

THE PACIFIC SHRIMP FISHERY OF MEXICO

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ABSTRACT

The Pacific shrimp fishery is the most important Mexican fishery in terms of foreign exchange and employment. This fishery comprises an offshore and a lagoon fishery, like other tropical shrimp fisheries of the world. The offshore fishery¹ supports the largest fleet; the lagoon fishery supports the most fishermen.

The lagoon fishery began in pre-Hispanic times, with native barriers called *tapos*. This fishery has become very important in coastal lagoons of the Pacific, and nowadays cast nets such as *atarrayas* and *suriperas* are also used. The catch has stabilized at around 4,000 to 6,000 metric tons (MT) in the last 25 years, with some fluctuations.

The offshore fishery was developed in the 1930s with modified sardine boats. The fleet grew rapidly to 800 boats, and remained stable until 1971. From 1971 to 1981 it increased to 1,700 boats. This important increase in the fleet was made without any increase in the catch. The present catch level is 25,000 to 27,000 MT, with important stock fluctuations in the last 25 years. In the early 1960s and 1980s the catch reached similar maximum levels. During the late 1960s and 1970s the annual catch per boat decreased to a minimum from 40 to 15 MT.

Total catch in both fisheries has reached 40,000 to 55,000 MT in the last five years (1980–84). Regionally, Sonora and Sinaloa provided the main part of the catch. A similar but less important area is that of Oaxaca and Chiapas.

RESUMEN

La pesquería de camarón del Pacífico de México es la más importante del país desde el punto de vista de obtención de divisas y generación de empleo. Está integrada por una pesquería de altamar y otra de aguas protegidas como lo están también otras pesquerías tropicales en el mundo. La primera sostiene la mayor flota pesquera del país, mientras que la segunda sostiene la mayor parte del empleo.

La pesquería de aguas protegidas se ha desarrollado en los sistemas lagunarios costeros desde la

época prehispánica, con barreras llamadas "tapos." Actualmente es una pesquería muy importante en la mayoría de los sistemas lagunarios del Pacífico, e incluye, además de los tapos, redes denominadas *atarrayas* y *suriperas*. La captura en aguas protegidas se ha estabilizado en 4,000–6,000 ton en los últimos 25 años, y se han observado importantes fluctuaciones en la captura a través de los años.

La pesquería de altamar se desarrolló en los años 30 gracias a la introducción de sardineros modificados. Desde esa época hasta los años 60 la flota camaronera mexicana del Pacífico creció rápidamente hasta alcanzar una flota de 800 barcos, la cual permaneció estable hasta 1971. En la década de 1971–81, la flota creció hasta alcanzar 1,700 barcos. Este importante crecimiento de la flota ocurrió sin ningún incremento paralelo en la captura. Los niveles actuales de captura se encuentran entre las 25,000 y 27,000 ton, con importantes fluctuaciones en los últimos 25 años. A principio de los años 60 y 80 se lograron capturas máximas similares y, a finales de los años 60 y durante los años 70, las capturas alcanzaron sus niveles mínimos, descendiendo de 40 a 15 ton por barco por año.

La captura total en ambas pesquerías alcanzó unas 40,000–55,000 ton en el período 1980–84. Desde el punto de vista regional, los estados de Sonora y Sinaloa aportan la mayor parte de las capturas. Una zona similar aunque de menor importancia es la de Oaxaca y Chiapas.

INTRODUCTION

The Pacific shrimp fishery is the most important fishery for the country of Mexico, from both economic and social standpoints. More than 80% of the total catch is exported, which results in an important contribution to foreign exchange. The fishery has an offshore and a lagoon component, as do most other tropical shrimp fisheries in the world. About 1,600 trawlers operate in the offshore fishery. This is the largest fishing fleet in the country, and represents an important investment. The lagoon fishery is the main support of many communities established near the numerous lagoons along the Pacific coast.

During 1980–84, the total catch fluctuated from

¹In this paper, offshore shrimp fishery is defined as that occurring in bottom depths ranging from 5 to 60 fathoms.

TABLE 1
 Pacific Shrimp Catch by States (MT, Heads on)

State	1980	1981	1982	1983	1984
Baja California	1,698	1,780	1,818	1,162	965
Baja California Sur	579	211	563	1,070	427
Sonora	16,880	14,177	15,053	15,605	12,001
Sinaloa	22,944	16,536	28,318	25,303	25,962
Nayarit	872	711	1,659	2,266	1,121
Jalisco	0	0	0	32	3
Colima	114	94	381	657	532
Michoacán	0	0	0	0	1
Guerrero	133	122	114	121	106
Oaxaca	5,494	5,872	5,734	5,771	6,862
Chiapas	1,546	2,208	1,495	1,803	2,984
Total	50,260	41,711	55,135	53,790	50,964

TABLE 2
 Pacific Shrimp Fleet by States

State	1980	1981	1982	1983	1984
Baja California	51	68	60	64	58
Baja California Sur	13	21	34	38	38
Sonora	664	743	712	593	593
Sinaloa	509	557	580	570	570
Nayarit	4	3	5	24	24
Jalisco	0	0	1	13	13
Colima	74	77	31	29	29
Michoacán	7	0	6	8	8
Guerrero	14	11	8	8	8
Oaxaca	166	164	187	181	181
Chiapas	38	48	33	35	35
Total	1,540	1,692	1,657	1,563	1,557

40,000 to 55,000 MT (heads on), the main part of it (up to 80%) from the offshore fishery. Of that, more than 80% is caught in the Gulf of California, 15% in the Gulf of Tehuantepec, and less than 5% on the west coast of Baja California and the central Pacific coast of Mexico (Table 1).

Within the Gulf of California, Sonora and Sinaloa support the main part of the fishery (76% of the total catch), mainly because of the great number of lagoons and the excellent trawling areas on the continental shelf.

Fleet size contributes to the relative importance of this fishery; 75% of the shrimp trawlers were originally based in these two states, mostly at Guaymas and Mazatlán (Table 2). This fleet operates through the entire Pacific area, switching from

ground to ground as a function of the minimum commercial densities available at each of them. The same is true for the rest of the fleet during the fishing season.

In the Gulf of Tehuantepec, Oaxaca supports the main part of the total shrimp catch, taken mostly by the Salina Cruz fleet. There are also important lagoon areas here.

The Pacific shrimp fishery is mainly based on three species: brown shrimp (*Penaeus californiensis*), blue shrimp (*Penaeus stylirostris*), and white shrimp (*Penaeus vannamei*). Other species commonly found in the landings are the red shrimp (*Penaeus brevisrostris*) and other species of *Xiphopenaeus* and *Sicyonia*. Their landings have become increasingly important as the fleet grows.

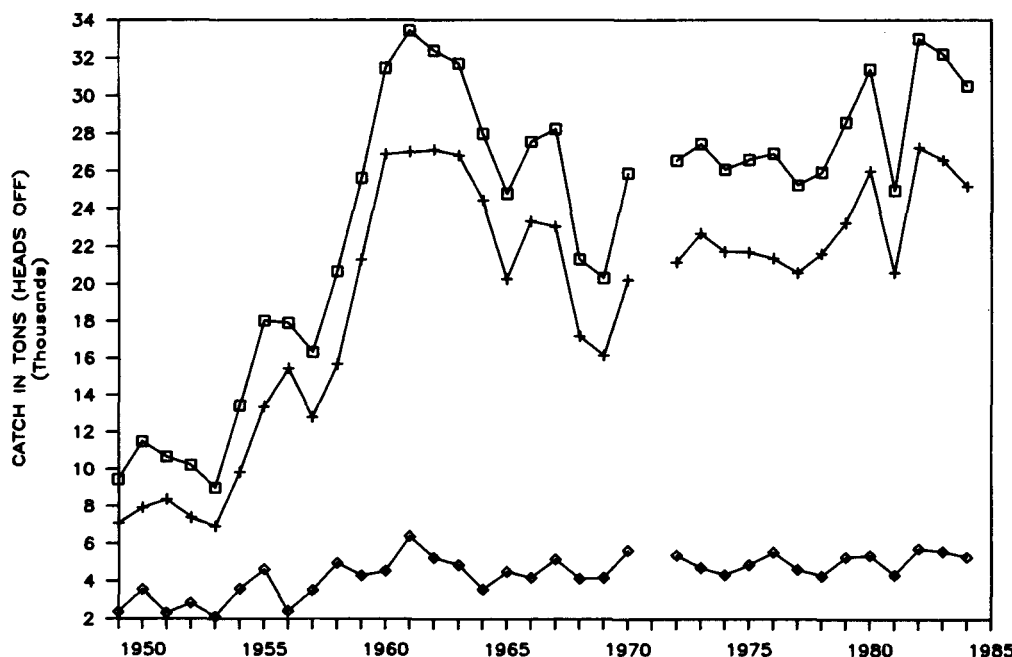


Figure 1. Catch trends in the Pacific shrimp fishery of Mexico. □ = total; † = offshore fishery; ◇ = lagoon fishery.

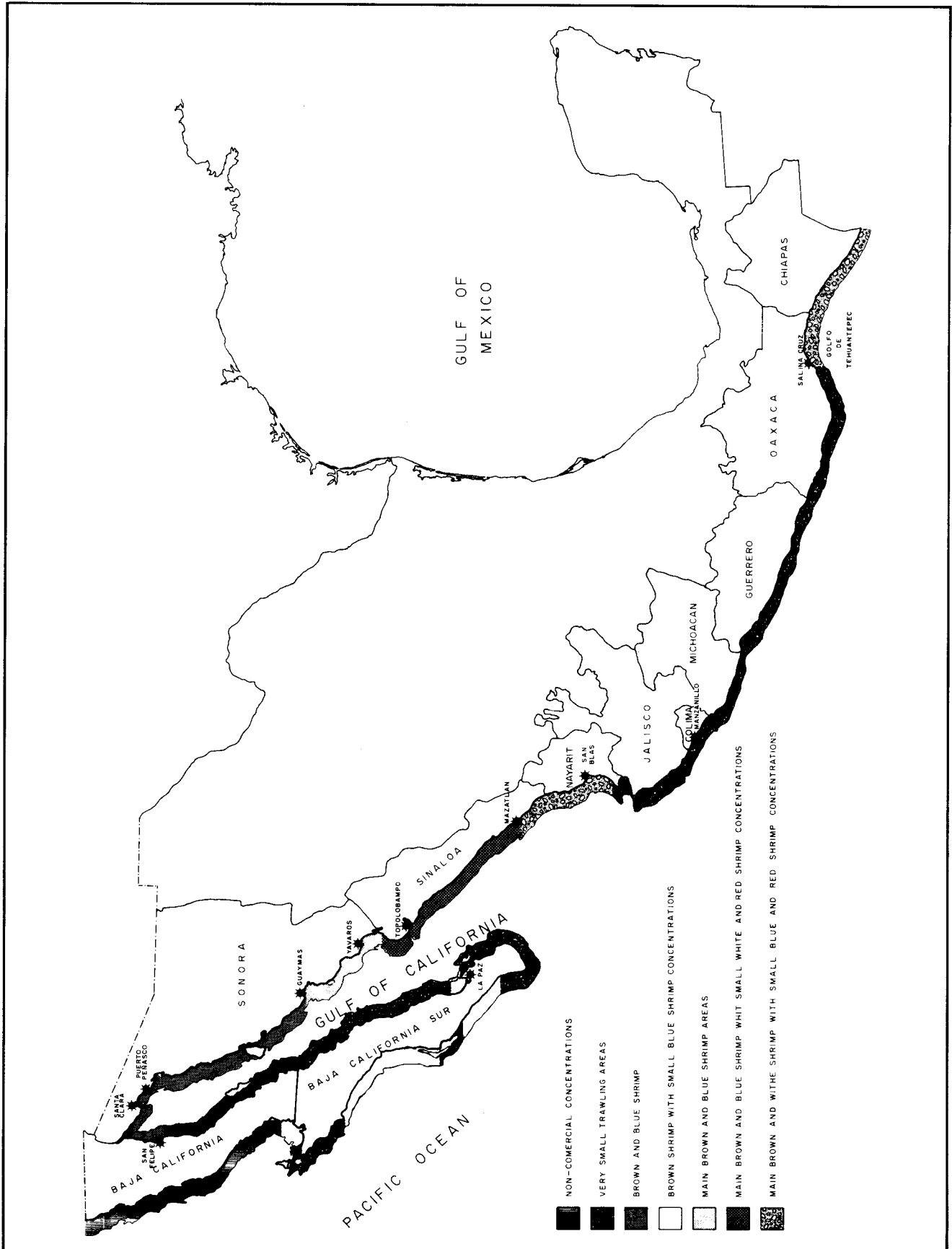


Figure 2. Geographical distribution of commercially important shrimp species in the Pacific fishery.

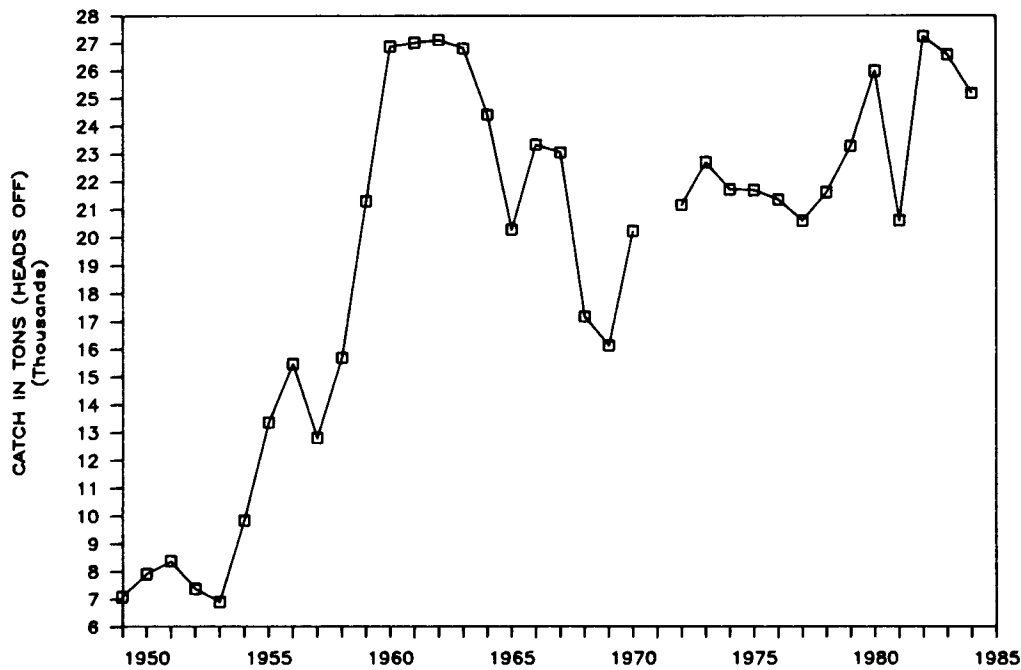


Figure 3. Catch trends in the Pacific shrimp offshore fishery.

TABLE 3
 Pacific Shrimp Offshore Fishery

Year	No. of boats	Catch (MT)	Catch per boat (MT)
1949		7,086	
1950		7,920	
1951		8,370	
1952		7,369	
1953		6,902	
1954		9,841	
1955		13,372	
1956	458	15,474	33.79
1957	514	12,806	24.91
1958	838	15,697	18.73
1959	730	21,315	29.20
1960	807	26,900	33.33
1961	694	27,030	38.95
1962	688	27,136	39.44
1963	819	26,820	32.75
1964	867	24,431	28.18
1965	880	20,285	23.05
1966	653	23,356	35.77
1967	710	23,072	32.50
1968	731	17,186	23.51
1969	754	16,150	21.42
1970	762	20,242	26.56
1971	845	—	—
1972	919	21,182	23.05
1973	1,041	22,719	21.82
1974	1,196	21,738	18.18
1975	1,192	21,705	18.21
1976	1,237	21,362	17.27
1977	1,329	20,606	15.50
1978	1,358	21,635	15.93
1979	1,515	23,290	15.37
1980	1,540	26,016	16.89
1981	1,692	20,621	12.19
1982	1,657	27,257	16.45
1983	1,681	26,592	15.82
1984	1,557	25,195	16.18

THE LAGOON FISHERY

The lagoon fishery was developed in pre-Hispanic times by natives, mainly in Sinaloa and Nayarit in the southeastern Gulf of California. They mostly used the *tapos*, barriers built with mangrove sticks across the channels and mouths of estuaries and lagoons. Shrimp juveniles (mainly blue and white shrimp) are trapped during their seasonal migration from the nursery areas in the estuaries to the spawning grounds offshore. The *tapos* system was described by Nuñez and Chapa (1951). Recently, *tapos* have been built with concrete and wood.

The *atarraya* (throw-net) and the *suripera* cast net are also commonly used nowadays. Both are usually made by the fishermen and operated from a small boat (12 m being the most common length) with an outboard engine of typically 45 hp. These nets were introduced around 1920.

The lagoon fisheries of the northern part of the Gulf of California and Magdalena Bay on the west coast of Baja California are based on the catch of blue shrimp juveniles, but in the southern part of the gulf this fishery comprises mostly blue and white shrimp juveniles. In the Gulf of Tehuantepec, white shrimp juveniles predominate.

The Gulf of California lagoon fishery operates from September to December in the north, and from August to February in the south. It operates throughout the year in the Gulf of Tehuantepec. The differences are mainly because recruitment regimes vary in each area.

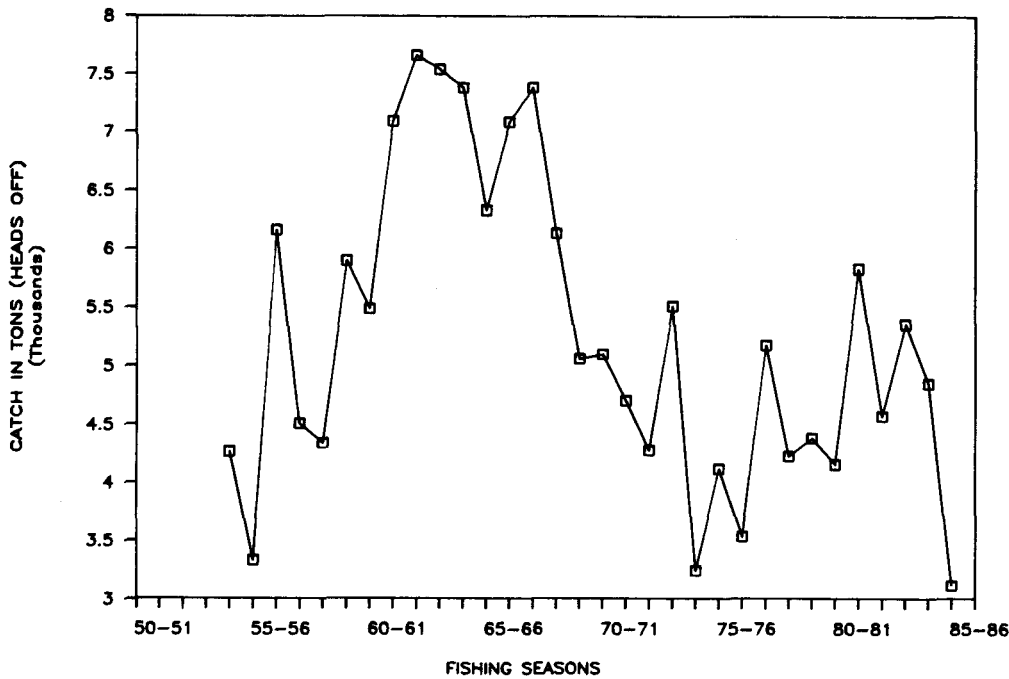


Figure 4. Catch trends in the Guaymas shrimp offshore fishery.

TABLE 4
 Guaymas Shrimp Fishery

Fishing season	No. of boats	Catch (MT)	Catch per boat (MT)
1953-54	164	4,267	26.02
1954-55	133	3,329	25.03
1955-56	136	6,161	45.30
1956-57	166	4,506	27.14
1957-58	183	4,336	23.69
1958-59	165	5,899	35.75
1959-60	170	5,487	32.28
1960-61	184	7,092	38.54
1961-62	200	7,663	38.32
1962-63	227	7,543	33.23
1963-64	234	7,381	31.54
1964-65	233	6,331	27.17
1965-66	225	7,086	31.49
1966-67	239	7,386	30.90
1967-68	219	6,131	28.00
1968-69	269	5,059	18.81
1969-70	289	5,097	17.64
1970-71	282	4,703	16.68
1971-72	273	4,275	15.66
1972-73	274	5,511	20.11
1973-74	281	3,242	11.54
1974-75	342	4,119	12.04
1975-76	444	3,535	7.96
1976-77	429	5,177	12.07
1977-78	438	4,225	9.65
1978-79	429	4,383	10.22
1979-80	495	4,154	8.39
1980-81	481	5,833	12.13
1981-82	392	4,569	11.66
1982-83	349	5,360	15.36
1983-84	383	4,850	12.66
1984-85	337	3,115	9.24

The historical catch is shown in Figure 1. During the last 30 years catches have stabilized at around 4,600 MT (heads off), with fluctuations of approximately 25%. This fishery now covers most of the lagoons. An increase in the catch by mere fishery management techniques seems unlikely. Dredging of sand bars at lagoon mouths, promoted during the last 15 years, has apparently helped maintain the catch levels, but has not resulted in an increase.

In the long term, reduced river runoff because of dams and agricultural irrigation has had, apparently, little or no effect on the lagoon shrimp catch. The main prospect for increasing catch in the lagoon shrimp fisheries lies in shrimp aquaculture, which has been promoted for the last five years in experimental and commercial operations, mostly in the gulfs of California and Tehuantepec.

THE OFFSHORE FISHERY

The offshore shrimp fishery has been documented by Ferreira (1965). It began in 1921 at Guaymas with two United States boats. During the 1930s, 17 California sardine boats were modified to trawl, and were incorporated into the fleet. Japanese trawlers explored the Mexican Pacific coast and located the main trawling areas in the same decade.

During the 1940s and 1950s the fishery expanded to the entire Gulf of California and the Gulf of Tehuantepec. During the late 1950s, double-rig trawls were introduced. By 1960, fishing opera-

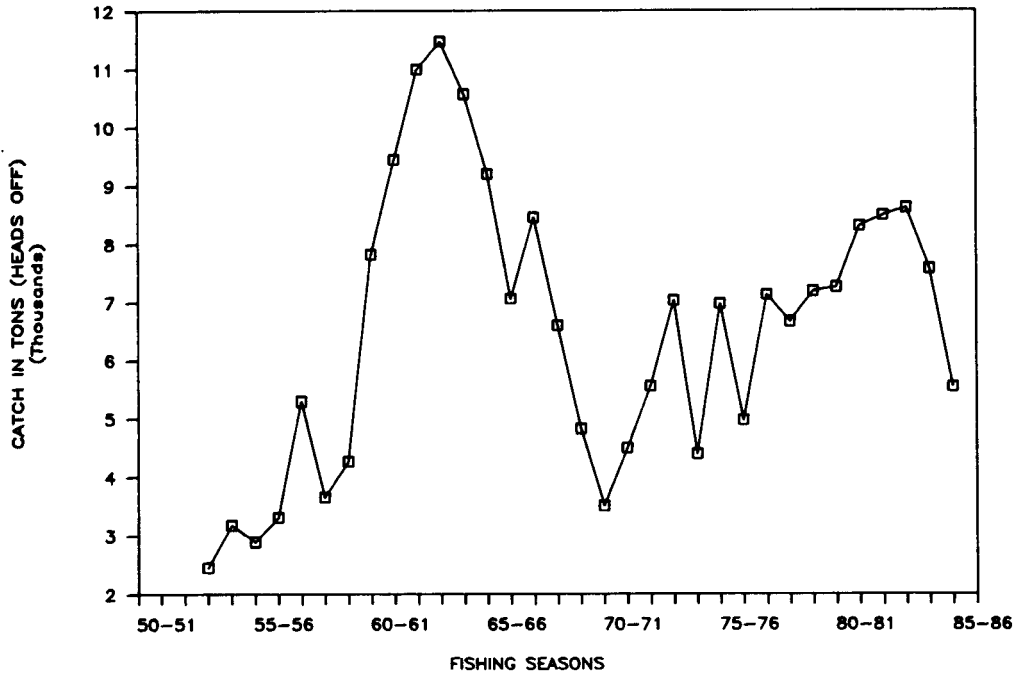


Figure 5. Catch trends in the Mazatlán shrimp offshore fishery.

tions extended to the southwest coast of Baja California. During the late 1960s and early 1970s, the fishermen gradually reduced mesh size (Lluch 1977). In 1977, mesh size regulation was introduced as a management measure.

Nowadays the fleet is equipped either with semi-balloon trawls or flat trawlnets. Official mesh size is 2¼ inches for the body and wings, and 1¾ inches in the cod end. Headrope length averages about 64

feet. Common vessel length ranges from 18 to 23 m. Wooden trawlers are usually powered by 200–250 hp diesels, and new steel trawlers with 350–500 hp motors.

The offshore fishery catches mainly brown shrimp along the coast, from Baja California to the Guatemala border, at depths ranging from 5 to 50 fathoms. Blue and white shrimp are caught from 5 to 20 fathoms. Red shrimp is obtained in the range

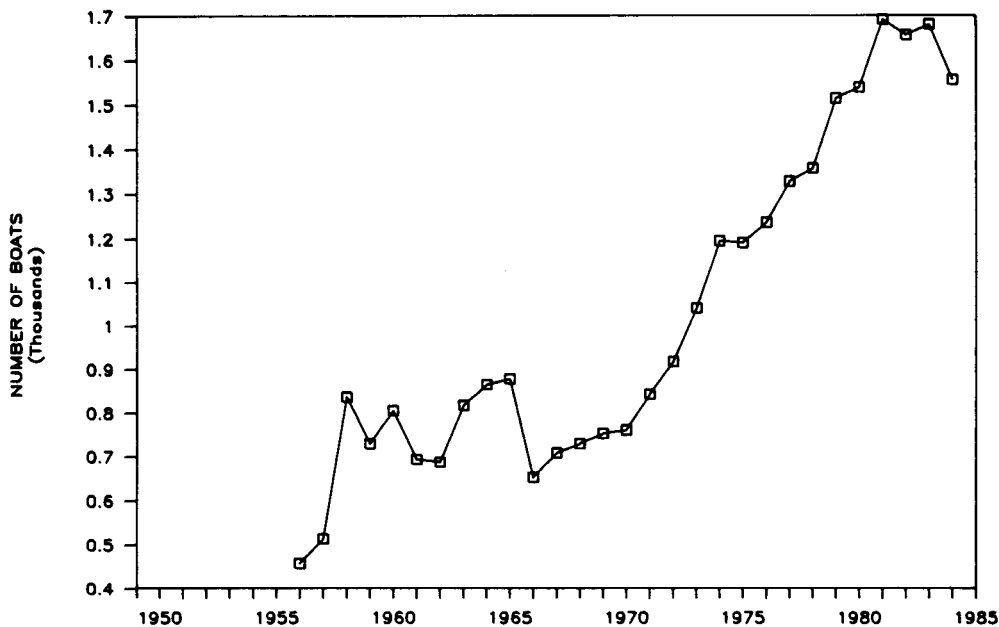


Figure 6. Historical evolution in the Pacific shrimper fleet.

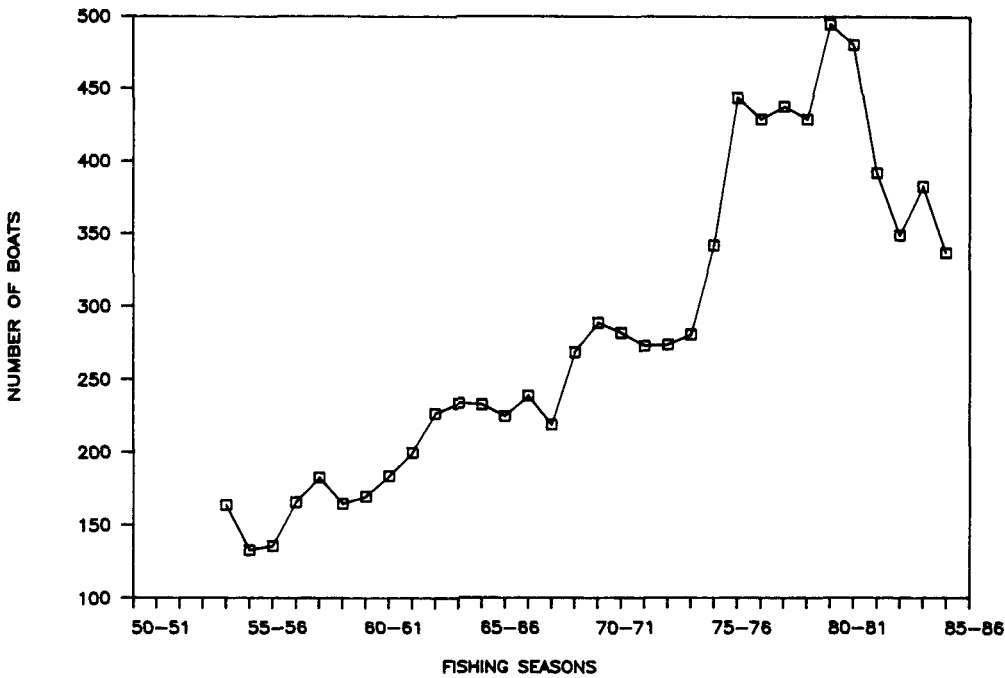


Figure 7. Historical evolution in the Guaymas shrimper fleet.

of 8 to 60 fathoms, in the southeastern part of the Gulf of California and all of the Gulf of Tehuantepec.

The fishery operates mainly from October to June, with a closed season during the remaining months. About 60% to 70% of the total season's landings is obtained during the first three months of the open season, mainly because of fleet size.

Both the main trawling areas and the species distribution are shown in Figure 2. Normally, when

the open season begins, the fleet operates intensively in the central and eastern parts of the Gulf of California. As abundance declines in these areas, the fleet spreads its operation to other parts of the Pacific coast. The end of the open season is officially declared around May or June, but the vessels generally stop when shrimp density falls below that which is economical to fish.

For the last 12 years, shrimp stocks have been monitored by the Instituto Nacional de la Pesca

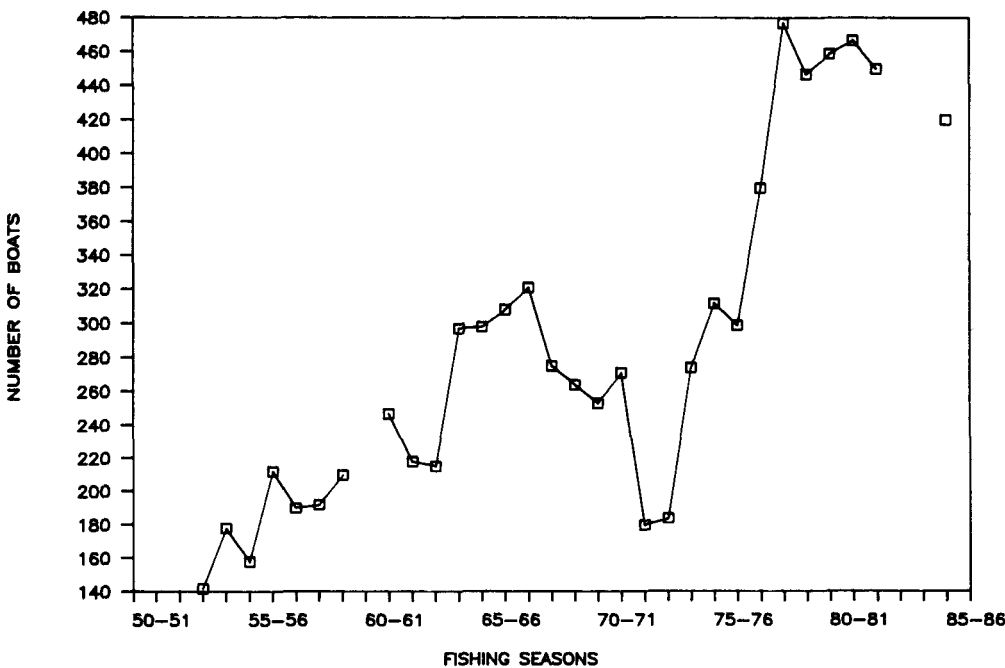


Figure 8. Historical evolution in the Mazatlán shrimper fleet.

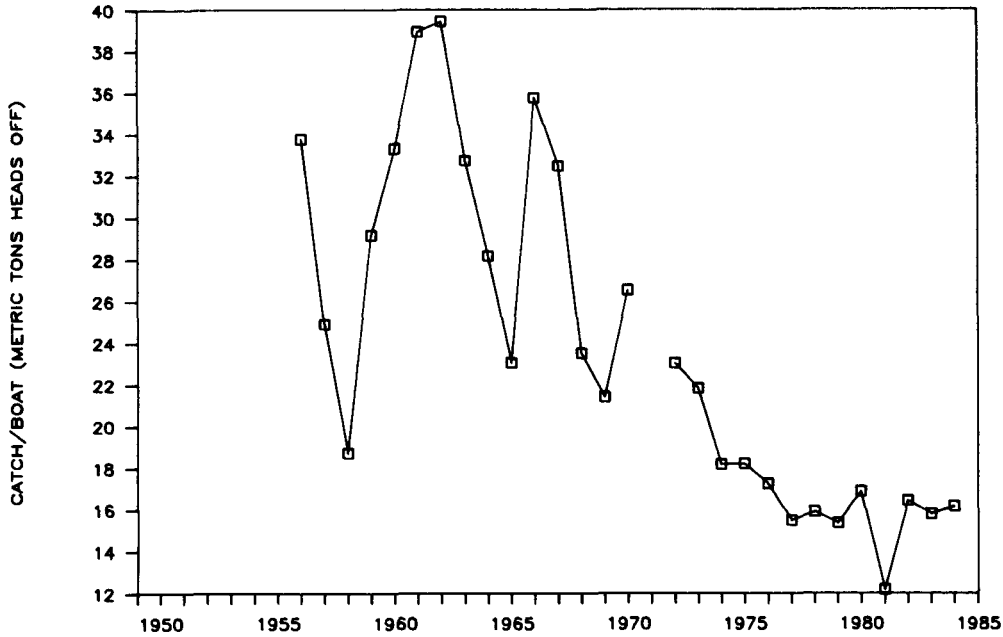


Figure 9. Catch/boat trends in the Pacific shrimp offshore fishery of Mexico.

(INP), together with other research and educational institutions, in order to recommend the beginning of the next open season. During these monitoring programs, spawning and recruitment areas are mapped each year.

Figure 1 shows the evolution of the total annual shrimp catch, which is influenced mainly by the offshore catch. During the last 30 years the offshore catch fluctuated widely. Beginning in the late 1950s, there was a rapid increase, reaching 26,000–

27,000 MT (heads off) in the early 1960s. From 1965 to 1979 there was a sharp decline in catch, followed by an increase in the early 1980s that reached levels similar to the peak ones (Figure 3; Table 3). Interannual changes are masked by the aggregation of data of two different seasons into one year. The increase in catch observed during 1979–84 followed the aforementioned regulation in mesh size.

The first maximum, observed during the early

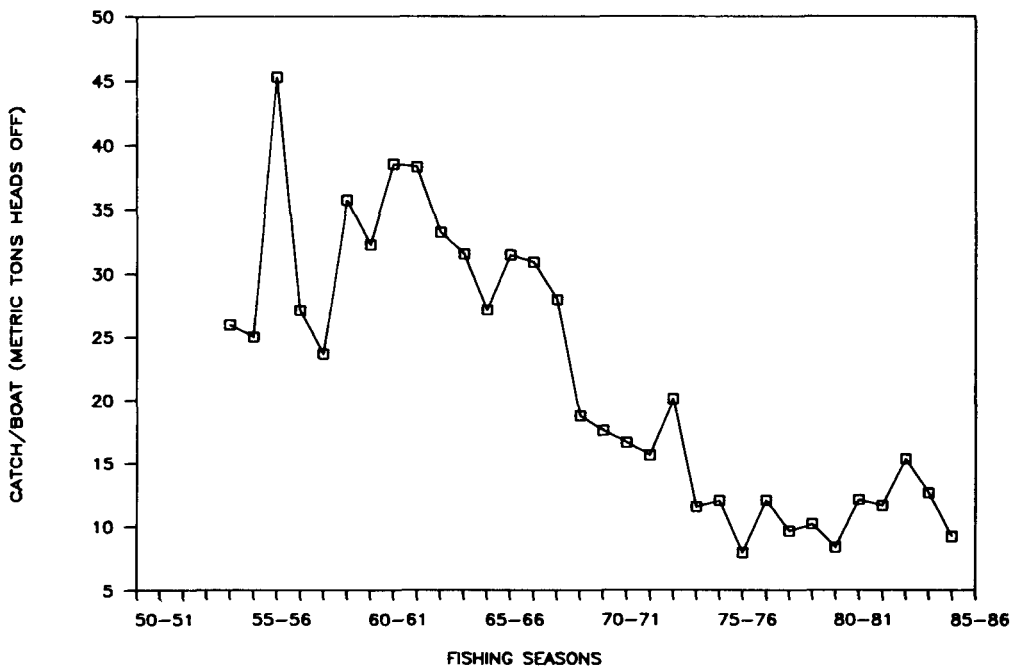


Figure 10. Catch/boat trends in the Guaymas shrimp offshore fishery.

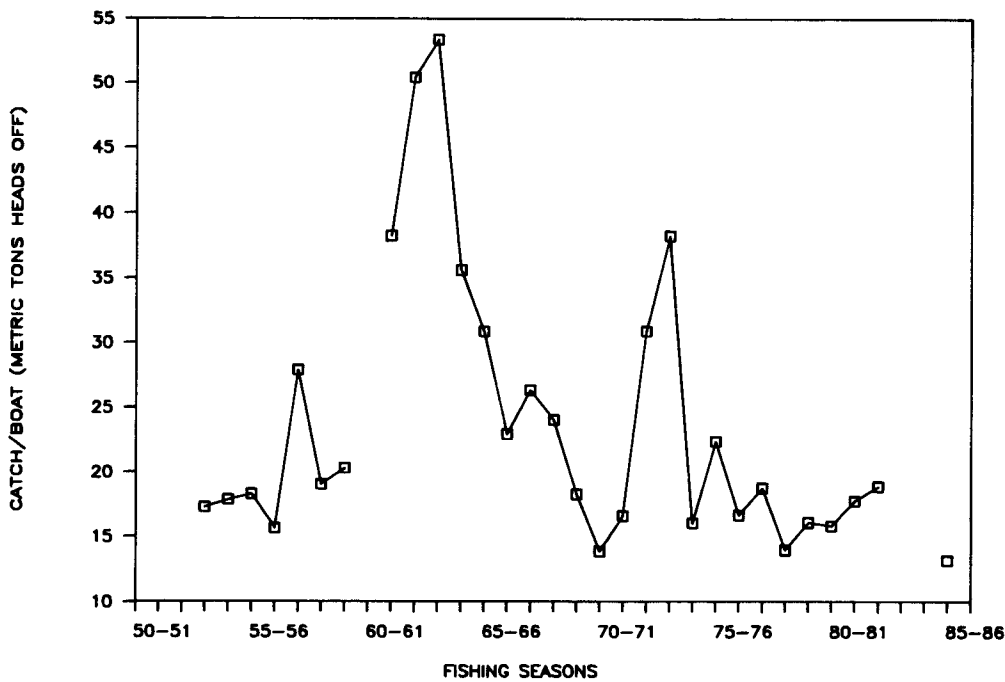


Figure 11. Catch/boat trends in the Mazatlán shrimp offshore fishery.

TABLE 5
 Mazatlán Shrimp Fishery

Fishing season	No. of boats	Catch (MT)	Catch per boat (MT)
1952-53	142	2,454	17.28
1953-54	178	3,181	17.87
1954-55	158	2,893	18.31
1955-56	212	3,317	15.65
1956-57	190	5,302	27.91
1957-58	192	3,660	19.06
1958-59	210	4,267	20.32
1959-60	—	7,824	—
1960-61	247	9,451	38.26
1961-62	218	11,000	50.46
1962-63	215	11,480	53.40
1963-64	297	10,575	35.61
1964-65	298	9,200	30.87
1965-66	308	7,065	22.94
1966-67	321	8,458	26.35
1967-68	275	6,609	24.03
1968-69	264	4,829	18.29
1969-70	253	3,509	13.87
1970-71	271	4,499	16.60
1971-72	180	5,563	30.91
1972-73	184	7,038	38.25
1973-74	274	4,398	16.05
1974-75	312	6,983	22.38
1975-76	299	4,978	16.65
1976-77	380	7,138	18.78
1977-78	477	6,674	13.99
1978-79	447	7,204	16.12
1979-80	459	7,268	15.83
1980-81	467	8,312	17.80
1981-82	450	8,501	18.89
1982-83	—	8,628	—
1983-84	—	7,585	—
1984-85	420	5,550	13.21

1960s, was due mainly to the Guaymas and Mazatlán fleet operation; similar catch trends are observed in both fisheries (Figures 4 and 5; Tables 4 and 5). Interannual changes in catch are clearly seen in the Guaymas fishery (catch data are aggregated by fishing seasons). The recent maximum (early 1980s) was reached by all of the fishery; the Guaymas and Mazatlán fisheries contributed in smaller proportion to it, in contrast to the former maximum.

Fleet evolution shows an increase from the beginning of the time series and up to 1958, and a stable fleet size of around 800 boats during the next 13 years (Figure 6).

From 1971 to 1980 the fleet increased to 1,700 boats, clearly apparent in the Guaymas and Mazatlán fleet (Figures 7 and 8) and in other small fleets in the Gulf of California. The fleet doubled without any increase in the total catch, and the catch per boat diminished from 39 MT (heads off) per year in 1971 to 15 MT in 1980 (Figures 9-11). This decrease in catch per boat is observed in both the Guaymas and Mazatlán fisheries. During the declining phase, the Mazatlán fishery and the Pacific fishery were analyzed by Lluch (1977) and Lluch et al. (internal report, unpublished); the Guaymas fishery was analyzed by Rodriguez de la Cruz (1973, 1981) and Rodriguez de la Cruz and Rosales (1977). Following these reports, shrimp fleet growth was stopped in 1981. From then on, the

Pacific shrimp fleet stabilized; furthermore, a decreasing trend is observed in the Guaymas and Mazatlán fleets.

The main problems that remain in the Pacific shrimp fishery are the interseasonal and long-term stock fluctuations observed in the last 30 years. These changes are particularly important in the Gulf of California.

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