oysters.

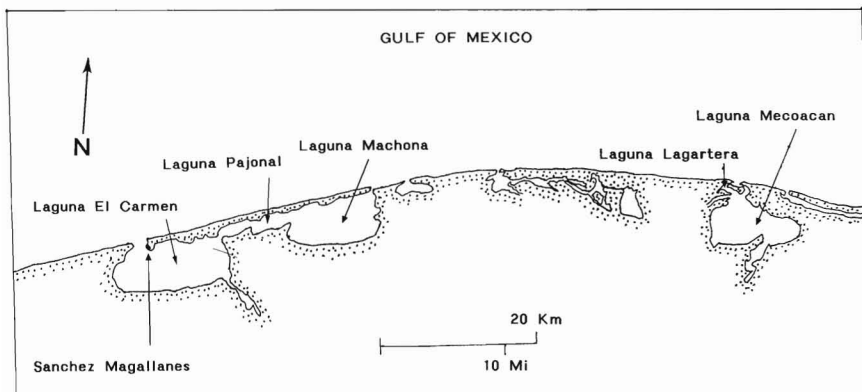


Figure 8.—The principal oystering lagoons in the State of Tabasco. Oyster beds occupy about 10% of their areas.

<sup>6</sup> Alejandro Cruz Diaz, Fisherman, "Los Tamarindos" cooperative, Ciudad Del Carmen, Campeche, Mex.

<sup>7</sup> Jose Hernandez, Fisherman, Muscatel, Tamaulipas, Mex.

tor is the Gulf oyster drill, *Urosalpinx perrugata*. The shells of live oysters are hosts of the mud blister forming worm, *Polydora* sp., and most shells have some black areas on their inside surface caused by the worm. Animal associates attached to oysters in every lagoon include barnacles and the mussel, *Brachidontes* sp. In February 1997, the mussels were so abundant on oysters in Laguna Lagartera the oysters had the shape of balls. In the past, the noncommercial oyster, *Ostrea equestris*, had become so abundant on *C. virginica* in some lagoons the *C. virginica* were difficult to handle (Hildebrand<sup>4</sup>).

In Tabasco, the oyster predators include the boring snails, *Melongena melongena* and *Thais haemostoma*; blue crabs, *Callinectes sapidus*; and flatworms (Garrido and Utrera, 1987). Competitors of oyster spat on shells include barnacles, *Balanus* sp.; slipper shells, *Crepidula* sp.; bryozoa, *Bowerbankia* sp. and *Schizoporella* sp.; mussels; and the sponge, *Cliona* sp. A species of red sponge occurs in the Tabasco lagoons. The fishermen related that oysters do well in areas where this sponge grows (Galvan<sup>1</sup>).

The oyster pathogen known as Dermo, *Perkinsus marinus*, is highly prevalent in the Tabasco lagoons (Burreson et al., 1994). The oysters die at about 7–8 cm and Dermo is the likely cause of the mortality. The oysters also die after 1 year in all the other lagoons from La-

guna Pueblo Viejo through Laguna de Terminos (Galvan<sup>1</sup>). Dermo probably causes the mortalities throughout this range. A survey of Dermo over the entire range of oysters in eastern Mexico has not been reported.

Small quantities of mangrove oysters, *C. rhizophorae*, are also present (Anonymous, 1996), but they are too small for harvesting. Descriptions of them in Mexico were unavailable.

### Public Health Problems

Public health regarding oysters is a concern. Human habitation is relatively sparse on the shores of most lagoons, and most oyster harvesting beds are far distant from population centers, but sewage treatment is absent or rudimentary. Some sections of lagoons have low concentrations of coliform bacteria. The most critical problems are in Laguna

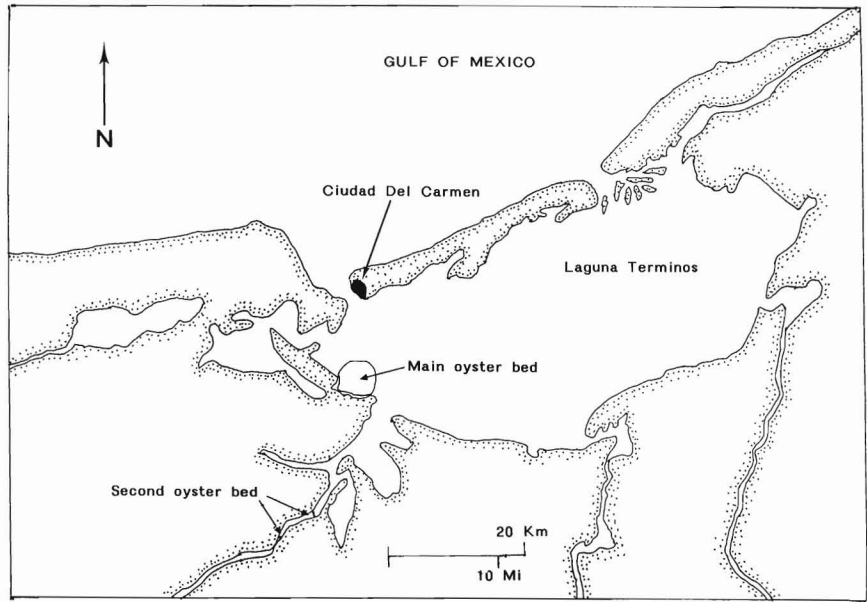


Figure 9.—The locations of the two commercial oyster beds in the Laguna de Terminos region.



Figure 10.—An oyster from Laguna Madre with its upper valve removed.



Figure 11.—At the left, six oyster shells from Laguna Madre. The upper three are “huaraches,” while the bottom three are “bolas.” At the right, six shells of market-sized oysters from Laguna El Carmen. The ruler between the shells is 15 cm (6 inches) long.

Pueblo Viejo and Laguna Alvarado, which receive effluents from the city of Tampico and the town of Alvarado, respectively. In this century, groups of people occasionally have become ill from eating oysters and, in recent years, such an event was publicized by the media (newspapers, radio, and television), leading to a temporary drop in demand for oysters.

Construction of sewage-treatment plants to reduce the coliforms has been considered too expensive to finance. The Federal Government has been attempting to support the industry by constructing better processing plants, issuing higher standards for shucking and handling oysters, and is considering deparating oysters before sale. Federal Government health authorities check lagoon waters and oyster meats in the plants at least once every 4 months to determine whether they meet standards for human consumption. A rapid transport of oysters from the beds to markets and the oysters being in ice on the trucks undoubtedly prevents bacteria from multiplying substantially.

Oil pollution was a problem in the lagoons of Tabasco in the 1980's. Oil drilling platforms were installed in the Gulf of Mexico offshore of the lagoons. Pipes on the platforms sometimes broke and northerly winds blew oil slicks into the lagoons contaminating the oysters to a small extent. Such contamination has rarely occurred in the 1990's and has not been serious (Galvan<sup>1</sup>). Some fishermen blamed any oyster mortalities on the oil, but Burreson et al. (1994) suggest that Dermo was the actual cause.

Red tides appear about once every 2 years in northern estuaries, according to fishermen (Perez<sup>8</sup>). The tides usually persist for 2–3 weeks, and the Federal Government suspends harvesting for several weeks to protect public health.

### Fishermen's Cooperatives

Most fishermen belong to cooperatives where they sell their oysters and other marine species. The cooperatives own the buildings where the oysters are

<sup>8</sup> Jose Julio Perez, Fisherman, Carboneras, Tamaulipas, Mex.

processed and sold. Separate lagoons have from one cooperative, such as in Laguna Alvarado with 81 members and Laguna de Terminos with 56 members, to several, such as in Laguna Madre, Laguna Puerto Viejo, Laguna Tamiahua (with eight), and the lagoons of Tabasco. Some cooperatives have at least 200 members. In certain lagoons, fishermen can harvest oysters anywhere, but in others all sections of bottom are under individual cooperative control and only cooperative members can harvest oysters in them. Individual cooperative control over bottoms is practiced in Lagunas Puerto Viejo, Tamiahua (Fig. 7), and in Laguna de Terminos, but not in Lagunas Madre, El Carmen, Pajonal, and Machona (Galvan<sup>1</sup>).

When a fisherman sells a product to his cooperative, it takes 8% of the selling price and the buyer pays 10% of the purchase price to the cooperative. The total money is paid to the Federal Government as a tax.

### The Fishermen

The oyster fishermen, all of whom are males, live in small communities on the shores of the lagoons. Most walk to their boats and the cooperatives. They have low incomes (Galvan<sup>1</sup>). A common saying around the oystering areas is "Fishermen go out to harvest oysters to make enough money to purchase some food to eat." The tonger in a boat pays the worker he has hired to cull his catch about \$3.50 a day.

In the mid-1990's, there were 350 fishermen in Laguna Pueblo Viejo; nearly all were oystering on good days when there was a demand for oysters (Anonymous, 1996). In Lagunas El Carmen, Pajonal, and Machona combined, about 150 men harvested oysters on typical good days (Galvan<sup>1</sup>), and 50 did so in Laguna de Terminos (Cruz<sup>6</sup>). Similar statistics for the other lagoons were not available.

### Harvesting Gear and Methods

Fishermen harvest the oysters with tongs from boats (Fig. 12, 13) or by hand while wading (Fig. 14). In Lagunas Pueblo Viejo and Tamiahua, most harvesting is with tongs, and in Lagunas El Carmen, Pajonal, and Machona,

nearly all harvesting is with tongs (Galvan<sup>1</sup>). The harvesting vessels include narrow wooden boats, 4.9–6.1 m long, and fiberglass boats, about 7.6 m long, and in Tabasco some dugout canoes as well. The dugouts, once common, are becoming scarcer because few large trees remain with which to make them. All vessels are propelled by outboard motors ranging from 15 to 45 hp. A new fiberglass boat costs \$1,500 and a new 45-hp outboard motor costs \$3,500 (Rodriguez<sup>9</sup>). The tongs and cross-piece at the bottom are made of wood; most are made of mahogany, *Swietenia mahogani*. Long nails are driven into the cross-piece to act as teeth. A pair of tongs costs \$12.90–\$25.80 depending on their length which ranges from 2.4 to 4.6 m (Galvan<sup>1</sup>). Heavy old knives are used to cull the oyster clusters (Fig. 15).

Individual fishermen usually harvest oysters 3–4 days a week during the open season, but harvesting can be as infrequent as 1 day a week when the market demand is poor. They always harvest them on orders from the cooperatives which in turn have orders from buyers. The government insists that at least two men are present in each boat, one to harvest the oysters and one to cull and return shells, some containing seed, to the beds. In most lagoons, when there are no orders for oysters, the fishermen seek finfish or shrimp. Laguna Terminos is one exception where oyster fishermen seek only oysters. Boats with two men typically harvest 3–4 sacks in 8 h of harvesting. Each sack contains about 450 culled oysters which weigh 35 kg. A boat with four men (two tongers and two cullers) harvests about 7 sacks. In Laguna Madre, at least one crew of three tongers harvests 27–33 sacks (12,000 to 15,000 culled oysters) per day (Rodriguez<sup>9</sup>).

Fishermen do most hand harvesting at wading depths, less than 1 m. To protect against cuts, they wear short boots or sandals and gloves. Most fishermen put the oysters in floating containers when harvesting. In Laguna Madre, the fishermen use large galvanized wash-

<sup>9</sup> Severo Rodriguez, Fisherman, Carboneras, Tamaulipas, Mex.

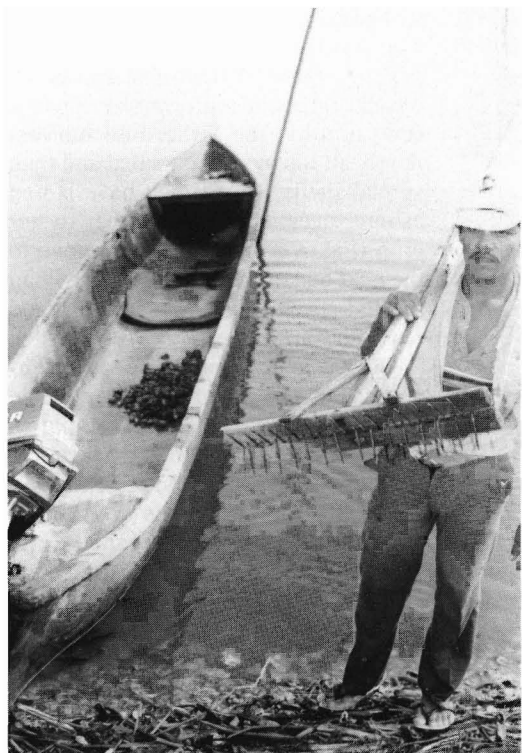


Figure 12.—(Left) A fisherman with his tongs, dugout canoe, and some oysters at the shore of the town of Sanchez Magallanes, Laguna El Carmen.

Figure 13.—(Above) Fisherman tonging oysters in Laguna Machona with helper culling his oysters.

Figure 14.—(Below left) Harvesting oysters by hand and holding them in a dugout canoe, Laguna Lagartera.

Figure 15.—(Below right) Using part of an old machete as a culling iron.

ing tubs, while in the south in Lagunas Lagartera, Mecoacan, and de Terminos, they use plastic and wooden boxes with floats attached and holding about a bushel (Fig. 16).

In Laguna Madre, many fishermen gather oysters by hand-picking when the water is warm enough to permit wading. This is all months except December, January, and February, when they harvest with tongs. About one-third of the oysters in Laguna Pueblo Viejo are harvested by hand-picking (Corripio<sup>3</sup>). In Laguna Tamiahua, a crew of three, with two in the water hand-picking and one in their boat culling, can harvest as many as 11 sacks of oysters in 6 h, while a crew of two, with one picking and one culling, can harvest about 6 sacks in 8 h.

Hand harvesting is the only method used in the small lagoons of Mandinga and Alvarado. In Mandinga, fishermen, who range in age from 14 to 70 (Gallegos<sup>10</sup>), usually dive for oysters about 4 hr a day. They wear face masks but not fins. They obtain about 85% of the

<sup>10</sup> Ing. Pesq. Horacio Gallegos Salledo, Calle Francisco Villa Lotes 8 and 9 Int. 201, Colonia Flores Magon, Bola Del Rio, Veracruz, Mex.



oysters in water 1.5–2 m deep and the remainder in waters up to 4 m deep, by making shallow dives to see the oyster clusters on the bottom. When oysters are abundant, a fisherman can get as many as 25–30 oysters in clusters on a dive. The divers put the oysters directly into their boats. A typical harvest for a two-man crew is 5.5–6.7 sacks (2,500–3,000 oysters) per day. In Laguna Alvarado, the fishermen open their oysters on the beds, put the meats in cans, and return the shells to the beds. They later wash the meats ashore when they pack them (Hernandez<sup>11</sup>).



In Laguna de Terminos, where oysters are harvested only by hand-picking, 17–20 fishermen ride from the city of Ciudad Del Carmen to the oyster beds, a 1-h run, in each of three 7.6 m boats. Once there, they waded onto an oyster bed, pick up oysters, cull them, and put them into floating wooden boxes that each hold about 540 oysters

<sup>11</sup> Hermilo Hernandez Sosa, Fisherman, Arbolillo Municipio de Alvarado, Veracruz, Mex.



Figure 16.—Tubs with floats used to hold oysters while fishermen hand-pick them. In tub at right is face mask fishermen wear when harvesting at depths beyond about 1 m.

or about a bushel. When the boxes are full, they put them on the boat. Each man has a quota of 2,700 oysters (5 boxes) a day of harvesting. Each boat returns to the cooperative oyster house in Ciudad Del Carmen with 85–100 boxes of oysters. The men usually work 8-h days from 4 a.m. to 12 noon. They shuck their oysters in the cooperative plant in the afternoons on harvesting days when the demand for them is high; however, they may shuck them the following morning instead of harvesting if the demand is low (Cruz<sup>6</sup>).

### Oyster Culture

Oyster culture has to be inexpensive because the fishermen have low in-

comes (Galvan<sup>1</sup>). The principal oyster culture method practiced by the fishermen is returning nearly all shells to the beds after the oysters are shucked, an action mandated and closely overseen by the Federal Government since 1976. No more than 20% of oysters can be sold in the shell because that shell rarely is returned to the beds. If a cooperative sells more than 20% of its oysters in the shell, it has to obtain shells from another area and spread them to make up the loss (Rodriguez<sup>5</sup>). The government forbids cooperatives to sell shells for other purposes, such as to the poultry industry.

The hand harvesters from Lagunas Mandinga to de Terminos work the oys-

ter beds in a similar way, which ensures a crop will always be available for harvesting. The crop will also consist of oysters of about uniform size. Over a few months, the fishermen harvest nearly all the oysters on a bed and then spread shells, which they have stored ashore, over it to start another oyster crop (Fig. 17, 18). They then move to the next bed of oysters, which they had shelled several months previously, and repeat the procedure (Cruz<sup>6</sup>; Gallegos<sup>10</sup>).

Government officials in addition encourage some cooperatives to practice hanging oyster culture. For example, in the Lagunas El Carmen and Machona, Tabasco, cooperatives are hanging necklaces of oyster shells in water 1–1.5 m deep. Fishermen store shells (Fig. 19) and then drill holes in their centers and string them onto monofilament lines about 50 cm long; each necklace has 17 pairs of shells (Fig. 20). The necklaces are hung from horizontal wooden poles set on the tops of cement posts anchored in the bottom about 4 m apart; about 15 pairs of necklaces are set on each beam (Fig. 21). Each farm unit has about 1,500 posts. In 1996, one cooperative farm in Laguna El Carmen set out 80,000 necklaces. Most shells with oyster seed are spread on the beds, while the rest remain on the strings until ready to be harvested. In the two lagoons, about 5% of available stored shells are put onto the necklaces while the remainder are spread on the beds.



Figure 17.—Cooperative members spreading shells over a bed where they had harvested all the oysters, to start another crop.



Figure 18.—Oysterman spreading oyster shells over bed of his cooperative.



Extremely large shells are used as ash trays.

In Laguna Mandinga, Veracruz, some cooperatives are engaged in a new project that involves placing burlap bags, which have been soaked in a water slurry of cement, sand, and a small amount of ground oyster shell and then air-dried (Fig. 22), in the estuary to col-

lect oyster sets. The spat are removed when about 2 cm long and are spread on hard bottoms. In 8 months after setting, the oysters grow to a length of about 8 cm, a perfect market size (Gallegos<sup>10</sup>; Chavez<sup>12</sup>).

<sup>12</sup> Jesus Chavez Campos, Cooperative secretary, Pescadores de Mandinga Cooperative, Veracruz, Mex.

### Local Oyster Consumption

Nearly all fishermen take some oysters home to eat. Their families eat oysters from one to four times a week. In one village bordering on Laguna Madre, the local people spread shells on a nearby bottom to have a supply of oysters to eat themselves. Oysters are



Figure 19.—Stored oyster shells near shore of Laguna El Carmen to be used as cultch for oyster larvae.



Figure 21.—Beams supported by cement posts holding necklaces of shells, Laguna El Carmen.

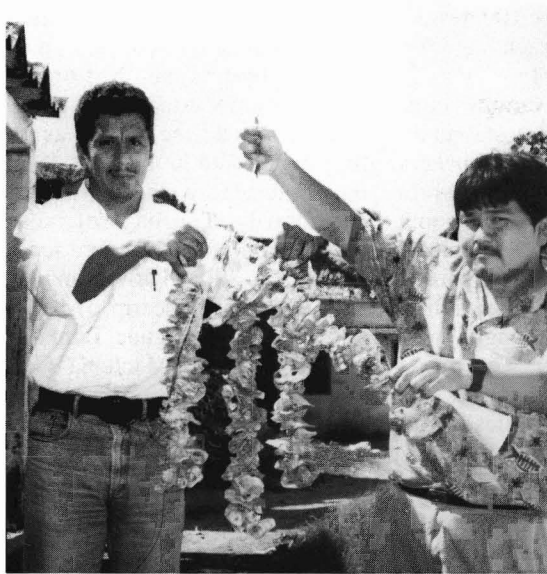


Figure 20.—Necklaces of oyster shells in Sanchez Magallanes, Tabasco, to be suspended as cultch for oyster larvae in Laguna El Carmen. They are held by Juan Galvan Utrera (left), Chief, Aquaculture Department of SEMARNAP, Villahermosa, Tabasco, and Armando Wakida-Kusunoki (right), junior author of this paper.



Figure 22.—Air-drying bags which were dipped into a water slurry of cement-sand-ground oyster shell. They will be suspended in Laguna Mandinga, Veracruz, as cultch for oyster larvae.

served in cocktails with tomato, onion, chile, and oil, or with lemon, salt, ketchup, hot pepper, and onion; or on the half-shell. Oysters are also cooked in various ways: 1) with oil, onion, tomato, and hot sauce; 2) in a soup with blue crabs, shrimp, and clams; or 3) breaded in corn meal and fried (Perez<sup>8</sup>).

### Processing Oysters

At least 90% of harvested oysters are shucked and sold as meats. The oysters usually are harvested, shucked, and packed in the same day when the demand is strong. Fishermen land the oysters in the late morning and they are opened and packed by 6 p.m. (Corripio<sup>3</sup>). Otherwise, they are held over for shucking until the following day. The processing buildings are in towns on the shores of lagoons where oysters are harvested. Nearly all buildings have cement floors, walls, and tables, glass windows, and screen doors, while some have roofs but no walls (Fig. 23). The oyster knives are similar to the common wood-handled oyster knife used in the U.S., but they have a wider steel blade (Fig. 24). Most are made by local tradesmen from discarded machetes and then sold for about \$3.85 apiece. In the States of Tamaulipas and Veracruz, the knives have square handles, while those in Tabasco and Campeche have round handles. The shuckers include men, women, and children as young as seven, all of whom work on a piece-work basis, but fishermen often open their own oysters. Shuckers are paid from \$1.42–\$1.55/1,000 oysters opened (Lara<sup>13</sup>). Each person usually opens from 2,000–5,000 oysters/day, the most experienced people opening the largest numbers (Galvan<sup>1</sup>).

The shuckers, usually wearing a white cap, white apron, and white boots as mandated by the Federal Government, stand next to the tables in cooperative buildings and shuck the oysters into plastic bowls. In most cooperatives, workers empty the meats into a large cement tank of freshwater and then scoop them out with colanders of measured volumes, such as a liter, and

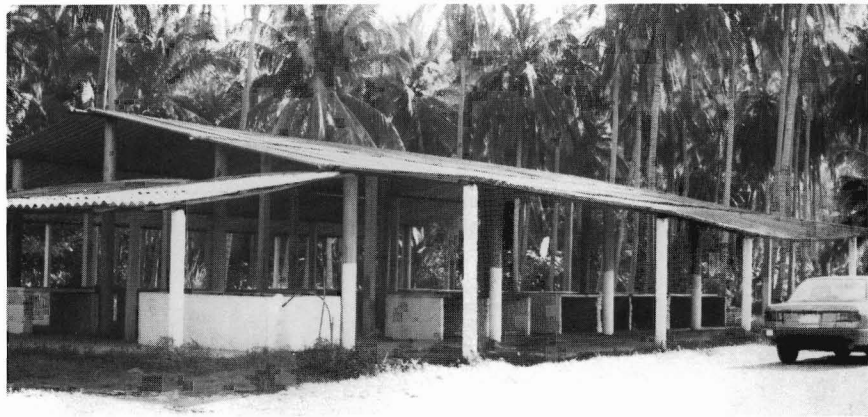


Figure 23.—A cooperative building with no walls where oysters are shucked and packed on the shore of Laguna Lagartera, Tabasco.

empty them into clear plastic bags. The bagged meats are free of mud and have few shell particles. The workers then dip the bags into freshwater to fill them and tie a tight knot in their ends to seal them (Fig. 25). The bags contain about half oyster meats and half water. Buyers want freshwater in the bags so the meats will swell (Galvan<sup>1</sup>).

The quantity of oysters in bags varies in different places and times, and it is based on directives from buyers. The smallest quantity observed was in Ciudad Del Carmen where 100 oysters were hand-counted into each bag. The largest quantities are 3–4 l.

Oyster handling at the various cooperatives appeared to be the most sanitary in Ciudad Del Carmen. The shuckers wore gauze face masks, besides white aprons, white caps, and white boots (Fig. 26). Instead of emptying meats into large cement tanks, workers poured them into 8-l plastic pans containing freshwater continuously changed from faucets of running water. The meats were swirled around by hand to free them of mud and shell particles before they were counted and packed.

Small quantities of oysters are also shucked out-of-doors on the shores of lagoons, such as Mecoacan, during the morning they are harvested (Fig. 27). The meats are sold in plastic bags on the same day along busy roadways which run past the lagoons (Fig. 28).

The remaining oysters are sold in the shell. The fishermen pack them in burlap bags and set each bag on a scale to

ensure it weighs 35–36 kg (Fig. 29), and then a crew loads them onto a truck for delivery.

### Markets and Marketing

Oyster meats and shelled oysters are sold in most Mexican population centers, and the largest market is Mexico City with a population of about 17 million. East coast oysters are sold in cities such as Cancun, Coatzacoalcos, San Luis Potosi, Puebla, Guadalajara, and Merida, and in most all states. Buyers send their trucks to the various cooperatives on the coast to pick up and deliver the oysters they had ordered. At the cooperatives, the trucks usually are waiting to load the oysters as soon as they are packed in the bags. If not, the bags of meats are placed in a cold room temporarily. The bags of meats are packed in a bed of crushed ice on the trucks (Fig. 30) and driven immediately to an inland city. The trip to Mexico City takes 7 h from Laguna Tamiagua and 11 h from Laguna Machona (Galvan<sup>1</sup>). Once there, they are taken immediately to fish markets and restaurants. The length of time from oysters leaving the beds to reaching the markets commonly is within 24 h.

A truck must have a load of at least 100 sacks of shelled oysters for the owner to make the trip from the coast to an inland city worthwhile. A full load for a typical 3-ton truck is 100–120 sacks. In 1996, a cooperative in Tamiagua paid fishermen \$6.45/sack of oysters, buyers paid the cooperative \$7.75/

<sup>13</sup> Rocio Lara Lara, Oyster shucker, Sanchez Magallanes, Tabasco, Mex.

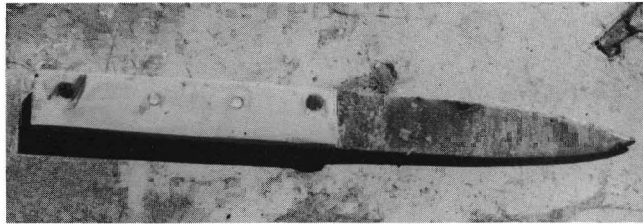


Figure 24.—(Above) A typical knife used to shuck oysters in eastern Mexico.



Figure 25.—(Right) Workers partially filling plastic bags with oyster meats, shore of Laguna Machona. One worker is preparing to tie knot in top of bag to seal it. The bags usually contain more water than is shown here.



Figure 26.—Oyster shuckers in packing plant in Ciudad Del Carmen, Campeche; note face masks, and white caps, aprons, and boots.



Figure 27.—Shucking oysters on the shore of Laguna Meacoacan. The oysters were harvested and will be on sale during the same day.

sack, and retailers in Mexico City paid the buyers \$10.32/sack. Some restaurants in Mexico City hold oysters in saltwater tanks while selling them.

Oyster meats in plastic bags are sold in fish markets (Fig. 31) and outdoor markets wherever fish are sold. The quantity of meats usually ranges from 100 to 1,000/bag, and their prices vary among outlets. In 1996, in Laguna El Carmen, the cooperative paid fishermen \$4.64/bag of 1,000 meats and sold them for \$6.19; a fish market in Coatzacoalcos sold them for \$10.32. Other prices in the same fish market were: \$1.29 for 70 oysters, \$2.58 for 250 oys-

ters of mixed sizes and for 500 small oysters, and \$3.87 for 200 large oysters. In a fish market in Ciudad Del Carmen, prices for similar bags were: \$1.29 for 100 small oysters, \$1.81 for 100 large oysters, \$3.35 for 200 oysters, and \$4.90 for 800 oysters. In an outdoor market in the town of Paraiso, bags of 200 oysters sold for \$1.29 each. Schoolboys sold bags of 200 oyster meats each on the side of a busy road on a Sunday morning for \$1.29 each.

A small restaurant in the city of Naranjos sold oyster cocktails and oysters on the half-shell. The restaurant bought small oyster meats with 1,000/

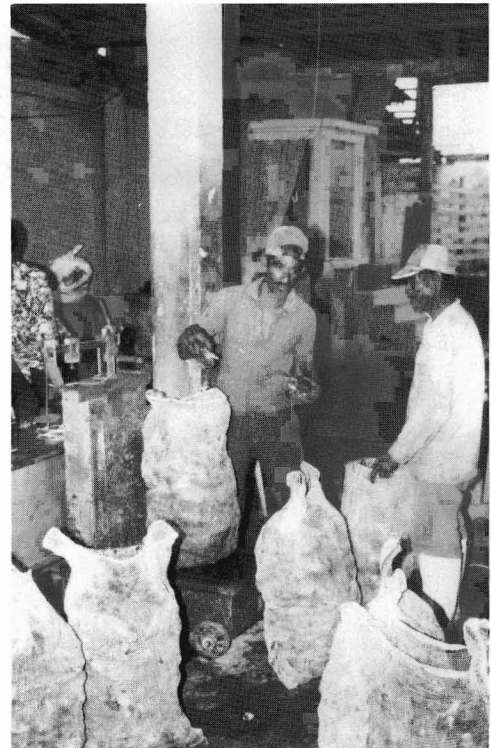
bag and large meats with 500/bag for \$2.58/bag. It charged \$2.06 for a cocktail with small oysters, \$3.23 for a cocktail with large oysters, and \$3.23 for a serving of 25 oysters of the half-shell. Its customers, as did at least one restaurant in Mexico, preferred oysters from Tamiagua Lagoon (salinity 18–21‰) to those from Laguna Madre (salinity about 32‰) because they had a



Figure 28.—(Above) Selling oyster meats on a roadside near Laguna Mecocan.

Figure 29.—(Right) Weighing oysters at a cooperative in Tuxpan, Veracruz. The bags must weigh a minimum of 35 kilos (77 pounds).

Figure 30.—(Below right) Crew at shore of Laguna Machona packing bags of oyster meats in bed of crushed ice in truck bound for an inland city.



better flavor. This restaurant ordinarily sold 5–6 bags of oyster meats in cocktails and some oysters on the half-shell every day (Almanda<sup>14</sup>). An upscale restaurant in Ciudad Del Carmen sold oyster cocktails with 15 oysters for \$1.93, with 25 oysters for \$3.87, and a jumbo cocktail for \$5.80 (Fig. 32). An inexpensive restaurant in the city sold cocktails for \$1.29 each. Another restaurant sold oyster soup for \$1.29/bowl.

When the Mexican economy is good and people in the cities have spare money, oysters sales are brisk. When it is poor, sales are slow.

#### Recent Developments

The Federal Government is concerned about the sanitary conditions under which oysters are handled in cooperative processing plants. New shucking plants are being constructed in Laguna Machona, Laguna Pajonal, and some other lagoons that will have more sanitary conditions. The government would like to improve the water quality in lagoons to meet the standards for



harvesting shellfish set by the U.S. Food and Drug Administration so that oysters can be exported to the United States and other countries. One measure might be to transplant oysters from contaminated to certified bottoms. For the short term, oysters probably would have to be depurated before they would be sufficiently pure to meet export standards.

#### Future Prospects

The oyster industry of eastern Mexico appears to have a solid future. The Mexican people have become more conservation-minded and will try to preserve oyster resources and habitats (Galvan<sup>1</sup>). Abundances of oysters could be increased by spreading additional quantities of shells on beds. No surveys have

<sup>14</sup> Juana Almada de Hernandez, Emiliano Zapata #12, Col. Progreso, Naranjas, Veracruz, Mex.

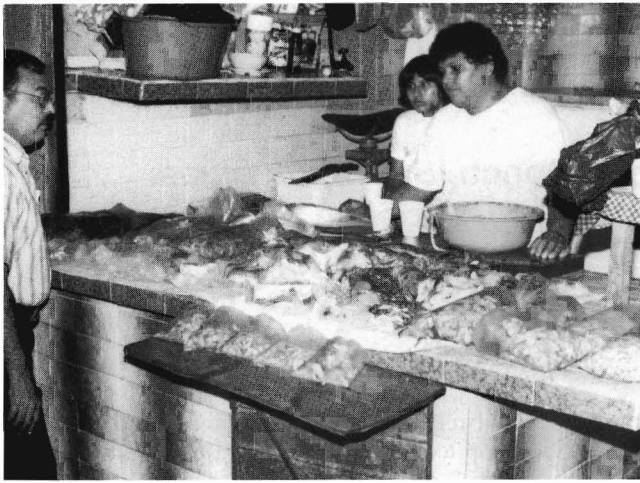


Figure 31.—Oyster meats in plastic bags being displayed for sale in a fish market in Coatzacoalcos, Veracruz.

been made as yet to determine whether deposits of fossil shells are present in the lagoons, but they probably exist because they are abundant in U.S. estuaries along the Gulf of Mexico from Louisiana to Florida (Gunter, 1951). If present, shells could be mined for spreading on the beds.

With the establishment of the North American Free Trade Agreement (NAFTA), the export of Mexican oysters to the United States would be encouraged more than in the past and production would expand. The impediment to export now is ensuring proper oyster sanitation.

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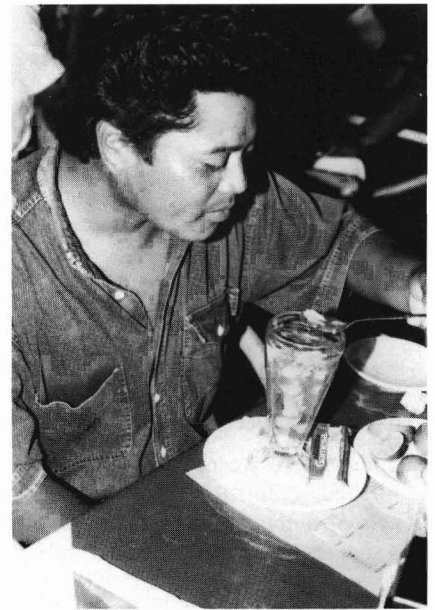


Figure 32.—Eating an oyster cocktail in restaurant in Ciudad Del Carmen, Campeche.