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NOAA Technical Report NMFS Circular 401

Fisheries and Fishery Resources of New York Bight

J. L. McHugh

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U.S. DEPARTMENT OF COMMERCE
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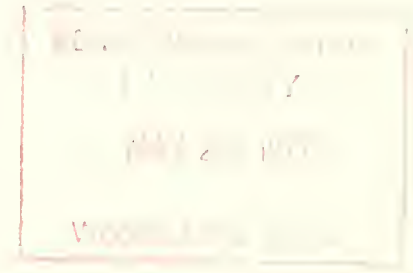

U.S. DEPARTMENT OF COMMERCE
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Historic domestic commercial, recreational, and foreign marine fishery landings in the north and middle Atlantic regions including New York Bight.

FISHERIES AND FISHERY RESOURCES OF NEW YORK BIGHT[1] [2]

J. L. McHUGH[3]

ABSTRACT

The history of total fish and shellfish landings in the two states (New York and New Jersey) that form the landward boundaries of New York Bight is a history of change. Resource after resource has produced maximum landings, then declined. Total landings dropped from about 315,000 metric tons in 1956 to about 23,000 in 1967 and have risen only moderately since that time. The rise and fall of the industrial fisheries, mostly menhaden, was responsible for most of this decline, and this has masked trends in the food fisheries.

Altogether about 132 species or groups of species of fishes and invertebrates have been reported as landed in New Jersey or New York since 1880. Fifty of these are discussed and illustrated with figures and tables of landings.

Edible finfish species as a group reached peak landings in 1939 and declined fairly steadily to about one-third that level in the 1970s. Molluscan and crustacean shellfish production reached two peaks, in 1950 and 1966, the second considerably higher than the first. This recovery of shellfish landings in 1966 would not have occurred were it not for the rapid development of the surf clam fishery in the 1950s.

The timing of the declines makes it clear that foreign fishing was not the cause, for foreign fishing probably could not have affected the fisheries of New York Bight before the mid-1960s. Actually, total catches of resources taken only by domestic fishermen have declined more sharply than total domestic catches of species shared with foreign fleets. Foreign fishing is but a symptom of the troubles of the domestic fisheries, some of which are imagined. The ills of the domestic fisheries are economic and sociopolitical, and they will not yield easily to scientific solutions.

INTRODUCTION

The coasts of New Jersey and New York form the western and northern boundaries of what is commonly known as New York Bight. The Bight has been defined as those coastal waters extending from Montauk Point, Long Island, N.Y. to Cape May, N.J. and out to the edge of the continental shelf (Figs. 1, 2). These waters have been an important fishing ground since the early days of the settlement of North America, and they still produce important quantities of fish and shellfish. In 1975 (National Marine Fisheries Service 1976) the two states produced a total marine commercial catch of about 82,000 metric tons with a landed value of $48.0 million. As will be evident later, this is considerably less than maximum historic landings but it is still substantial. To some extent the decline in commercial landings has been offset by an increase in the catch by saltwater sport fishermen. New Jersey ranked ninth by weight and fifteenth by value among the coastal states in commercial marine fishery landings in 1975, the latest year for which such figures are available; New York ranked seventeenth by weight but eleventh by value. Together, the two states accounted for about 4% of total U.S. commercial landings by weight and about 4.7% in landed value. There is also considerable foreign fishing and some domestic fishing in the area outside the 12-mile zone of domestic fishery jurisdiction. The foreign catch in subareas 5 and 6 of the International Commission for the Northwest Atlantic Fisheries (ICNAF) was nearly 800,000 metric tons in 1974, but in 1972 was more than a million metric tons. The recreational catch in the New York Bight area cannot be determined exactly, but it is probably about 90,000 metric tons, not including invertebrates. Reported recreational catches of finfishes in 1970, the latest year for which estimates are available, were about 121,300 metric tons for the north Atlantic region (Maine to New York inclusive) and 111,700 metric tons for the middle Atlantic region (New Jersey to North Carolina inclusive).

The international fisheries are now under a reasonable degree of control. For example, ICNAF established quotas for subareas 5 and 6 in 1976 totalling 815,000 metric tons for 12 species or groups of species, but also placed a stringent additional constraint by setting a total allowable catch, all species combined, of 650,000 metric

[1]Parts of the analysis on which this paper is based were made under support of a fellowship with the Woodrow Wilson International Center for Scholars, Washington, D.C., July-August 1971. The work was completed and the paper written under support from the Marine Ecosystems Analysis Program (MESA) of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

The historical review of marine fisheries in New York State is a result of research sponsored by the New York Sea Grant Institute under a grant from the Office of Sea Grant, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

[2]Contribution 000 of the Marine Sciences Research Center of the State University of New York, Stony Brook, N.Y.

[3]Marine Sciences Research Center, State University of New York, Stony Brook, NY 11794.

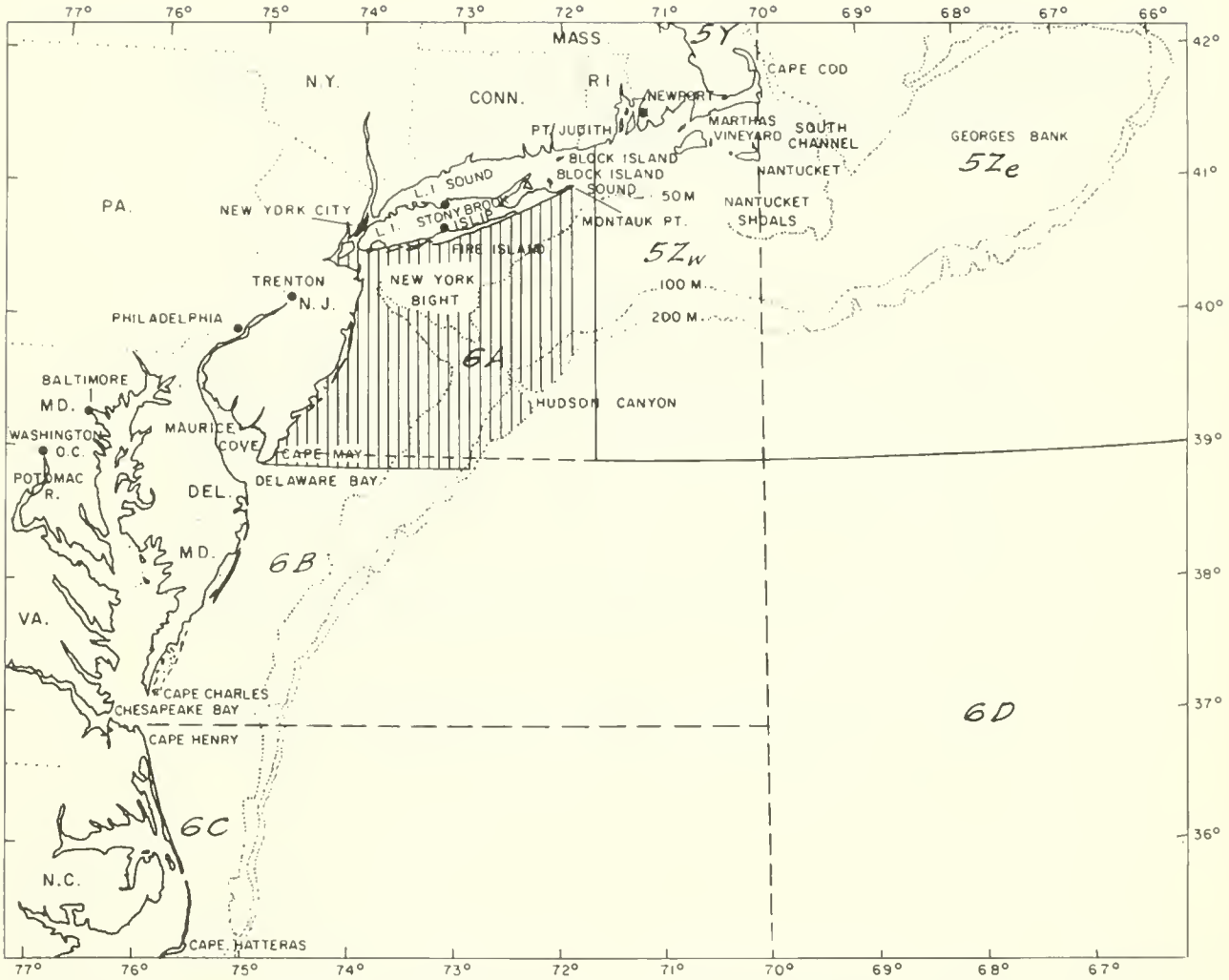


Figure 1.—Middle Atlantic Bight (Cape Cod to Cape Hatteras) showing location of the area known as New York Bight and subareas 5 and 6 of the International Commission for the Northwest Atlantic Fisheries (ICNAF). Only part of division 5Y, which includes all of the Gulf of Maine, is shown. For all practical purposes it can be assumed that the fishing grounds end at the 200 m isobath, thus it is not important that the northern and eastern boundaries of subarea 5 and the eastern boundary of subarea 6 are not shown. The southern boundary of subarea 6 is just off the chart, at lat. 35°00′N.

tons. Domestic fisheries in the area, as will be illustrated in the species discussions to follow, are by no means under such rigid control. This applies particularly to the recreational fisheries, which essentially are uncontrolled.

New York Bight is flanked on two sides by the greatest concentration of human population in North America. Some 17 million people live in the New York metropolitan region alone. Shipping in and out of the area is heavy, the waters and beaches are used extensively for recreation, including sport fishing, and the inner part of the Bight receives large quantities of domestic and industrial wastes. The Bight also has been considered seriously as a site for deep-draft supertanker ports, offshore air terminals, and offshore nuclear power plants. Exploratory drilling for petroleum in Baltimore Canyon Trough, off the New Jersey coast, is under serious consideration. These issues, and recent intensified public and official interest in environmental quality, have marked the Bight for special attention. As background for environmental studies and environmental management in the area, it is important to understand the history of its marine fisheries and the present condition of the living resources on which these fisheries are based.

An historical review of the marine fisheries of New York State has already been published (McHugh 1972a). The principal conclusions of that study were that the record of landings since 1880 provided a classic example of ineffective management and that the principal causes of the decline of commercial fishing in New York were sociopolitical and domestic, not directly related to foreign fishing. This report deals primarily with New Jersey fisheries. The opportunity has been taken, however, to bring the New York study up to date by considering landings and trends in the period 1971-75. The New Jersey study was part of the intensive investigation of New

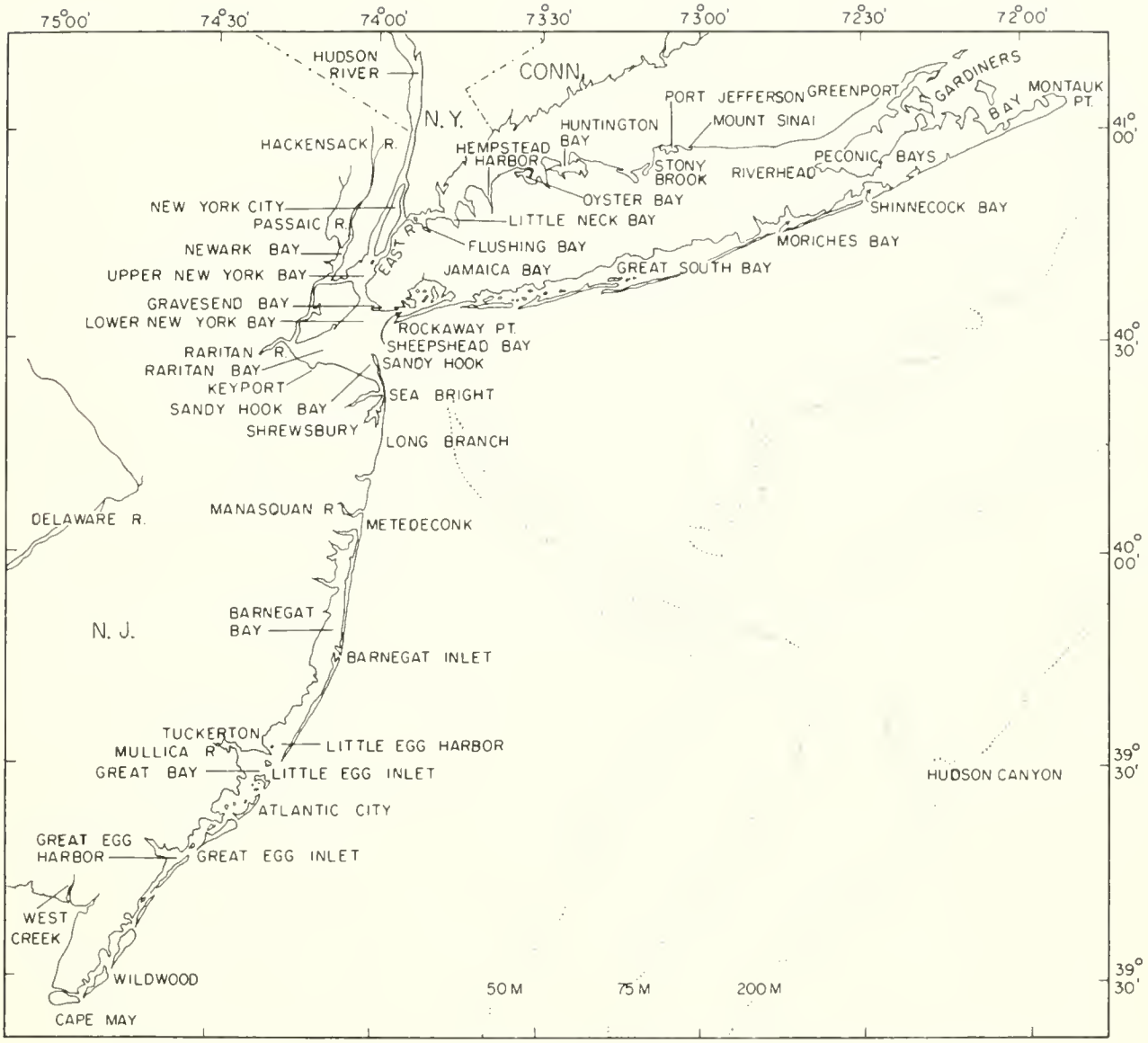


Figure 2.—New York Bight showing most place names mentioned in the text. Other place names are in Figure 1.

York Bight presently being carried out by the Marine Ecosystems Analysis program (MESA) of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

SOURCES OF INFORMATION

Commercial fishery landings in the New York Bight area are available back to 1880. An almost unbroken series of annual commercial landings is available for New Jersey and New York since 1929, but records prior to that time were intermittent. These have been published, usually about 2 yr in arrears, by the National Marine Fisheries Service and its predecessor agencies. New Jersey landings include catches from Delaware Bay and other coastal bays and lagoons. New York landings include catches from Long Island Sound and the important bays of the eastern end and south shore of Long Island. These waters are not included within the definition of New York Bight as far as the present MESA studies are concerned, but they do not now account for a very large part of total commercial landings in either state. New York landings from 1954 to 1969 inclusive were reported by statistical areas which apparently allow separation of ocean catches from those made in sheltered inshore waters, but it is not clear whether landings reported from a statistical area represent catches made exclusively in those waters or landings at ports within the area. Although documentary proof does not exist, it is commonly believed that commercial fishery landings are larger than official records show. This is not unique to the New York Bight area. It probably is a common

phenomenon in most coastal areas, and arises from the practice prevalent in the commercial fisheries, especially at smaller, less well-organized points of landing, to pay off in cash and keep no accurate records of the transaction.

No satisfactory historical record of marine sport fish catches exists for the area. Biologists of the two states have made various partial studies of saltwater sport fishing and these are useful in providing intuitive estimates of the saltwater sport fisheries of the area as a whole. The national surveys of 1960, 1965, and 1970, conducted by the Bureau of the Census (Clark [1962]; Deuel and Clark 1968; Deuel 1973) included New Jersey and New York, but the estimates were for larger areas and catches for individual states were not reported. New Jersey is included in the estimate for the middle Atlantic area, New Jersey to Cape Hatteras inclusive. New York is included with the New England coastal states. Further subdivision would not provide useful estimates state by state because the national sample was too small (David G. Deuel, pers. commun.). Mohr[4] recently made estimates of recreational finfish catches in New York waters from available data and McHugh (in press a) made rough estimates of recreational shellfish catches.

Foreign catches in the sector of New York Bight beyond 12 miles have been reported by ICNAF since 1966, when a new statistical subarea was established by that body, subarea 6, extending from Block Island Sound to Cape Hatteras. This subarea is further subdivided, and division 6A includes essentially the New York Bight area as it has been defined for MESA purposes (Fig. 1).

These statistics—domestic commercial and recreational, and foreign—have been collected from various sources and have been published in a compendium of available information (McHugh and Williams 1976). That publication contains an extensive bibliography, and the references are not repeated here.

Some species discussed in the present paper were not included in the New York study (McHugh 1972a).[5] To bring the two studies into agreement as a treatment of the fisheries of New York Bight as a whole, additional information on the marine fisheries of New York State has been included where appropriate.

TOTAL LANDINGS IN NEW JERSEY

As in New York, commercial marine landings in New Jersey have been dominated most of the time by industrial fisheries, especially for menhaden. Therefore, the history of total landings in New Jersey is largely a history of the menhaden fishery (Fig. 3). To analyze the record thoroughly, landings must be examined by species. It is useful to examine total landings, but to do this intelligently the data must be divided into two subsets, industrial fisheries and food fisheries (Fig. 4, 5). Trends in the food fisheries are easier to understand if finfisheries and shellfisheries are separated (Fig. 5).

Figure 3.—Total annual commercial landings of fishes and shellfishes in New Jersey 1880-1975. The lower line shows menhaden landings. In this, as in other figures, broken lines have been used to connect years between which one or more years data are missing.

The food shellfisheries as a whole show two principal periods of development. The early period, ending about 1953, was dominated by the oyster industry (*Crassostrea virginica*), although the trend in oyster production has been downward since the 19th century. The sharp rise in total shellfish production that began in the late 1950s came about mainly through the phenomenal develop-

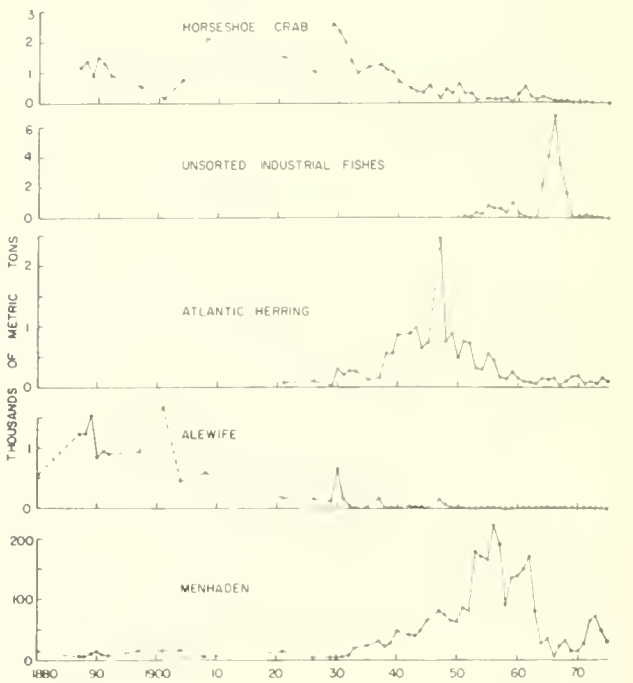


Figure 4.—Annual commercial landings of industrial fishes and shellfishes in New Jersey 1880-1975.

[4]Mohr, Peter Thomas. 1976. Marine Sport fisheries of New York State. A thesis presented in partial fulfillment of the requirements for the degree of Master of Science in Marine Environmental Sciences, State University of New York at Stony Brook.

An error in the introduction to that paper should be noted. On page 586 it was stated that surf clam landings dominate the New York catch. This is true for New York and New Jersey combined, but the dominant species in New York landings is hard clam.

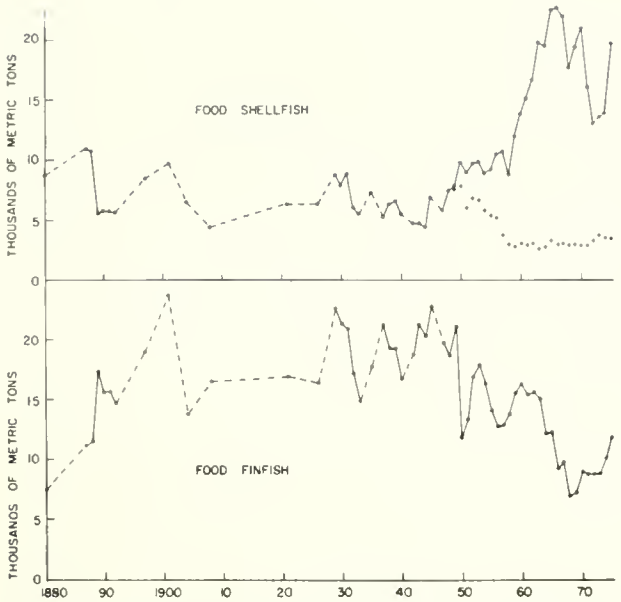


Figure 5.—Annual commercial landings of fishes and shellfishes used as human food in New Jersey 1880-1975. The isolated points in the upper panel represent shellfish landings minus surf clam meats, to illustrate the point that if it had not been for development of the surf clam fishery shellfish landings would have shown a downward trend also.

ment of the surf clam industry (*Spisula solidissima*). The history of the shellfisheries in New Jersey is typical of the development of coastal fisheries everywhere, characterized by an early concentration on resources close to shore, followed by an extension of the fishery to additional species and to more distant waters.

The history of the finfisheries shows different trends: an apparent rise to peak production in the last two decades of the 19th century; apparently a drop of about 25% from 1904 to 1926, although records are not available for most years in this early period; a period of relatively high total landings from 1929 to 1949, as shorebound fisheries like the pound net fishery were superseded by the mobile and more efficient trawl fishery (Perlmutter 1959; Knapp in press); followed by a steady drop as the stocks of many species began to decline. The numbers of species in the catch also reflect these changes. In the first period 52 species or species groups[6] were listed, in the second period 60, third period 80, and fourth period 67.

If the surf clam catch is omitted, the history of total food fish and food shellfish landings in New Jersey is similar to the history of food fishery landings in New York. Catches increased until early in the 20th century, dropped during the first 25 yr of the 20th century, rose again, and remained relatively high in the period 1930-50, and then began a steady decline which apparently is still in progress. In New Jersey, as already mentioned and as illustrated in Figure 5, the postwar decline in total food fish and shellfish production is masked by the rapidly increasing catch of surf clam, produced by a new industry which began off the coast of Long Island after the second world war and soon shifted to the much more abundant surf clam resource off New Jersey. Except for the sea scallop industry, which is now much less productive than it was 15 yr ago, this is the only important offshore fishery for molluscan shellfish.

If total landings of food finfishes and food shellfishes in New York are separated (McHugh 1974), the similarity of trends in landings in the two states is even more apparent (Fig. 5). Postwar development of the surf clam industry did not distort the trend of shellfish landings so much in New York State because the resource is apparently much less abundant off Long Island than it is off the New Jersey coast. Shellfish landings other than surf clam, represented by the unconnected points in the 1950s to 1970s in Figure 5, have declined irregularly but steadily since the 19th century in both states.

Food finfish landings in both states fall into four or five fairly distinct periods. Trends in New Jersey landings (Fig. 5) are not dissimilar to those in New York (McHugh 1974). The first two decades were characterized by rising catches, probably because the demand for fish was rising as the population grew, and fishing intensity increased in response. The causes of the decline in the second period probably were complex, partly economic and partly biological, a combination of maximum availability and fluctuation in abundance of fish stocks and perhaps some local overfishing. The third period, extending from 1929 to about 1950, was a period of relative prosperity for the food fisheries generally in both states, which began with the development of the trawl fisheries (Pearson 1932), and was extended by the special circumstances of the second world war.

The coastal trawl fisheries, which began in the late 1920s, made available a much larger resource than could be exploited by shorebound fisheries like the pound net and haul seine industries. Domestic trawlers were able to follow migratory resources from Cape Hatteras, N.C. to Cape Cod, Mass. in all seasons. The growth of this fishery was one important cause, although not the only cause, of the decline of pound net fisheries along the coast (Knapp in press). The fourth period in the history of the food finfisheries covers the last two decades up to the present. The causes of the downward trend were complex, including lower prices for fish and rising costs of fishing in the postwar era, and declining abundance and probably overfishing of some species, although Reintjes and Roithmayr (1960) believed that, with the possible exception of black sea bass, most species in the Middle Atlantic Bight area were underutilized. In the last 10 yr, additional complications have been added by the growth of foreign fisheries off the northeastern coast of the United States. This development has completed a chain of events characteristic of the evolution of all fisheries. For reasons of efficiency and economics, the domestic trawl fisheries partially broke the bonds that tied the early fisheries so firmly to the shore (Knapp in press). But

[6]Some species were grouped in official statistics, e.g., drums, searobins, and some other categories like flounders, eels, and hakes were grouped in early statistics but separated later. For consistency it has been assumed that all species later listed separately were represented in early catches.

the more efficient coastal trawlers still had constraints that linked them to the land. They had no means of processing their catch other than to ice it or freeze it, and since their carrying capacity was limited, they had to return to port at frequent intervals to unload. The large, highly flexible, self-contained fishing fleets of the distant-water fishing nations, centrally controlled and capable of catching and processing any resource, edible or industrial, have reduced the possibilities for survival of some segments of the domestic fishing fleet, especially if domestic fisheries continue to operate on the assumption that they can survive by holding to traditional methods of operation.

Despite the additional and serious problems that foreign fishing poses for domestic fisheries in the Middle Atlantic Bight, it is a dangerous oversimplification to blame all the troubles of the domestic fishing industry on "the Russians" (McHugh 1974; Williams 1975). This has been confirmed by Gates and Norton (1974), who viewed foreign fishing, along with other issues, primarily as symptoms rather than causes of the problems of the domestic fisheries. Smith (1975) reached essentially the same conclusion in a study of the otter trawl fishery of Oregon. The basic problems of our coastal fisheries are domestic, but most people tend to forget that the decline of many fisheries of New Jersey and New York, as in most other coastal states, began long before the postwar expansion of foreign distant-water fisheries began (Fig. 5). The basic problems are sociopolitical and economic, and these problems have made it virtually impossible for the United States to manage its coastal fisheries effectively. Almost without exception, we have been unable to establish viable management regimes for coastal fishery resources over which the United States has complete control. These include most of the shellfisheries, which with few exceptions harvest resources endemic to territorial waters, and even some migratory fishes like menhaden and striped bass, which apparently seldom, if ever, move beyond the 12-mile zone of fishery jurisdiction during their seasonal migrations. These matters have been discussed in detail by Knapp (in press) and Williams (1975).

INDUSTRIAL FISHERIES

As in the State of New York (McHugh 1972a), industrial fisheries, mostly for menhaden, have dominated the marine fisheries of New Jersey for most of recorded history (Figs 3, 4). The principal difference is that, whereas menhaden landings in New York apparently were substantial at times in the period prior to 1940, the menhaden industry in New Jersey was relatively minor before the second world war. The menhaden industry in the early days was traditionally based in New England, and this probably explains why it developed earlier in New York than in New Jersey.

Examination of Figure 4 suggests that the industrial fisheries of New Jersey can be divided into five fairly distinct periods each dominated by a different species or group of species. Average annual landings of these and other industrial species are given in Table 1.

Table 1.--Average annual landings of industrial fishes and industrial shellfishes, including bait, in New Jersey for five major periods in the history of the industrial fisheries of the State. Weights in metric tons.

Species	1880-1926	1929-1952	1953-1962	1963-1970	1971-1975
Menhaden	10,165	41,811	161,069	28,838	47,788
Horseshoe crab	1,014	920	167	47	*
Alewives	862	78	5	5	4
Sharks, skates, and rays	28	71	9	7	2
Atlantic herring	14	630	244	116	88
Searobins	6	19	35	12	2
Round herring	5	*			
Shrimp	3	38	9	1	1
Misc. industrial fishes	*	15	442	2,246	16
Mummichog		2			
Sandworms		1			
Bloodworms		1			
Minnows		*			
Miscellaneous bait	*				

* less than 0.5 metric ton.

Atlantic Menhaden

In 1880 (Earll 1887) the menhaden, *Brevoortia tyrannus* (Latrobe), industry dominated the fisheries of Sandy Hook Bay; five large factories for production of oil and meal were operating as compared with only one in New Jersey today. The fish were caught in pound nets and fykes, whereas today most of the menhaden catch is taken by purse seines. An important menhaden fishery operated also in the vicinity of Atlantic City, delivering catches to factories at Tuckerton and Great Egg Harbor. Large quantities of menhaden taken in haul seines and pound nets in this area were used directly as fertilizer for farm lands.

In 1880 (Mather 1887) menhaden applied directly to the soil provided fertilizer for extensive farm lands on Long Island. At the eastern end of Long Island, at least 16 menhaden factories were operating, some of them formerly whaling bases. The menhaden resource was responsible for development of a rich agricultural industry in the sterile, sandy soil.

One cause of the great postwar development of the Atlantic coast menhaden fishery was the decline of the sardine industry on the Pacific coast (McHugh 1969a). Demand for fish meal as an ingredient of poultry rations was stimulated by rapid postwar growth of the poultry industry. Landings of menhaden in New Jersey and New York rose rapidly in the 1940s and 1950s, and in both states the catch remained high for about a decade. In New York landings fluctuated about a level of 40,000 metric tons, more or less, during this period of greatest development of the fishery. In New Jersey (Figs 3, 4) it was considerably greater. The peak postwar catch was about four times as great in New Jersey as in New York, but the period of relatively high catches began somewhat

earlier and therefore lasted longer in New York, probably because the industry was already established. Landings in both states dropped substantially in 1958. This was caused by a decline in abundance of the living resource, but catches rose again as the strongly dominant year class of menhaden hatched in 1958 (Henry 1971) reached an age at which it was most available to the fishery in the New York Bight area. The two peaks and the low point of landings in this period of greatest prosperity of the menhaden industry came in the same years, the peaks in 1956-57 and 1962 and the low in 1958, but maximum landings in New Jersey were recorded in 1956 and in New York in 1962.

The decline of the menhaden fishery in the New York Bight area (McHugh 1972a) was caused principally by intensive fishing in Chesapeake Bay. The Virginia purse-seine fishery, which once took mostly 2- and 3-yr-olds, by the late 1960s was taking mostly fish 1 and 2 yr of age, and few survived to migrate north at greater ages as many menhaden formerly did. The recent increase in menhaden catches north of Chesapeake Bay is reflected in New Jersey landings (Fig. 3), which have increased more than fourfold from the low point in 1970. The last menhaden factory in New York has not operated since 1969, and recent large catches in Long Island Sound were delivered to the single remaining New Jersey factory at Port Monmouth, or to New England, for processing.

At one time it was believed that the stocks of menhaden in the New York Bight area were distinct from those exploited in Chespeake Bay (June 1958; Sutherland 1963). If this is so, then the recent sharp increase in landings in the New York Bight area might have been made possible by release of energy formerly utilized by the southern stock when it was less heavily exploited and thus could migrate into the Bight in substantial numbers. Recently, however, it has been concluded that Atlantic menhaden from Florida to New England belong to a single population (Dryfoos et al. 1973). This means that the recent local increase in abundance must have been related to the strong 1969 year class. Fishing effort dropped by 54% during the period of declining abundance of menhaden (Schaaf 1975), and this probably allowed increasing numbers of fish to survive to reach northern waters. The temporary increase in abundance, however, stimulated more intensive fishing. The prospect for the menhaden fishery is not bright, although Boone (1976) has reported that abundance of young menhaden in Maryland waters in 1975 was the second highest on record.

No significant harvest of menhaden has been reported by other nations fishing in the area. Grosslein et al. (1973)[7] have pointed out that the only serious possibility of major foreign catches would be in winter when the resource is concentrated off the Carolinas. They recommended that the area be closed to foreign fishing at that time.

Industrial Trawl Fishery

In New York the rapid decline of menhaden catches after 1962 stimulated a search for alternate resources, and for a few years (1962-66) a substantial industrial trawl fishery developed (McHugh 1972a). At its peak in 1964 this fishery produced about 53,500 metric tons of unsorted and unidentified industrial fishes, which was almost as large as the greatest annual postwar landing of menhaden in New York, recorded in 1962. This catch undoubtedly included substantial quantities of food fishes, although red hake, *Urophycis chuss* (Walbaum), probably was the major species by weight (Edwards and Lux 1958).

In New Jersey a similar industrial trawl fishery developed (Fig. 4), beginning in 1964 and ending in 1968, but landings were relatively small. The maximum reported catch was about 6,613 metric tons in 1966. The species composition of these landings has not been reported in detail (LoVerde 1969), but the greatest part of the industrial trawl catch (Table 2)[8] was searobins, *Prionotus carolinus* (Linnaeus) and *P. evolans* (Linnaeus). These landings were not identified by species. Only 86 metric tons of searobins were reported as such in 1966 (Table 2).

Horseshoe Crab

The horseshoe crab, *Limulus polyphemus* (Linnaeus), industry at its recorded peak in 1929 produced about 2,600 metric tons of industrial raw material. Landings of horseshoe crab (or king crab, as it was called in early statistical publications) in New York were very small and infrequent, and minor catches were recorded only for 1887, 1888, and 1921. With this exception, horseshoe crab has been a unique commercial fishery resource of New Jersey and Delaware. The geographic range of the species is from Maine to Yucatan.

In New Jersey considerable quantities of horseshoe crab once were landed (Fig. 4). Cook (1857—in Shuster 1957) reported "immense numbers" taken in Delaware Bay for fertilizer. Shuster (1957) concluded that extensive use for fertilizer had much reduced the abundance of these animals. Maximum landings reported in the State of Delaware were 476 metric tons in 1892. Substantial landings were reported in New Jersey until the early 1940s. The subsequent decline of the fishery was caused mainly by forced closure of processing plants through public reactions to offensive odors (Eugene LoVerde pers. commun.). Shuster (1960) said that meal produced from horseshoe crabs has a protein content of 46%. *Limulus* also has been used as bait for eels and as food for poultry and hogs. The horseshoe crab is an estuarine

[7] Grosslein, M. D., E. G. Heyerdahl, and H. Stern, Jr. 1973. Status of the international fisheries off the middle Atlantic coast. Northeast Fish. Cent., Natl. Mar. Fish. Serv., Lab. Ref. No. 73-4, 117 p. [A technical reference document prepared for the bilateral negotiations of USA with USSR and Poland.]

[8] In this, and most other tables, foreign catches are given only for those ICNAF statistical areas in which fishing might be expected to affect the domestic coastal fisheries of New York Bight (Fig. 1).

Table 2.--Estimated commercial and recreational catches of searobins in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

Year	Domestic commercial catch NY	NJ	Me-NY incl.	NJ-NC incl.	Recreational catch Me-NY incl.	NJ-NC incl.	ICNAF Foreign catch $5Z_w$	$5Z_e$	6
1960	3	8	100	9	180	2,088			
1961	3	1	99	1					
1962	-	*	50	2					
1963	5	9	66	43					
1964	11	20	54	261					147
1965	33	-	153	83	1,841	1,727			
1966	19	86	127	299			98		1,279
1967	29	-	99	153			124		370
1968	25	3	173	49			20	1,110	7,872
1969	30	1	63	40			1,758	-	145
1970	34	-	97	18	2,341	6,735	-	-	-
1971	64	6	137	6			-	-	812
1972	20	1	98	1			64	173	3,520
1973	24	3	106	3			147	1,419	1,263
1974	19	*	124	*			52	783	1,296
1975	20	*	(73)	*			323	232	482

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Foreign catches for 1975 are provisional. This species is included with the second tier quota for 1976.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

* Less than 0.5 metric ton.

animal, and thus not strictly a resource of the open waters of New York Bight.

Alewives

Alewife, *Alosa pseudoharengus* (Wilson), and blueback herring, *A. aestivalis* (Mitchill), were important species in the early fisheries along the Atlantic coast, but their importance in New Jersey in total weight landed declined fairly early in the 20th century (Fig. 4).[9] Alewives have been used as food fishes and as industrial fishes, hut the demand as human food has been declining, although less sharply in the area from Chesapeake Bay southward. There was apparently no attempt in New Jersey to use alewives as a substitute for menhaden in the 1960s as there was in 1966 in New York. Relatively large landings of alewives in New York in 1966 were caught by menhaden purse seiners (Lyles 1968) attempting to compensate for the declining menhaden resource.

Alewives are a popular recreational resource in certain areas during the spawning migration in spring. Where the species are abundant, as in certain Virginia rivers and in the Potomac, large quantities are taken by dip net as they migrate up rivers and streams. In the Delaware River at Trenton, considerable numbers are taken by hook and line. In other New Jersey streams lesser numbers are taken by anglers (Paul Hamer pers. commun.). For some reason, this sport fishery has been ignored in the national surveys of saltwater sport fishing, perhaps because it takes place in fresh water. No estimates of the magnitude of this sport catch exist.

Relatively large catches of alewives have been taken recently by foreign fleets operating in the Middle Atlantic Bight (Table 3). This has been a matter of serious concern, especially to the fishing industry in Virginia, where the resource is still of major importance. Grosslein et al. (1973, see footnote 7) confirmed that abundance inshore has been declining. Edwards (1975)[10] stated that the biomass of alewives in the area from the Gulf of Maine to Cape Hatteras inclusive was about 8 million pounds (3,630 metric tons) in the period 1972-74, down from 87 million pounds (39,500 metric tons) in 1963-65. The fishery now is controlled under bilateral agreements with the major fishing nations.

Atlantic Herring

Maximum recorded landings of Atlantic herring, *Clupea h. harengus* Linnaeus, in New Jersey were in 1947 (Fig. 4). Landings have been declining irregularly since that time. One use for this resource was as animal food, but local markets have declined (LoVerde 1972). Most of

[9]The two species are similar in appearance and have not been listed separately in the statistics, but under the collective term alewives.

[10]Edwards, R. L. 1975. Middle Atlantic fisheries: Recent changes in populations and the outlook. A paper presented at New York Bight meeting, New York City, November 1975, 20 ms p.

Table 3.--Estimated commercial catches of alewives in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

Year	Domestic commercial catch NY	NJ	Me-NY incl.	NJ-NC incl.	ICNAF Foreign catch $5Z_w$	$5Z_e$	6
1960	17	1	8,716	14,429			
1961	15	8	10,272	13,580			
1962	17	9	4,600	19,051			
1963	15	1	6,137	19,348			
1964	17	6	3,300	16,116			
1965	11	10	4,728	23,198			
1966	1,901	5	5,843	19,278			
1967	2	4	3,323	22,198		5,531	981
1968	-	4	1,202	23,503	12,805	8,430	1,075
1969	-	2	926	24,343	25,132	541	10,476
1970	1	4	1,400	14,802	9,628	4,222	6,053
1971	-	-	1,034	11,711	9,489	2,825	9,414
1972	*	7	1,815	10,595	2,762	4,761	4,975
1973	10	3	1,494	8,724	2,561	1,554	2,234
1974	*	5	1,578	9,639	962	1,213	2,818
1975	*	4	(2,462)	(8,172)	632	1,801	1,342

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of alewives.

Foreign catches for 1975 are provisional.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

* Less than 0.5 metric ton.

the catch is taken in spring in pound nets, as herring are returning toward Georges Bank from wintering grounds south of New Jersey. In 1967 fishermen in New Jersey were experimenting with midwater trawls to catch this species (LoVerde 1968), and it was anticipated that shortages of menhaden and searobins would stimulate development of a herring fishery. Apparently these attempts were not successful. There was no sharp increase in herring landings in New Jersey in the late 1960s, as there was in New York in 1966.

Except for the large 1966 landings in New York, which reached nearly 3,000 metric tons, the Atlantic herring fishery there was much smaller than in New Jersey. Atlantic herring have been used in New York to make pickled herring for human consumption, but the local processor has had difficulty recently in obtaining raw material.

According to Grosslein et al. (1973, see footnote 7) the Soviet Union began the offshore herring fishery in 1961, attracted by two strong year classes produced in 1960 and 1961. Poland and other countries entered the fishery in 1966 and later, and landings reached a peak of 373,000 tons in 1968, then declined (Table 4). The stock declined sharply from 1964 to 1969. Catch quotas were first imposed in 1972. The total allowable catch for 1976 is 69,000 metric tons. Total biomass in ICNAF subareas 5 and 6 combined in 1975 was estimated at 374,000 metric tons (Hennemuth 1975),[11] a considerable drop from the estimate of 4 billion pounds (1.8 million metric tons) in the period 1963-65 (Edwards 1975, see footnote 10).

Table 4.--Estimated commercial and recreational catches of Atlantic herring in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	89	147	70,246	152	-	-			
1961	74	96	26,318	101			67,550		
1962	29	94	71,813	99			151,421		
1963	39	69	70,126	77			97,102		544
1964	70	137	28,739	148			130,758		191
1965	126	113	34,152	208	136	-	39,778		1,913
1966	2,906	136	32,618	177			135,629		2,767
1967	67	24	31,165	524			213,449		4,104
1968	44	99	41,716	122			39,505	231,835	29,000
1969	60	168	31,170	197			46,375	206,366	52,166
1970	28	182	30,084	187	-	-	9,223	196,407	39,653
1971	7	38	33,944	1,150			10,403	207,796	40,530
1972	12	92	39,743	409			6,591	149,697	15,120
1973	9	52	26,009	233			14,309	169,673	13,726
1974	7	157	32,402	200			4,894	128,865	12,381
1975	56	100	(36,060)	(117)			1,179	135,624	4,701

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Foreign fleets caught an additional 72,330 metric tons of Atlantic herring in 1968 from Division 5Z which cannot be assigned to 5Ze or 5Zw.

Foreign catches for 1975 are provisional. The total ICNAF 1976 quota for Atlantic herring in subareas 5 and 6 was 67,000 metric tons.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

Shrimps

New York and New Jersey have had small shrimp fisheries, but both appear to have collapsed. In New York, landings of shrimp were reported for the period 1921 to 1940 inclusive, with a maximum of about 72 metric tons in 1931. In New Jersey the peak year on record was 1929, with a reported catch of about 203 metric tons. No landings were reported in New Jersey from 1966 to 1971 inclusive, but small amounts were recorded in 1972 and 1973. In New York no landings were listed from 1942 to 1971 inclusive, but in 1972 a total catch of about 11 metric tons was reported. According to LoVerde (pers. commun.) these landings were grass shrimp, *Palaemonetes pugio* Holthuis or *P. vulgaris* (Say), which are used as bait by sport fishermen. Recorded commercial landings probably do not reflect the total catch.

New York Bight lies outside the commercially viable ranges of the two important Atlantic coast shrimp resources used as human food. The commercial shrimp of the Gulf of Maine, *Pandalus borealis* Krøyer, apparently does not come south of Marthas Vineyard. Two of the three commercial species of *Penaeus*, *P. aztecus* Ives, brown shrimp, and *P. setiferus* (Linnaeus), white shrimp, have been recorded as far north as Massachusetts and Fire Island, N.Y. respectively (Williams 1974), but have not supported commercial fisheries north of North Carolina. Another shrimp of potential commercial importance off New York and New Jersey is *Dichelopandalus leptoceras* (Smith), which occurs in Long Island Sound as well as on the outer continental shelf (Wigley 1960).

SEMI-INDUSTRIAL FISHERIES

Some species are used as industrial and human food resources, as alewives and Atlantic herring sometimes have been. Quantities allocated to either purpose vary considerably, depending upon the market, availability of other food and industrial species, and other considerations. Red hake and silver hake are examples. Among the invertebrates, squids are used partially for industrial purposes, although industrial use of squids is for bait rather than fish meal or animal food. Clams often are used as bait also, but the sport fisherman sometimes harvests his own, and this part of the catch does not enter commercial channels.

Red Hake and White Hake

Red hake (also called squirrel hake or ling), *Urophycis chuss* (Walbaum), is somewhat similar in its dis-

[11] Hennemuth, R. C. 1975. Fisheries and renewable resources of the northwest Atlantic shelf. Paper presented at Symposium on Effects of Energy-Related Activities on the Atlantic Continental Shelf, Brookhaven National Laboratory, November 1975, 10 ms p.

tribution, migrations, and life history to silver hake. It is used to some extent as human food, but in New England usually over 90% of the catch is used for industrial purposes (Grosslein et al. 1973, see footnote 7). In New Jersey only about 10% of the catch is used as animal food, the remainder as human food (Eugene LoVerde pers. commun.). Limited markets sometimes force buyers to limit the amounts they will purchase. A single stock of red hake occupies the Middle Atlantic Bight, most abundantly between Cape Cod and Hudson Canyon. Red hake on Georges Bank belong to a distinct and separate stock (Grosslein et al. 1973, see footnote 7). Red hake and white hake, *Urophycis tenuis* (Mitchill), (Table 5) virtually were unutilized until the early 1940s, when wartime shortages of animal protein created a strong demand (U.S. Fish and Wildlife Service 1945). Greatest landings in New Jersey, as in New York, were made during and just following the second world war (Figs. 6, 7). Landings dropped abruptly after 1947, rose somewhat in the middle 1950s, and have fluctuated about a level less than 500 metric tons for the last 20 yr. Landings in New York followed a somewhat similar pattern, but at lower levels than in New Jersey (Fig. 7). This increase may have been stimulated by increased demand for fish during and immediately after the war. Landings probably were considerably higher in the middle 1960s than statistics indicate, for the brief upsurge in landings of unsorted and unidentified industrial species in New York (McHugh 1972a) probably was composed mainly of red hake, as was the industrial trawl catch in New England (Edwards and Lux 1958). As already noted, the industrial trawl fishery off New Jersey took mainly searobins, but small quantities of red hake may have been included.

The fishery for white hake is relatively minor (Figs. 6, 7). The two species were not separated in statistics prior to 1933 in New Jersey and 1937 in New York. Recently, white hake landings in both states have been very small (Table 5) as are foreign catches. It is probable that some white hake are included in red hake landings.

Foreign fleets began to take red hake in the middle Atlantic region in 1963 (Table 6). In 1966 they caught over 60,000 metric tons, which was almost double the greatest total U.S. catch of this species. Domestic landings dropped sharply in 1966, but although foreign catches have

Table 5.--Estimated commercial catches of white hake in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

Year	Domestic commercial catch				ICNAF Foreign catch		
	NY	NJ	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	1	20	2,591	34			
1961	•	46	2,316	49			
1962	1	49	2,546	52			
1963	2	51	2,781	54			
1964	1	26	3,111	26			
1965	•	20	2,704	21			
1966	•	22	1,603	22			
1967	•	15	1,255	15		16	
1968	1	14	1,261	14	-	80	-
1969	2	5	1,158	5	-	36	-
1970	2	10	1,844	10	79	177	-
1971	4	20	2,619	20	4	187	105
1972	3	17	2,999	17	-	191	-
1973	1	28	2,471	28	-	101	4
1974	3	26	3,780	26	-	196	-
1975	1	22	(3,520)	(22)	-	129	-

Recreational catches were included with red hake (squirrel hake) if any taken.

Foreign catches for 1975 are provisional. This species is included with the second tier quota for 1976.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

• Less than 0.5 metric ton.

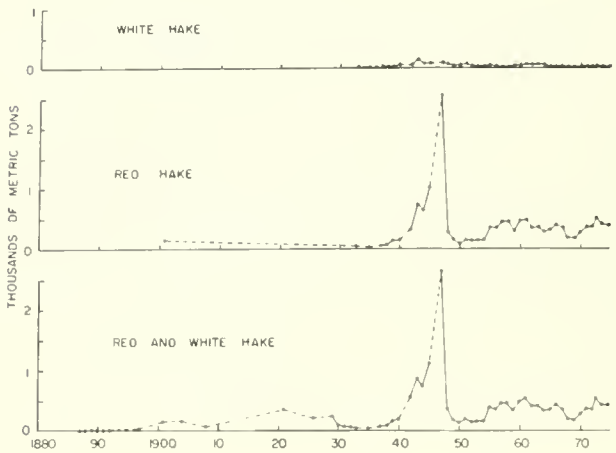


Figure 6.—Annual commercial landings of red hake and white hake in New Jersey 1887-1975.

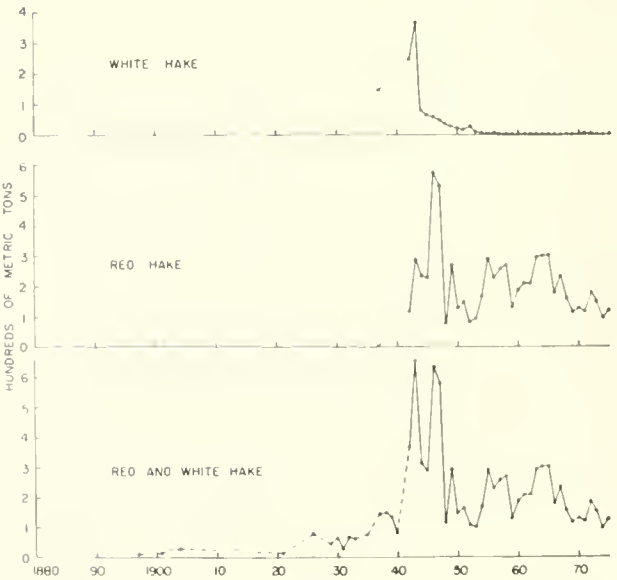


Figure 7.—Annual commercial landings of red hake and white hake in New York 1897-1975.

Table 6.--Estimated commercial and recreational catches of red hake in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

Year	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	190	464	3,609	474	159	159			
1961	207	482	3,486	494					
1962	207	349	2,678	374					
1963	294	349	2,670	375			3,205		770
1964	302	285	1,692	298			3,588		8,372
1965	303	307	1,509	326	400	235	58,572		11,745
1966	180	396	671	409			82,900		25,722
1967	236	331	395	342			38,422		14,884
1968	158	185	158	192			6,833	4,536	1,865
1969	115	178	520	182			40,928	4,237	4,099
1970	128	276	721	282	-	410	4,881	1,815	850
1971	117	323	629	336			11,578	5,858	9,510
1972	182	345	938	366			19,148	39,206	15,328
1973	153	507	699	523			22,257	24,592	15,626
1974	93	405	775	418			9,766	9,423	11,603
1975	113	403	(978)	(406)			1,077	14,948	10,137

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Foreign catches for 1975 are provisional. The total ICNAF 1976 quota for red hake in subareas 5 and 6 was 42,000 metric tons.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

been greatly reduced, domestic commercial landings have not improved because markets are limited.

Red hake and some other species spend winter and early spring offshore at the outer edge of the continental shelf. There they have been subject to foreign fishing. According to Edwards (1968) the fishing fleet of the USSR had been taking the available surplus prior to the spring inshore migration, and this had serious effects on domestic fisheries for the species. This led to bilateral agreements with the Soviet Union and Poland under which, among other things, these nations agreed not to fish for red hake and other species in zones at the edge of the shelf between 1 January and 15 April (U.S. Department of State 1970a, 1970b, 1973a, 1973b). These zones (Fig. 1) include the entire offshore boundary of New York Bight. Later, a somewhat similar agreement was concluded with Romania (U.S. Department of State 1973c). The total allowable catch of red hake for 1976 in ICNAF subareas 5 and 6 combined has been set at 42,000 metric tons. The estimated standing crop in 1975 is 117,000 metric tons (Hennemuth 1975, see footnote 11) down sharply from the period 1963-65 when the standing crop was about 694 million pounds or 315,000 metric tons according to Edwards (1975, see footnote 10).

Red hake also is of growing importance as a saltwater sport fish in the area. Reintjes and Roithmayr (1960) reported that the species ranked fifth in numbers caught in the party and charter boat fisheries of New Jersey in 1954, exceeded only by scup, black sea bass, weakfish, and bluefish. The national saltwater angling surveys estimated that in the area from New Jersey to Cape Hatteras inclusive the sport catch of red hake almost tripled from 1960 to 1970, from 350,000 to 900,000 pounds (159 to 408 metric tons).

Silver Hake

Silver hake or whiting, *Merluccius bilinearis* (Mitchill), has been an important commercial species in the New Jersey area since the 1920s (Fig. 8). Most of the catch is taken in otter trawls. Landings in New Jersey, as in New York (McHugh 1972a), were high in the 1940s, dropped sharply in the late 1940s, and stayed relatively low for several years. Landings in both states have risen since the early 1950s, but have fluctuated widely, perhaps partly from differences in recruitment (ICNAF 1973), but also because markets are limited and variable. The 1971 year class was strong and stock size was expected to increase in all divisions of ICNAF subareas 5 and 6. New York landings of silver hake have been somewhat less than in New Jersey, but the major trends have been similar.

Graham (1968) pointed out that although silver hake was the most abundant groundfish on New England Banks, the U.S. market could absorb only a small part of the potential harvest at that time. He stated that total domestic landings had decreased since the peak in 1957 and concluded that the catch was controlled by economic forces. This is reflected in widely variable prices paid to fishermen in New York and New Jersey as well (McHugh 1976),[12] and in limits placed by buyers on the amount of hake they would accept.

From Nantucket Shoals through the middle Atlantic area, there is a single stock of silver hake which migrates to deep offshore waters at about 150 fathoms (273 m) in winter and moves inshore to depths less than 50 fathoms (91 m) from spring to fall (Grosslein et al. 1973, see footnote 7). Relative abundance of this stock declined rapidly after 1965, but strong year classes in 1971 and 1972 were expected to increase abundance in 1973-74. Estimated maximum sustainable yield of this stock is 69,000 metric tons. The U.S. share of the quota for 1973

[12] McHugh, J. L. 1976. Trends in fish prices in the New York Bight area. Manuscript in preparation.

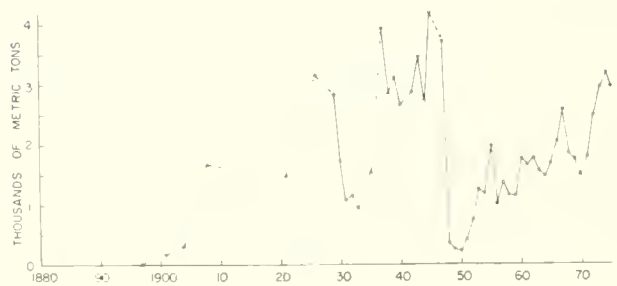


Figure 8.—Annual commercial landings of silver hake in New Jersey 1897-1975.

was 25,000 tons, of which New Jersey landed 2,928 and New York 876 metric tons.

Estimated total maximum sustainable yield for ICNAF subareas 5 and 6 combined is about 150,000 metric tons. Total allowable catch for 1976 has been set at 103,000 metric tons. The estimated standing crop in 1975 was about 43% below the level required to produce the maximum sustainable yield (Hennemuth 1975, see footnote 11).

Silver hake and other species important to domestic fishermen concentrate at the edge of the continental shelf in winter and early spring. Bilateral agreements with the USSR and Poland (U.S. Department of State 1970a, 1970b) provide protection for the species from 1 January to 15 April, when they are particularly vulnerable to fishing (Fig. 1).

The decline in silver hake landings in the New York Bight area after World War II probably had economic causes. New Jersey fishermen apparently were unable to compete with the much larger New England fishery (LoVerde 1966), especially in Massachusetts and Maine. Most of the New Jersey catch is made in winter and spring, when higher priced species are scarce in the area. Taylor et al. (1957) suggested that general warming of coastal waters from the 1920s into the 1950s might have been responsible for the drop in silver hake landings in New York and New Jersey, which was especially noticeable in pound net catches. Low prices for silver hake have been a recurrent problem. Another complication has been that silver hake are used for industrial purposes as well as for human food. Since 1949 (Grosslein et al. 1973, see footnote 7) the proportion of the total U.S. catch of silver hake used as industrial fish has varied from 22 to 78%, the greatest percentages associated with the largest catches.

Silver hake apparently is not a major recreational species in the Middle Atlantic Bight (Table 7), but in 1970 it ranked among the first 10 species taken by party boats in New York Bight (Buchanan 1972).

Table 7.--Estimated commercial and recreational catches of silver hake in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	1,630	1,733	48,639	1,983	821	980			
1961	1,192	1,670	43,805	1,883					
1962	1,235	1,774	45,569	2,099			41,900		
1963	1,074	1,547	40,336	1,686			103,697		4,191
1964	1,417	1,484	41,185	1,560			167,308		16,889
1965	1,514	1,692	35,706	1,750	1,902	814	281,431		17,726
1966	911	2,050	38,941	2,068			121,373		92,924
1967	1,762	2,565	28,934	2,610			70,005		18,626
1968	1,502	1,834	34,040	1,861			15,881	28,914	15,082
1969	949	1,735	18,650	1,765			50,428	16,478	7,184
1970	463	1,489	18,667	1,518	299	651	8,857	20,667	3,414
1971	480	1,790	13,267	1,958			11,577	54,143	7,785
1972	1,193	2,468	9,440	2,478			21,345	76,633	8,148
1973	876	2,925	16,387	2,933			46,936	56,509	12,081
1974	887	3,185	10,185	3,202			43,535	64,081	7,693
1975	1,179	2,933	(16,240)	(2,945)			11,181	58,427	22,211

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Foreign catches for 1975 are provisional. The total ICNAF 1976 quota for silver hake in subareas 5 and 6 was 103,000 metric tons.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

Squids

Squids have never been of major importance in coastal fisheries of the United States. Rathjen (1973) identified the two most abundant species in this area as long-finned squid, *Loligo pealci* (Lesueur), and short-finned squid, *Illex illecebrosus* (Lesueur). Both are taken by domestic commercial fisheries in the New York Bight area, although most of the catch probably is *Loligo*. In New Jersey and New York most of the catch is taken by otter trawls.

Maximum landings reported in New Jersey were about 750 metric tons in 1939 (Fig. 9). Landings have been irregularly downward since that time (Table 8). Two major peaks occurred in New York landings, at about 750 metric tons in 1939 and about 660 metric tons in 1962. In the United States squids are used mostly as bait, but certain ethnic groups, especially in large cities like New York, value them as food. The highly variable landings, like those of silver hake, probably are related more to

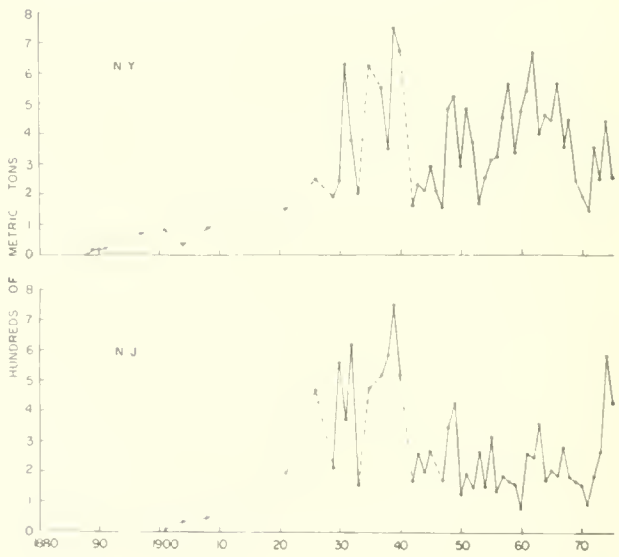


Figure 9.—Annual commercial landings of squids in New York and New Jersey 1888-1975.

variable demand and price than to fluctuating abundance.

Japanese trawlers began fishing long-finned squid in the Middle Atlantic Bight about 1969 and started experimental trawling for the short-finned species in 1972 (Rathjen 1973). Fleets of several other nations now take considerable quantities.

Edwards (1968) estimated that the standing crop of

Table 8.--Estimated commercial catch of squids in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

Year	Domestic commercial catch				ICNAF Foreign catch		
	NY	NJ	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	470	80	1,417	223			
1961	538	263	1,092	434			
1962	660	247	1,784	373			
1963	396	361	1,613	507			
1964	457	171	709	296			
1965	442	206	823	334			
1966	562	190	798	396			48
1967	350	282	1,175	565			6
1968	442	184	1,277	405	112		1,619
1969	241	170	1,116	358	3,724		3,398
1970	184	160	680	365	6,000		9,000
1971	141	93	943	289	1,921	7,769	10,371
1972	347	187	1,000	315	4,116	21,456	21,841
1973	244	265	1,398	356	11,123	23,804	20,139
1974	437	584	1,725	723	4,459	22,295	25,289
1975	258	427	(1,140)	(520)	2,454	13,291	28,900

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of invertebrates.

Foreign catches for 1975 are provisional. The total ICNAF 1976 quota for squids in subareas 5 and 6 was 74,000 metric tons

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

Loligo was 700 million pounds (about 318,000 metric tons). Grosslein et al. (1973, see footnote 7) estimated conservatively that the average biomass in the Middle Atlantic Bight is 50,000 to 100,000 tons. The greatest catch on record, domestic and foreign, was about 57,000 metric tons in 1973. Grosslein et al. also concluded that the current rate of exploitation probably is below maximum sustainable yield (although the 1973 catch of over 57,000 metric tons was near the lower limit of their estimate and about 50% of their upper limit). These authors were more concerned about the effects of incidental catches of species like silver hake, scup, butterfish, summer flounder, sea bass, and red hake, which are important to U.S. coastal fishermen. If the conservative estimates of squid standing crop are reasonably accurate, concern about the squid resource might also be warranted. The 1976 quota placed on the squid catch in ICNAF subareas 5 and 6 combined by international agreement is 74,000 tons.

FOOD FISHERIES

Trends in landings illustrated in Figure 5 have led to the assumption that the history of New Jersey's commercial fisheries can be divided into five relatively distinct periods. Tables 9 and 10 have been based on this assumption. These five periods were: 1) an initial period in which catches of major species were high, or were rising to a peak (1880-1901); 2) a period (1904-26) in which catches of most species apparently were reduced, and in which only 4 yr of landings were collected; 3) a period of relative prosperity (1929-49), characterized by development of the trawl fisheries, and in the middle and late

Table 9.--Average annual commercial landings of food shellfishes in New Jersey for five major periods in the history of the commercial food shellfisheries of the State. Weights in metric tons.

Species	1880-1901	1904-1926	1929-1949	1950-1970	1971-1975
American oyster	5,300	4,292	3,513	1,317	539
Hard clam	1,712	654	1,129	1,214	898
Blue crab	413	102	423	411	996
Soft clam	268	166	444	55	35
Mussels	146	286	2	*	2
American lobster	65	147	202	423	544
Scallops	9	5	107	283	172
Sea scallop				241	165
Bay scallop				42	7
Squids		187	391	199	311
Surf clam	1	19	151	10,651	11,786
Conch			8	96	55
Rock crab				10	78
Red crab					3

* Less than 0.5 metric tons.

1940s by the stimulating effects of wartime shortages of animal protein; 4) a decade of rapidly declining catches of almost all species except surf clam and striped bass (1950-70); and 5) a recent 5-yr period of increasing abundance and increased catches of several formerly important species. Consideration of the following discussions by species will make it clear that this division into five periods, although it is a useful generality, oversimplifies the dynamic aspects of the fisheries of New Jersey, as it did for New York (McHugh 1972a). In each period, landings of individual species rose and fell, as the resources upon which the fisheries were based varied in abundance from natural causes or from fishing, or were more or less available to the fishing fleets for a variety of reasons. Nevertheless, the five periods recognized appear to provide a simplified view of the evolution of the fisheries by gears, fishing grounds, and the economics of the industry, as has been explained already.

The illustrations are based entirely on reported domestic commercial fishery landings. This is because estimates of domestic recreational catches of marine resources are available only for 3 yr: 1960, 1965, and 1970 and because sport catches and foreign catches have not been reported by waters of individual states. In discussions of individual species, however, available information on recreational and foreign fisheries has been given due consideration.

The food fisheries of New Jersey have been dominated by American oyster and hard clam until recently. Since the late 1940s surf clam has been the major species (Tables 9, 10). Important finfishes in the 19th century were American shad, bluefish, weakfish, black sea bass, Atlantic sturgeon, and Atlantic cod. More recently, food fish landings have been dominated by scup, summer flounder, silver hake, and butterfish. But commercial catches of some important species have increased and decreased from time to time for various reasons and some species have become important to sport fishermen, so

Table 1.--Average annual commercial landings of major food fishes in New Jersey for five major periods in the history of the commercial food finfisheries of the State. Weights in metric tons.

Species	1880-1901	1904-1926	1929-1949	1950-1970	1971-1975
American shad	4,073	914	919	323	72
Bluefish	2,733	844	598	388	451
Weakfish	2,653	5,822	3,091	528	1,440
Black sea bass	978	1,044	1,217	147	306
Atlantic sturgeon	676	49	4	5	6
Atlantic cod	614	899	1,246	405	82
Flounders	388	749	1,356	2,204	1,708
Summer			1,173	2,072	1,325
Winter			64	74	51
Yellowtail			34	45	324
Witch			5	12	3
American plaice			5	*	*
Eels	309	135	111	45	97
American				40	94
Conger				5	3
Butterfish	217	1,060	1,489	755	418
White perch	209	72	35	40	44
Striped bass	159	29	53	147	225
American bonito	121	362	212	18	1
Scup	74	1,000	2,711	4,155	1,899
Croaker and spot	63	1,032	1,462	58	95
Croaker		839	1,306	37	87
Spot		193	156	21	8
Carp	52	147	82	38	29
Hakes	24	209	429	316	420
Red hake				289	397
White hake				27	23
Silver hake	21	1,656	2,309	1,430	2,661
Atlantic mackerel	5	382	1,631	234	537
Atlantic bluefin tuna		50	22	337	799
Tilefish			4	25	252

Individual flounder catches do not agree with total flounder catch in the period 1929-1949 because flounders were not recorded by species prior to 1937. In the period 1971-1975 some unclassified flounder catches are included in the total flounder catch.

* Less than 0.5 metric ton.

that commercial landings as an index of total catch exaggerate declines. Growth of saltwater sport fishing also has introduced difficult sociopolitical complications.

Some of the changes in abundance or availability of food fishes as indicated by trends in commercial landings can be explained with some confidence, but much of the interpretation is speculative at best. Scientists generally are much more aware of the complications and uncertainties than laymen are, and less likely to be sure about the causes of variations in the catch. When they are reasonably certain, scientists are likely to view the situation differently than laymen do, and when scientists are uncertain, they are less likely to take sides or to make simplified assertions. This tends to exacerbate, rather than alleviate, objective appraisal of the situation and rational interpretation and solution of problems. One way of putting it is to say that, for the most part, in fishery management the democratic process leads to identification of the wrong problems and the wrong solutions (McHugh 1972b).

Recreational fisheries in marine coastal waters of the United States have clearly increased in importance, especially as growing prosperity and leisure time have provided opportunities for recreation. However, sport fishing was a popular pastime in certain areas in the 1880s also (Earll 1887; Mather 1887). On the New Jersey coast Barnegat Bay and Atlantic City were favorite sport fishing centers, and it was reported that recreational fishermen gave so much of their catch to local residents that markets for commercial catches were poor. Sport fishing was also popular at many points on Long Island. Mather (1887) in fact included recreational and subsistence catches in his estimates of the New York catch, which means that his figures are not comparable with later statistics.

Recreational fishing without a doubt has competed significantly with commercial fishing for the available stocks of some species in coastal waters. Declines in commercial catches of some resources may have been balanced by increased catches by recreational fishermen. Existence of substantial sport fisheries for some species greatly complicates the problem of obtaining adequate information for management, and for establishing effective management measures if a scientific basis for management is available. Gathering reasonably accurate statistics on recreational catch and effort, and enforcement of regulations on saltwater sport fishing, will be extremely difficult and costly. But, even in the absence of sport fishing, e.g., as in the Pacific sardine and Atlantic menhaden fisheries, it has not been possible to prevent overfishing. Moreover, in many domestic marine commercial fisheries it is questionable whether reasonably accurate statistics have been gathered, or ever will be possible, under our permissive democratic system of government.

Because it illustrates rather nicely the evolution of coastal fisheries and the inability of government to manage harvesting of common-property or open-access fishery resources, the ensuing discussion by species has been arranged chronologically in terms of the decade in which New Jersey landings of each resource reached a maximum. Within each decade the resources are arranged in descending order of importance by maximum weight landed. The order of discussion follows the order of arrangement of species in Table 11, but the table also includes all species or groups of species that have been reported at any time as landed in New Jersey. Only about one-third of these species have been selected for discussion. For comparison, a similar table by decades is given for New York (Table 12).

American Oyster

Historically, American oyster, *Crassostrea virginica* (Gmelin), has been one of the most important fishery resources of the Middle Atlantic Bight, whether its importance is reckoned by weight or by value. Value expressed in dollars is not a good criterion because the real

Table 11.--Maximum historic commercial landings of all fish and shellfish species reported for New Jersey. Species are arranged chronologically by the decade in which maximum landings were reported, and in descending order by weight within each decade. This is the order in which species discussions have been arranged.

Decade	Species	Maximum landings in metric tons	Year
1880-1890	American oyster	8,318	1887
	Bluefish	4,214	1890
	Atlantic sturgeon	1,670	1888
	Sheepshead	28	1887
	Pike or pickerel	14	1888
1891-1900	Mussels	1,143	1897
	Carp	356	1897
	Yellow perch	227	1891
	Tautog	131	1897
	Suckers	64	1897
	Black bass	5	1892
1901-1910	American shad	6,364	1901
	Weakfish	5,431	1901
	Alewives	1,688	1901
	Unclassified eels (probably mostly American eel)	618	1901
	White perch	577	1901
	Atlantic tomcod	120	1901
	Catfish and bullheads	117	1901
	Haddock	103	1901
	Drums	103	1904
	Round herring	60	1904
	Striped mullet	43	1901
	Rainbow smelt	4	1904
1911-1920	Available records show no peak catch in this period.		
1921-1930	Atlantic cod	3,529	1930
	Horseshoe crab	2,589	1929
	Shrimp	203	1929
	Unclassified sharks	80	1930
	Black drum	31	1921
	Hickory shad	13	1921
	Minnows	8	1930
	Cusk	5	1929
	Hagfish[1]	3	1930
1931-1940	Atlantic croaker	3,342	1935
	Butterfish	2,613	1939
	Blue crab	2,200	1939
	Squids	751	1939
	Atlantic bonito	682	1940
	American eel	123	1937
	Spanish mackerel	107	1931
	Northern kingfish	72	1939
	King mackerel	68	1937
	Grayfish	46	1938
	Pollock	46	1938
	Red snapper	25	1937
	Cero	23	1937
	Sandworms	13	1935
	Mummichog	12	1933
	Bloodworms	11	1935
1941-1950	Atlantic mackerel	8,648	1949
	Silver hake	4,189	1945
	Red hake	2,536	1947
	Atlantic herring	2,446	1947
	Hard clam	2,307	1950
	Soft clam	1,474	1948
	Chub mackerel	1,474	1948
	Spot	595	1943
	Harvestfish	162	1943
	Skates and rays	146	1942
	White hake	143	1943
	Atlantic wolffish	86	1948
	Frigate mackerel	77	1944
	American plaice	15	1943
	Gizzard shad	10	1948
	Ocean pout	8	1943
	Pilotfish	8	1949
	Pinfish	7	1944
	Red drum	7	1942
	Silver perch	4	1945
	Grunts	3	1950
1951-1960	Atlantic menhaden	220,552	1956
	Scup	7,080	1953
	Black sea bass	4,176	1952
	Summer flounder	3,678	1958
	Little tunny	328	1952
	Unclassified food fishes	287	1951
	Searobins	124	1959
	Goosefish	35	1951
	Conger eel	21	1953
	Amberjack	3	1957
1961-1970	Surf clam	19,584	1966
	Unclassified industrial fishes	6,607	1967
	Bluefin tuna	1,398	1970
	Sea scallop	860	1965
	American lobster	832	1970
	Swordfish	454	1965
	Striped bass	452	1964
	Conch	238	1963
	Winter flounder	199	1966
	Bay scallop	171	1964
	Northern puffer	73	1963
	Rock crab	38	1969
	Witch flounder	25	1967
1971-1975	Yellowtail flounder	588	1971
	Tilefish	434	1975

In addition, the following species produced maximum landings of 1 metric ton or less: Atlantic salmon (1901, 1904)[2], jewfish (1929), wahoo (1929), dolphin (1930), periwinkles (1932), cunner (1935), American sand lance (1935), banded rudderfish (1937), angelfish (1940), cobia (1940-1942), razor clam (1947), tarpon (1962, 1968), redfish (1965), and white marlin (1965).

1/ This may have been a misprint for hogfish.
2/ Atlantic salmon was virtually eliminated by 1800. The maximum catch obviously predates the statistical series from which these figures were drawn.

Table 1. --Maximum historic commercial landings of all fish and shellfish species reported for New York State. Species are arranged chronologically by the decade in which maximum landings were reported, and in descending order by weight within each decade

Decade	Species	Maximum landings in metric tons	Year
1880-1890	Atlantic menhaden	1/ 131,059	1880
		(98,159)	(1904)
	American shad	1,965	1889
	Soft clam	1/ 1,546	1880
		(716)	(1890)
	Unspecified eels (probably mostly American eel)	791	1889
	Blue crab	1/ 737	1880
		(583)	(1888)
	Minnows	256	1888
	Searobins	227	1888
	Atlantic tomcod	140	1890
	White perch	114	1887
	Striped mullet	87	1889
	King mackerel	84	1890
	Tautog	83	1889
	Spanish mackerel	35	1890
	Sheepshead	10	1890
	Horseshoe crab	10	1887
1891-1900	Atlantic sturgeon	194	1897
	Pike or pickerel	4	1891
1901-1910	American oyster	9,108	1904
	Bluefish	5,177	1904
	Weakfish	5,059	1908
	Mussels	3,708	1908
	Suckers	99	1901
	Tidewater silverside	90	1908
	Catfish and bullheads	79	1901
	Skates and rays	76	1908
	Striped killifish	64	1901
	Miscellaneous bait	30	1908
	Sunfish	6	1901
1911-1920	Available records show no peak catch in this period.		
1921-1930	Haddock	7,720	1926
	Tilefish	1,199	1929
	Spot	198	1926
	Carp	192	1921
	Swordfish	147	1929
	Bloodworms	34	1929
	Sandworms	26	1929, 1930
1921-1930 (cont.)	Hickory shad	10	1921
	Rainbow smelt	4	1929
1931-1940	Atlantic cod	3,874	1938
	Winter flounder	3,067	1938
	Butterfish	2,380	1939
	Squids	745	1939
	Pollock	350	1933
	Redfish	184	1939
	Atlantic croaker	183	1940
	Chub mackerel	135	1940
	Shrimp	72	1931
	Sand shrimp	71	1940
	Bluefin tuna	67	1938
	Cusk	61	1932
	Witch flounder	40	1937
	Northern kingfish	37	1940
	Atlantic halibut	24	1933
	American sand lance	17	1932
	Banded rudderfish	16	1940
	Yellow perch	13	1937
	Red snapper	2	1938
	Grouper	2	1938
1941-1950	Yellowtail flounder	5,391	1942
	Hard clam	4,686	1947
	Surf clam	2,940	1946
	Silver hake	2,686	1943
	Sea scallop	2,180	1950
	Atlantic mackerel	1,663	1947
	Northern puffer	1,065	1945
	Red hake	576	1946
	White hake	369	1943
	Unclassified food fishes	240	1949
	Atlantic bonito	227	1943
	Conch	173	1943
	Conger eel	138	1944
	Atlantic silverside	136	1950
	Ocean pout	131	1943
	American plaice	78	1944
	Frigate mackerel	73	1943
	Striped anchovy	72	1950
	Little tunny	45	1949
	Goosefish	42	1944
	Unclassified sharks	16	1943
	Atlantic wolffish	13	1946
	Cunner	4	1946
1951-1960	Scup	6,495	1958
	Summer flounder	1,932	1956
	Black sea bass	1,267	1951
	American eel	165	1951
	Catfish and bullheads	32	1951
1961-1970	Unclassified industrial fishes	53,486	1964
	Atlantic herring	2,905	1966
	Alewives	1,699	1966
	Bay scallop	449	1962
	Grayfish	89	1967
	Razor clam	7	1967
1971-1975	American lobster	812	1971
	Striped bass	759	1973

In addition, the following species produced maximum landings of 1 metric ton or less: Atlantic salmon (1901)2/, cero (1901), pompano (1921, 1926), pilotfish (1926), drums (1926, 1932, 1933), rock crab (1929, 1930), pigfish (1932), red drum (1937), black drum (1939, 1942), blue runner (1943), white marlin (1945), dolphin (1948, 1949), and crappie (1952, 1956)

1/ Estimated landings in New York in 1880 included figures on recreational and subsistence catches, and thus probably are exaggerated in comparison with figures for later years, and possibly also for New Jersey. When peak landings of a species fell in 1880 the next highest year is given in parentheses.

2/ Atlantic salmon was virtually eliminated by 1800. The maximum catch obviously predates the statistical series from which these figures were drawn.

value of the dollar changes with time. A study based on standard dollars is in progress (McHugh 1976, see footnote 12) but for purposes of this discussion the relative importance of oyster and other species will be expressed in weight landed. By this criterion, maximum oyster production in New Jersey has been exceeded only by Atlantic menhaden, surf clam, and Atlantic mackerel (Table 11). This comparison is not completely parallel, however, because oyster landings have been expressed in weights of meats, shells excluded (Table 13), whereas menhaden and mackerel have been reported as weight in the round (live weight).

In the 1880s (Earll 1887) a fairly important oyster industry operated as far up Raritan Bay as Keyport and Perth Amboy. Oyster fisheries also were important in Newark Bay. Along the ocean coast of New Jersey, Shrewsbury was a well-known oyster producing area, using seed transplanted from Keyport. The center of oyster production in New Jersey at that time, however, was in Delaware Bay at Maurice Cove. Oysters were abundant in all suitable places in Delaware Bay and the estuary to at least 50 miles up the Bay from Cape May, even in deep water, and in various bays along the ocean coast of New Jersey.

In New York waters in the 1880s (Mather 1887) the oyster industry was concentrated at the western end of Long Island, especially in Little Neck and Oyster bays on the Long Island Sound side and Jamaica, Sheepshead, and Great South bays on the south shore. Bluepoints and Rockaway oysters were already well-established trade names. At the eastern end of Long Island oyster production was small, although some experimental plantings were being tried. Most seed oysters came from bays along the Connecticut shore, but some local sets were obtained. Generally, however, setting was unreliable in New York waters. Seed planted in Hempstead Harbor was imported from the south. The relatively important oyster industry of Little Neck Bay obtained its seed from the East River, which is now badly polluted. In most bays along the north shore of Long Island, planting grounds were leased to oystermen by the towns, but in Little Neck Bay there was no such arrangement. There, planters staked out grounds although they had no legal claim, but according to Mather these appropriated rights were respected. In contrast, in Oyster Bay, where the Town leased grounds to private planters, some refused to pay rental fees and defended their claims by force.

Oyster production in New Jersey, as in New York, has been dropping irregularly but steadily since records have been kept (Fig. 10). Landings were variable, but apparently highest, in the period up to 1931. Some of the short-term fluctuations in oyster production during this period undoubtedly were in response to economic conditions, for in the absence of unusual and catastrophic environmental conditions the crop can be held on the bottom for sale when prices are favorable. This could account for the rather wide fluctuations in reported landings in the period 1880-1936. In New Jersey, as in New York (McHugh 1972a), the oyster industry prospered from the early 1930s to the early 1950s. The similarity is

Table 13.--Estimated commercial landings of American oyster in the north and middle Atlantic regions of the United States coast 1960-1975. Weights of meats in metric tons.

Year	North Atlantic region		Middle Atlantic region	
	Me-NY incl.	NY only	NJ-NC incl.	NJ only
1960	594(5,826)	368(3,603)	13,005(127,455)	76(744
1961	563(5,512)	358(3,505)	13,536(132,653)	499(4,886)
1962	464(4,543)	331(3,241)	10,222(100,176)	705(6,913)
1963	384(3,760)	179(1,752)	8,856(86,790)	234(2,291)
1964	185(1,811)	97(950)	10,872(106,556)	498(4,876
1965	245(2,399)	91(891)	10,255(100,498)	237(2,321)
1966	266(2,605)	80(783)	10,295(100,890)	316(3,094)
1967	193(1,889)	46(451)	12,430(121,815)	466(4,563)
1968	168(1,645)	79(773)	11,088(108,664)	598(5,865)
1969	166(1,626)	97(950)	10,722(105,071)	481(4,710)
1970	322(3,153)	236(2,311)	11,769(115,332)	393(3,006)
1971	439(4,298)	353(3,456)	12,312(120,659)	385(3,770)
1972	541(5,297)	505(4,945)	12,137(118,945)	777(7,617)
1973	671(6,580)	631(6,189)	11,922(116,840)	633(6,208)
1974	976(9,565)	705(6,909)	12,141(118,982)	458(4,49
1975	996(9,761)	956(9,369)	10,385(101,774)	441(4,322)

The national saltwater angling surveys for 1960, 1965, and 197 did not include recreational catches of invertebrates.

Live weights are given in parentheses for comparability with ICNAF statistics.

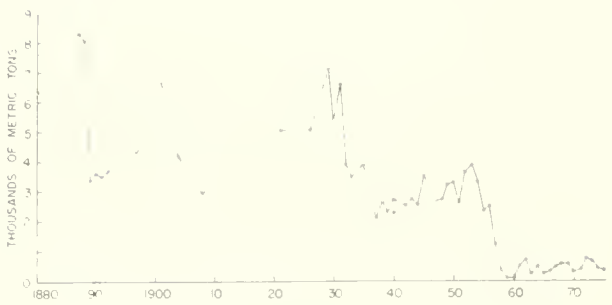


Figure 10.—Annual commercial landings of American oyster in New Jersey 1880-1975.

interesting, because in New York the oyster industry is privately controlled, either on leased bottom or on grounds owned outright, whereas in New Jersey the State controls seed production. In New Jersey, production of oyster meats remained fairly steady for nearly 20 yr, from about 1932 to 1953. The rather sharp collapse in the late 1950s was caused by disease, *Minchinia nelsoni* (Haskin et al. 1966), formerly known as MSX. This organism also is believed to be present on some Long Island oyster beds (Merrill and Tubiash 1970). Most oyster production in New Jersey now comes from Delaware Bay, hence cannot be attributed to the region defined here as New York Bight. Recently (Harold Haskin, pers. commun.), successful setting has increased the supply of seed oysters, and there is some hope that production will improve. Whether the industry has learned any lessons that will allow it to improve oystering practices and avoid the conditions that led to the decline remains to be seen. Recovery from the low point in 1960, when only about 76 metric tons of meats were produced in New Jersey, has been hampered by periodic closure of the Delaware River

seed beds by the State, poor quality of oysters, continued heavy mortality, and competition from other states (LoVerde 1965-72).

In New York also, production of oyster meats dropped sharply in the early depression years of the 1930s, but soon recovered, and remained fairly steady until 1950. Subsequently, weights of meats produced dropped sharply to an historic low, as happened in New Jersey in the late 1950s. Most of the decline of the oyster industry in New York has been attributed not to disease, but to a massive invasion of sea stars, *Asterias forbesi* (Desor), a serious shellfish predator. Through application of scientific culture techniques the industry in New York has shown substantial recovery, from an all-time low of 46 metric tons of meats in 1967 to almost 1,000 tons in 1975 (Table 13).

Bluefish

Landings of bluefish, *Pomatomus saltatrix* (Linnaeus), in New Jersey have followed a pattern similar to that in New York. Reported commercial catches were highest at about the turn of the century and the trend has been fairly steadily downward, with resurgences in the early 1930s and recently (Fig. 11). Bluefish is notably variable in abundance, but the reasons for these fluctuations are not known. It is probable that, in common with other highly migratory pelagic oceanic fishes, bluefish respond to changes in oceanographic conditions and are not always available on their inshore summer feeding grounds in constant proportion to their total abundance.

Bluefish was an abundant species in the 1880s in the New York Bight area. Mather (1887) said that it was increasing in abundance at that time. The species also was important recreationally.

Bluefish is a popular sport fish in New York Bight and estimated catches are much greater than commercial catches. Thus, the decline in abundance suggested by commercial landings may be more apparent than real. Table 14 shows that recreational and commercial catches of bluefish have been increasing since 1960. Although sport catch estimates are not available by states, the recreational catch is apparently much larger than the commercial catch. This is probably true despite the general view that sport catches may be exaggerated and

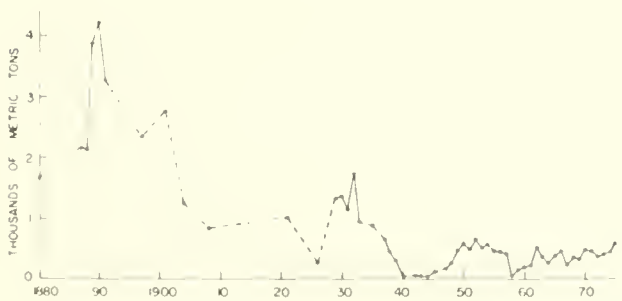


Figure 11.—Annual commercial landings of bluefish in New Jersey 1880-1975.

Table 14.--Estimated commercial and recreational catches of bluefish in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	52_w	52_e	6
1960	188	201	212	544	5,040	11,726			
1961	229	210	265	692					
1962	344	496	424	1,199					
1963	316	374	399	1,057					
1964	306	246	394	660					
1965	470	395	611	810	28,715	7,219			
1966	424	458	539	947					
1967	250	228	345	693					
1968	262	347	366	916					
1969	508	309	670	829					
1970	726	483	988	1,032	22,753	22,553			
1971	550	444	834	1,046			-	6	17
1972	455	368	684	1,477			2	16	-
1973	640	403	868	2,722			-	196	6
1974	484	455	728	3,132			14	68	17
1975	404	581	(639)	(3,090)			-	86	-

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Foreign catches for 1975 are provisional. This species is included with the second tier quota for 1976.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

commercial catches underestimated. Bluefish is the most important saltwater sport fish in the Bight, in total numbers and weight of the catch.

Bluefish have not been reported in foreign catches in the area until recently. In 1972 it was reported that foreign fleets took 18 metric tons in ICNAF subarea 5. In 1973, in division 5Z, 196 metric tons were reported as caught by foreign fleets, and 6 tons in subarea 6; in 1974 the total catch in subareas 5 and 6 was 99 metric tons. Bluefish are sometimes taken in domestic commercial trawl catches off southern New England in winter, and unusual numbers were taken in the Chesapeake winter trawl fishery in the winters of 1970 and 1971 (Grosslein et al. 1973, see footnote 7). They also are occasionally, although rarely, taken in scientific groundfish surveys at depths to about 275 m (Grosslein et al. 1973, see footnote 7). There is little doubt that bluefish have been unusually abundant recently and it is not surprising that they have been caught in places and by gears that usually do not take significant numbers, if any. It seems unlikely that the domestic bluefish fisheries are significantly affected by foreign fishing.

Atlantic Sturgeon

The history of sturgeon fisheries around the world is a history of early great abundance, followed very soon by virtual collapse of the fishery. In New Jersey average annual landings of Atlantic sturgeon, *Acipenser oxyrhynchus* Mitchill, were about 1,600 metric tons for the 3 yr 1887 to 1889 inclusive. The succeeding 7 yr of record from

1890 to 1908 inclusive produced an average catch of only about 175 metric tons per year, and although small catches have been reported up to the present time, they have not exceeded 12 metric tons since 1908 (Fig. 12). Shortnose sturgeon, *A. brevirostrum* Lesueur, also may appear in the catch.

New York landings of sturgeon apparently have never been as large as in New Jersey, probably because the State has only one major coastal river, whereas New Jersey borders on two. The greatest New York catch on record was 1897, about 194 metric tons. Subsequent landings have been small, about the same magnitude as in New Jersey. The rapid early decline in abundance may have had the same cause as in the Great Lakes (Harkness and Dymond 1961), where destruction of the resource was deliberate, as many fishermen killed sturgeon to avoid damage to gill nets set for other species. In New Jersey the decline occurred before 1890 (Fig. 12). It testifies to the remarkable resilience of fishery resources that sturgeon has been able to avoid extinction from attrition by incidental and probably some illegal catches, water pollution, and other effects of man's activities, and that small catches continue to this day (Table 15). Shortnose sturgeon is fairly abundant in the Hudson River (W. L. Dovel pers. commun.).

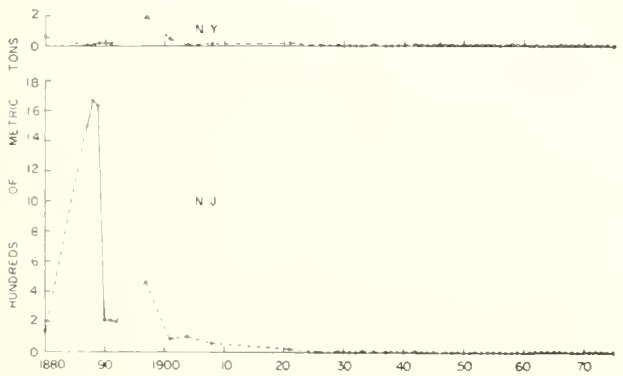


Figure 12.—Annual commercial landings of Atlantic sturgeon in New York and New Jersey 1880-1975.

Table 15.--Estimated commercial landings of Atlantic sturgeon in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

Year	North Atlantic region Me-NY incl.	NY only	Middle Atlantic region NJ-NC incl.	NJ only
1960	15	7	27	3
1961	11	4	37	7
1962	13	5	38	9
1963	10	2	31	6
1964	14	5	35	6
1965	8	3	68	7
1966	12	7	52	6
1967	10	5	29	4
1968	9	5	33	4
1969	10	5	74	3
1970	12	6	30	6
1971	7	3	49	5
1972	5	2	82	5
1973	8	1	45	8
1974	6	3	53	5
1975	(4)	2	(32)	6

No recreational or foreign catches of sturgeon were reported.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

Sea Mussels

At least two species of sea mussel, belonging to the genera *Mytilus* and *Modiolus*, have been harvested commercially in the New York Bight region. The major species is the blue or edible mussel, *Mytilus edulis* Linnaeus. Landings in New Jersey have never been very large (Fig. 13), nor have they been in New York, except for a catch of almost 4,000 metric tons of meats reported in 1908. The maximum catch in New Jersey was about 1,144 metric tons in 1897 (Fig. 13), but in most years landings have been much smaller than this. During the sec-

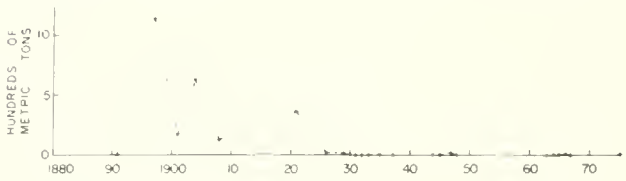


Figure 13.—Annual commercial landings of sea mussels, probably mostly blue mussel, in New Jersey 1891-1975.

Table 16.--Estimated commercial landings of sea mussels, probably mostly blue mussel, in the north and middle Atlantic regions of the United States coast 1960-1975. Weights of meats in metric tons.

Year	North Atlantic region Me-NY incl.	NY only	Middle Atlantic region NJ-NC incl.	NJ only
1960	231(807)	6(22)	-	-
1961	287(1,006)	8(29)	-	-
1962	269(941)	12(43)	-	-
1963	364(1,273)	34(118)	-	-
1964	145(507)	57(199)	*(1)	*(1)
1965	217(761)	134(469)	*(1)	*(1)
1966	247(866)	52(183)	8(29)	8(29)
1967	365(1,276)	13(44)	-	-
1968	317(1,111)	94(329)	-	-
1969	505(1,769)	306(1,071)	-	-
1970	303(1,060)	91(318)	-	-
1971	307(1,074)	144(505)	-	-
1972	352(1,232)	225(788)	-	-
1973	511(1,788)	311(1,088)	-	-
1974	359(1,256)	219(766)	3(10)	3(10)
1975	427(1,496)	48(168)	7(24)	7(24)

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of invertebrates.

Live weights are given in parentheses for comparability with ICNAF statistics.

- An unrecorded catch is possible.

* Less than 0.5 metric ton.

ond world war, landings in both states rose, especially in New York, as mussels were sought as a source of Vitamin A, but this use was soon ended by development of synthetic vitamins. There is a small but steady demand by certain ethnic groups which appreciate the fine flavor of mussels, and these landings have increased somewhat recently (Table 16). If demand were greater, it is almost certain that by wise management of harvesting the natural resource, or by mariculture, the yield could be increased considerably.

Tautog

Tautoga onitis (Linnaeus), tautog, is of minor commercial importance in the New York Bight region, but of considerable recreational importance (Table 17), especially in the region from New York north. Earll (1887) did not mention tautog as an important species in New Jersey in the 1880s, but Mather (1887) listed it among important species in Long Island Sound. The species is listed by ICNAF under the category "Other groundfish," but this probably is to accommodate the U.S. catch, for the species is not known to move in significant numbers beyond 12 miles from the coast (Bigelow and Schroeder 1953). Commercial catches in New York and New Jersey apparently have been declining in the long run (Fig. 14). New Jersey commercial landings have almost always been larger than in New York except recently.

Tautog is a relatively nonmigratory coastal species with specialized habitat preferences. Commercial catches are taken mostly by pots and traps in New Jersey, pound nets in New York, incidental to catches of other species. There is no evidence that the resource is in poor condition. Catches in the middle Atlantic area appear to be extremely variable, as might be expected with a species near the southern limit of its range.

Table 17.--Estimated commercial and recreational catches of tautog in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	North Atlantic region			Middle Atlantic region		
	Commercial		Recreational	Commercial		Recreational
Year	Me-NY incl.	NY only	Me-NY incl.	NJ-NC incl.	NJ only	NJ-NC incl.
1960	55	5	4,790	21	12	4,454
1961	48	5		17	15	
1962	50	4		29	24	
1963	51	4		26	25	
1964	47	9		18	17	
1965	42	12	5,014	19	16	69
1966	79	35		9	8	
1967	57	37		9	9	
1968	65	39		9	8	
1969	55	19		6	5	
1970	83	35	7,090	10	9	735
1971	55	22		6	6	
1972	57	18		14	14	
1973	56	22		11	10	
1974	59	25		14	10	
1975	(95)	50		(16)	15	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

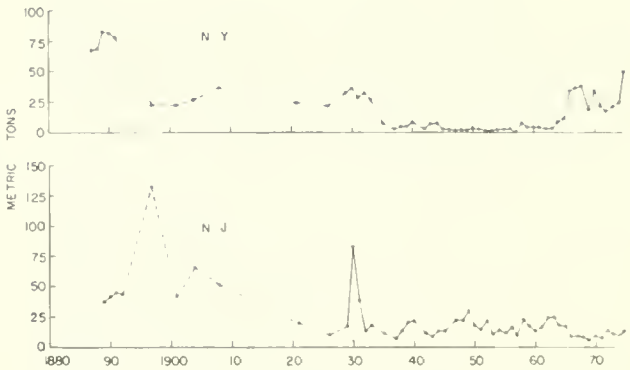


Figure 14.—Annual commercial landings of tautog in New York and New Jersey 1887-1975.

American Shad

Once one of the most popular food fishes of the Atlantic coast, American shad, *Alosa sapidissima* (Wilson), has declined to relatively minor importance in the New York Bight area.

In upper New York Bay and Newark Bay as well as in the Hudson, one of the most important fisheries in the 1880s was for American shad. Demand for shad in this area, and prices, were said to have declined because the fish had oily flavors (Mather 1887), but shad also were said to be less abundant than formerly. A few shad were caught even in some bays along the south shore of Long Island.

The history of commercial landings in New Jersey is similar to the trend in New York, although landings in New Jersey have been considerably higher. This is understandable, because most shad taken in New York waters come from the Hudson River, while New Jersey fishermen can fish in two major rivers, the Hudson and the Delaware. Most of the time more than half the weight of shad landed in New Jersey comes from the Hudson. In New Jersey, as in New York, commercial shad landings have shown two major peaks, one at the turn of the century and one in the 1940s (Fig. 15). The decline from about 1900 to the 1920s was caused by overfishing, water pollution, and construction of dams, but overfishing was believed to be the principal cause (U.S. Fish and Wildlife Service 1945). The increase which began about 1935 and reached a peak in the 1940s, in New York as well as in New Jersey, was caused by the management program in the Hudson River, which, by reducing fishing effort, allowed more fish to reach the spawning grounds. In part, the second peak was generated by the second world war, when regulations were relaxed to increase the supply of protein. A similar maximum in the 1940s shows in Connecticut shad landings also. The subsequent drop in

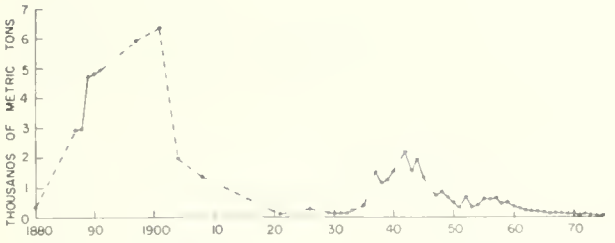


Figure 15.—Annual commercial landings of American shad in New Jersey 1880-1975.

catches probably was the result of overfishing during the war, as had been concluded for the New York fishery (Burdick 1954). But continued declines in catches of shad in New York waters apparently had economic rather than biological causes and this probably also was true for New Jersey. The condition of the shad resource of the Hudson River and the circumstances leading to the continued decline of the fishery in New York have been examined in detail by Medeiros (1975). In the Delaware Bay area, as in the Hudson River, fishermen say that shad prices reach their peak in the Philadelphia market before the Delaware River run begins. Low prices often force fishermen to stop fishing before the run hits its peak (Eugene LoVerde pers. commun.).

American shad has become a popular sport fish. Reported catches are about as large as commercial catches (Table 18). Commercial catches show substantial declines since 1960, but sport catch estimates are less revealing. Estimates for shad were not given in the 1960 sport fishing survey. Estimates for 1965 and 1970 show an increase in shad catches in the middle Atlantic region and a drop in the North Atlantic. But the combined figures suggest a relatively stable sport catch, which may mean that recreational fishermen are taking an increasing share of the total shad catch. Present concern about PCBs (polychlorinated biphenyls) in the Hudson River will affect recreational and commercial fisheries.

A foreign shad catch of 308 metric tons was reported in division 5Ze in 1973. Incidental catches are occasionally made by domestic trawlers operating close to shore.

Table 18.--Estimated commercial and recreational catches of American shad in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	North Atlantic region			Middle Atlantic region		
	Commercial		Recreational	Commercial		Recreational
Year	Me-NY incl.	NY only	Me-NY incl.	NJ-NC incl.	NJ only	NJ-NC incl.
1960	386	190	-	1,818	355	-
1961	386	138		2,059	287	
1962	324	110		2,340	218	
1963	239	92		1,984	201	
1964	209	64		2,159	195	
1965	233	60	656	2,663	178	1,476
1966	163	37		2,070	110	
1967	394	51		1,839	113	
1968	156	57		2,088	109	
1969	153	62		2,025	85	
1970	133	48	284	2,863	89	1,919
1971	64	33		1,480	46	
1972	119	47		1,701	119	
1973	65	(40)		1,601	65	
1974	(135)	(40)		1,038	55	
1975	(55)	(40)		(763)	55	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Recreational catches of shad were not recorded in 1960.

In 1973 a foreign catch of 308 metric tons of American shad was reported in subdivision 5Ze. No other foreign catches have been reported, but incidental catches are probable.

Shad landings for N.Y. are incomplete after 1972. It was assumed that about 40 metric tons were landed in each of the last three years.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

Weakfish

Cynoscion regalis (Bloch and Schneider) was a popular food fish in the early fishery. In the 1880s weakfish was taken in Upper New York Bay in fykes and gill nets, and was one of the principal species from May to November along the northern New Jersey seacoast and in Delaware Bay (Earll 1887). In New York waters weakfish was an important recreational as well as a commercial species in Long Island Sound (Mather 1887). At the eastern end of Long Island weakfish was said to be more abundant in the 1880s than the 1870s. It also was an important sport and commercial species along the south shore and at the western end of Long Island. Commercial landings in New Jersey apparently remained relatively high for more than 30 yr, beginning about 1897. The trend in commercial catches has been downward since about 1921 (Fig. 16), but the catch has been highly variable, as is characteristic of most fishes of coastal waters, and the three major dips in New Jersey landings, in 1926, 1933, and 1940, were followed rather quickly by major recoveries, although the general trend was downward. Perlmutter (1959) found that in the period 1930-49 weakfish on the average was the second most important food fish in commercial catches in the area from New York to Virginia. McHugh and Bailey (1957) showed that, over the period 1929 to 1946 inclusive, weakfish was more than three times as abundant in Virginia waters in 1936 as in 1933 and 1940, and that by 1946 abundance was less than one-seventh of the peak year 1936.

For nearly two decades no substantial recovery in abundance followed the low year 1950. In 1964 (LoVerde 1965) large numbers of young weakfish appeared off the southern New Jersey coast, and small weakfish, mostly too small to market, were abundant for the next few years. In 1969, this strong year class or year classes began to appear in the fishery, and commercial and recreational catches have been increasing more or less steadily in New Jersey and New York waters, as they have been in the Middle Atlantic Bight generally. Weakfish are said to have returned in abundance to Delaware Bay about 3 yr before abundance increased along the ocean coast of New Jersey (Paul Hamer pers. commun.), but this is reflected neither in commercial landings in

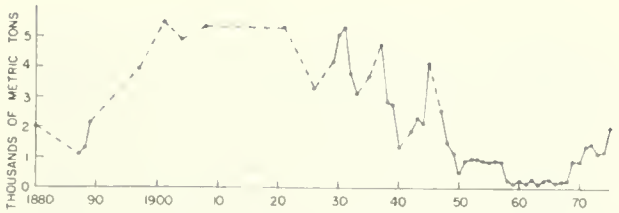


Figure 16.—Annual commercial landings of weakfish in New Jersey 1880-1975.

that State nor in landings for the entire middle Atlantic region (Table 19). According to Boone (1976) the recent increase in abundance of weakfish along the coast was caused by a strong year class born in 1969. He reported another dominant year class in 1975. As might be expected of a species of southern origin, weakfish landings in New York almost always have been substantially less than in New Jersey. Young weakfish recently have been taken in the Hudson River (W. L. Dovel pers. commun.).

Recreational catches of weakfish in the two statistical regions that meet at New York Bight have been estimated to exceed the commercial catch and the increase in sport catches has been relatively greater (Table 19). It is reasonable to conclude that recreational fishermen probably are taking an increasing share of the total catch and that the resource has increased in abundance recently from natural causes. Thus, the apparent downward trend in total abundance may not be real, and the decline in commercial catches probably has been offset by increased recreational catches. Nevertheless, it is clear that this resource fluctuates widely in abundance,

Table 19.--Estimated commercial and recreational catches of weakfish in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	North Atlantic region			Middle Atlantic region		
	Commercial		Recreational	Commercial		Recreational
Year	Me-NY incl.	NY only	Me-NY incl.	NJ-NC incl.	NJ only	NJ-NC incl.
1960	42	40	241	1,748	239	1,502
1961	25	24		1,965	190	
1962	27	22		2,102	295	
1963	40	39		1,558	151	
1964	26	25		1,997	247	
1965	35	33	205	2,282	271	822
1966	12	12		1,597	156	
1967	15	14		1,324	207	
1968	30	29		1,858	242	
1969	59	53		2,026	845	
1970	144	134	746	3,181	889	6,368
1971	671	580		4,390	1,398	
1972	868	830		6,298	1,442	
1973	657	575		6,685	1,162	
1974	884	647		5,669	1,218	
1975	(620)	620		(7,293)	1,982	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

and that declining catches in the 1950s and 1960s represented a real decline in abundance. Two things suggest, this and lack of effective management measures suggest that the present period of abundance probably will be temporary.

Weakfish, a coastal species, migrates north and south but does not move far offshore. There is no record of foreign catches.

Eels

Two species of eel have been taken in the commercial fisheries of New York and New Jersey, American eel, *Anguilla rostrata* (Lesueur), caught mostly in pots or traps in estuaries, and conger eel, *Conger oceanicus* (Mitchill). Conger eel is taken incidentally in otter trawls fishing for other species, and a few are caught in pots.

American eel was not mentioned by Earll (1887) as important along the northern New Jersey coast, but in the southern region of New Jersey the species was caught in pots, and also in winter with spears. In New York (Mather 1887) American eel was one of the most important commercial species in bays along the south shore and western end of Long Island, and in New York Harbor. American eel also was taken along the north shore of Long Island. It is obvious that American eel was much more important in the fisheries of the 1880s than it is today.

American eel is the more important species in weight landed. Catches of this species in New York have fluctuated considerably and the trend has been slightly downward since landings by species were first recorded in 1935 (Fig. 17). However, recorded catches of eels, probably mostly American eel, were considerably higher in the period 1887 to 1891 inclusive, with an average annual reported catch of about 677 metric tons. Trends and levels of catch have been about the same in New Jersey, but landings in that State increased in the 1960s (Fig. 18). Landings of conger eel in both states have dropped to insignificant levels since the 1940s.

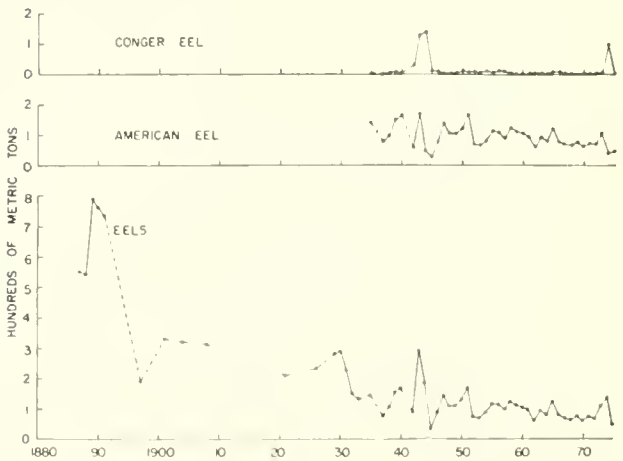


Figure 17.—Annual commercial landings of American and conger eel in New York 1887-1975.

Except with certain ethnic groups, eel is not a popular seafood in the United States. The resource in the New York Bight area probably is underexploited. Some enterprising fishermen have discovered markets for eel in Europe (Anon. 1972) and this probably accounts for recent rises in landings in both states. Potential markets also exist in Japan (Folsom 1973).

Substantial catches of American eel have been reported in the saltwater sport fisheries (Table 20). The estimated catch is substantially larger in the north Atlantic region than the middle Atlantic. Recently, considerable quantities of small American eel have been sold as live bait in New Jersey (Paul Hamer pers. commun.).

American eel has not been reported in foreign catches in the Middle Atlantic Bight, but conger eel is taken.

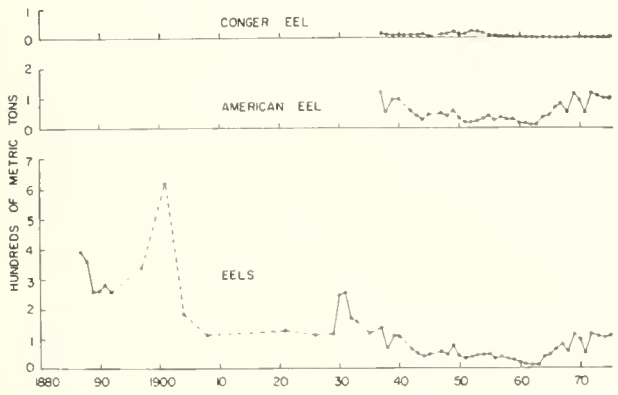


Figure 18.—Annual commercial landings of American and conger eel in New Jersey 1887-1975.

Table 20.--Estimated commercial and recreational catches of American eel in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	North Atlantic region			Middle Atlantic region		
	Commercial		Recreational	Commercial		Recreational
Year	Me-NY incl.	NY only	Me-NY incl.	NJ-NC incl.	NJ only	NJ-NC incl.
1960	164	104	675	227	19	232
1961	149	97		217	14	
1962	108	59		182	10	
1963	145	92		295	11	
1964	122	79		292	122	
1965	170	120	1,494	501	42	354
1966	129	77		418	65	
1967	131	67		543	80	
1968	169	64		523	53	
1969	149	76		628	113	
1970	148	61	1,436	806	94	336
1971	173	73		828	47	
1972	126	67		502	119	
1973	99	50		391	105	
1974	101	42		1,057	98	
1975	(132)	44		(909)	100	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

White Perch

White perch, *Morone americana* (Gmelin), a close relative of striped bass, is anadromous. Unlike striped bass, which makes extensive coastal migrations after it has reached an age of about 2 yr, white perch does not migrate far from its home stream. The species was mentioned by Mather (1887) as being caught in bays along the south shore of Long Island. It apparently was not an important commercial species in the New York Bight area in the 1880s, but white perch undoubtedly was taken by recreational fishermen. Commercial landings apparently were greatest about the turn of the century (Fig. 19), but the catch then fell off to much lower levels. Since the middle 1930s, however, the catch has fluctuated between 20 and 110 metric tons, interrupted periodically by declines of short duration, as can be expected of an estuarine species. In the 1960s most of the catch in New Jersey was taken in haul seines, gill nets, fykes, and hoop nets; and most of it was landed, and presumably caught, in counties bordering on the ocean coast.

Commercial landings of white perch in New York were apparently considerably smaller than in New Jersey until about the middle 1930s (Fig. 19). Since that time landings in both states have been relatively small, New Jersey landings on the average exceeding those in New York somewhat, as would be expected of a species which has its center of distribution to the south (Table 21).

Recreational catches of white perch have been much larger in the middle Atlantic than the north Atlantic

Table 21.--Estimated commercial and recreational catches of white perch in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	North Atlantic region			Middle Atlantic region		
	Commercial		Recreational	Commercial		Recreational
Year	Me-NY incl.	NY only	Me-NY incl.	NJ-NC incl.	NJ only	NJ-NC incl.
1960	10	8	386	826	26	2,984
1961	10	7		996	34	
1962	23	6		1,310	44	
1963	47	12		933	29	
1964	82	62		614	36	
1965	38	17	64	970	42	4,652
1966	40	28		1,355	71	
1967	43	37		1,006	54	
1968	46	39		1,211	72	
1969	46	30		1,366	41	
1970	98	75	15	1,011	35	5,712
1971	77	48		1,079	11	
1972	61	25		783	48	
1973	56	47		596	64	
1974	98	58		500	46	
1975	(44)	37		(528)	50	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

In 1970 recreational catches of white perch were included in the general category "perches."

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

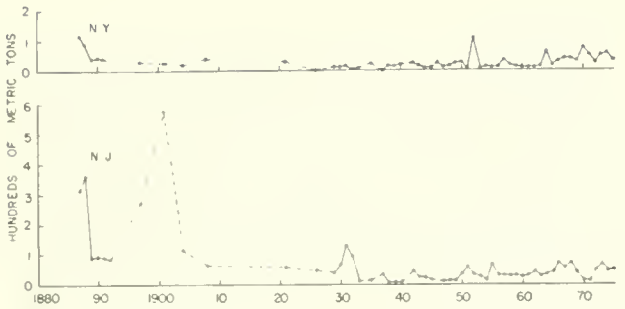


Figure 19.—Annual commercial landings of white perch in New York and New Jersey 1887-1975.

area. The northern limit of the species range is about Cape Cod. In the middle Atlantic area, sport catches, like commercial catches, apparently have been increasing since 1960 (Table 21).

No foreign catches of white perch have been reported, although occasional small catches have been reported in the domestic trawl fishery. These catches almost certainly were made close to shore.

Haddock

New Jersey and New York are south of the normal region of major abundance of haddock, *Melanogrammus aeglefinus* (Linnaeus), although the species does straggle as far south as Cape Hatteras in deep water and can be taken off New York and New Jersey in winter. Haddock was not mentioned by Earll (1887) or Mather (1887) as a component of the fisheries in the 1880s. Maximum landings reported in New Jersey were about 100 metric tons in 1901 and landings have been very small or zero for the last 65 yr (Fig. 20). Landings of haddock have never been high in New York relative to New England landings, but have been much higher than New Jersey. The maximum recorded for New York was 7,727 metric tons in 1926. New York landings were relatively high in the 1920s, low in the early 1930s, and high from 1938 to 1946 (McHugh 1972a). Smith (1915) mentioned South Channel (between Georges Bank and Nantucket Shoals) as an important fishing ground for haddock early in the 20th century. Royce et al. (1959) posulated an abundance of haddock on Nantucket Shoals in the late 1920s, and this coincides with peak haddock landings in New York State. In the early 1930s haddock on Nantucket Shoals retreated to Georges Bank, and this was thought to be associated with warming of northwest Atlantic waters in the first half of the present century (Taylor et al. 1957). It is possible that early landings in New Jersey represented an extreme southward extension of the range of the species when coastal waters were on the average cooler. The brief peak of landings at the turn of the century probably was taken in a handline or setline fishery offshore in winter, primarily directed at Atlantic cod. Most, if not all, of New York landings probably came from Nantucket Shoals and South Channel.

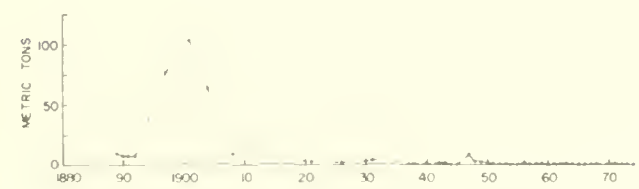


Figure 20.—Annual commercial landings of haddock in New Jersey 1889-1975.

Haddock has been a relatively important sport fish in the north Atlantic region, especially in the middle 1960s when the species was particularly abundant (Table 22). It was not sufficiently important from New Jersey south to warrant separate listing in the national surveys of saltwater sport fishing.

Haddock has been one of the most important species in the New England trawl fishery and ICNAF has paid special attention to this species. Strong year classes of 1962 and 1963 on Georges Bank provided initial impetus for movement of foreign fleets to Georges Bank and southward. This quickly led to overfishing of the haddock resource, and the catch is now stringently regulated by quota. The total allowable catch in ICNAF subareas 5 and 6 for 1976 has been set at 6,000 metric tons.

Table 22.--Estimated commercial and recreational catches of haddock in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	37	*	53,841	*	766	-		77	
1961	27	*	60,600	*				133	
1962	37	-	60,895	-				4,595	
1963	40	1	56,232	1				10,696	
1964	21	*	60,555	*				17,574	
1965	6	*	60,733	*	9,694	-		97,539	
1966	10	1	60,005	1				68,356	107
1967	12	*	44,664	*				16,730	-
1968	6	*	32,043	*			430	14,619	42
1969	9	-	20,788	-			14	5,707	-
1970	3	*	12,196	*	1,147	-	5	2,880	-
1971	7	*	9,779	*			123	3,404	-
1972	-	-	5,328	-			11	1,853	-
1973	*	1	3,768	1			28	2,526	-
1974	-	*	3,731	*			145	1,749	2
1975	*	-	(7,330)	-			-	1,424	-

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Foreign catches for 1975 are provisional. The total ICNAF 1976 quota for haddock in subareas 5 and 6 was 6,000 metric tons.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

* Less than 0.5 metric ton.

Atlantic Cod

New Jersey, like New York, is near the southern limit

of the range of Atlantic cod, *Gadus morhua* Linnaeus, and domestic commercial catches have been relatively small and variable (Fig. 21).

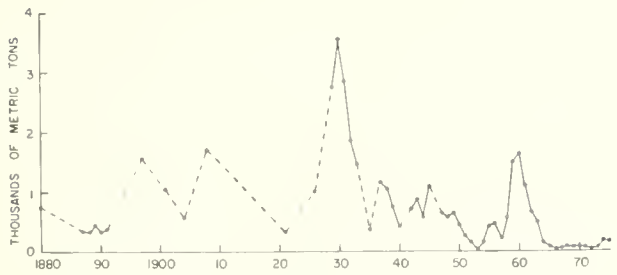


Figure 21.—Annual commercial landings of Atlantic cod in New Jersey 1880-1975.

In the 1880s in New Jersey a small winter cod fishery operated within 6 miles of shore, using handlines and longlines (Earll 1887). This fishery probably was responsible for the brief peak in haddock landings in the late 1800s and early 1900s. New York also had an offshore winter cod fishery in the 1800s (Mather 1887). At this time New York City was already a major point of landing for fish and shellfish from as far away as New England. Atlantic cod was the major species at 9.25 million pounds (about 4,000 metric tons).

Most of the Atlantic cod catch is taken from November to March inclusive, and little or nothing the rest of the year. The trend of landings has been down since 1930, although there was a brief upsurge in the late 1950s and early 1960s as cod showed up in greater abundance in local waters. Landings in New York are made throughout the year, although most of the catch is taken in winter. An extensive review of the cod fisheries and life history of the species has been published by Jensen (1972).

Estimates of recreational catches of cod have been of the same order of magnitude as domestic commercial catches (Table 23) in the north Atlantic and the middle Atlantic regions. In New York Bight the sport fishery for cod is largely a winter fishery (Buchanan 1972; Jensen 1974), although catches also are made in spring and fall.

Foreign catches of cod reached a maximum in ICNAF division 5Z in 1966 and subsequently have fallen off to about 25% of the 1966 level (Table 23). Catches in subarea 6, like domestic commercial and recreational catches, have been relatively small. In the New York Bight area, the cod catch appears to be shared about equally by domestic commercial fishermen, sport fishermen, and foreign fishermen. The total allowable catch in ICNAF subareas 5 and 6 for 1976 has been set at 43,000 metric tons.

Table 23.--Estimated commercial and recreational catches of Atlantic cod in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	453	1,613	16,444	1,872	11,426	2,590		19	
1961	529	1,091	19,657	1,477				278	
1962	467	673	20,400	878				7,849	
1963	400	502	18,499	632				13,049	
1964	234	128	17,405	171				12,840	
1965	166	75	16,253	99	13,144	421		26,923	
1966	112	7	17,027	18				41,069	75
1967	207	24	20,106	33				23,592	3
1968	165	78	22,209	116			454	27,334	74
1969	204	56	26,009	74			627	20,296	248
1970	172	85	24,054	89	16,188	104	235	10,439	179
1971	194	62	24,517	26			1,148	10,600	103
1972	107	19	20,956	22			1,146	10,344	163
1973	151	39	22,717	40			1,715	10,892	114
1974	210	153	26,272	156			673	8,149	132
1975	195	140	(24,500)	(147)			151	8,610	222

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Foreign catches for 1975 are provisional. The total ICNAF 1976 quota for Atlantic cod in subareas 5 and 6 was 43,000 metric tons.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

Atlantic Croaker

In the New York Bight area croaker, *Micropogon undulatus* (Linnaeus), is near the northern limit of its geographic range. In New Jersey (Fig. 22) the species was recorded in commercial catches from 1897 to 1975, but the period of major landings was from the middle 1930s to mid-1940s. The annual weight landed during this period was more than 10 times the New York catch. Commercial landings have been reported in New York only for the period 1926-46 inclusive (Fig. 23) plus a small catch in 1973, with peaks at about 150 metric tons in 1929 and 1930 and 183 metric tons in 1940. In Vir-

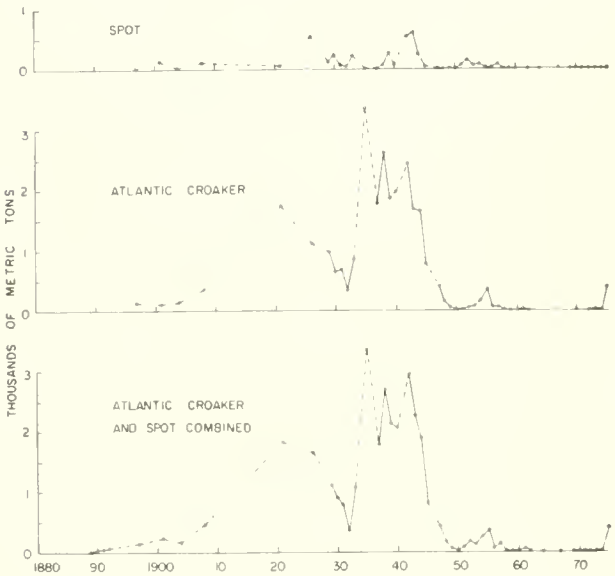


Figure 22.—Annual commercial landings of Atlantic croaker and spot in New Jersey 1889-1975.

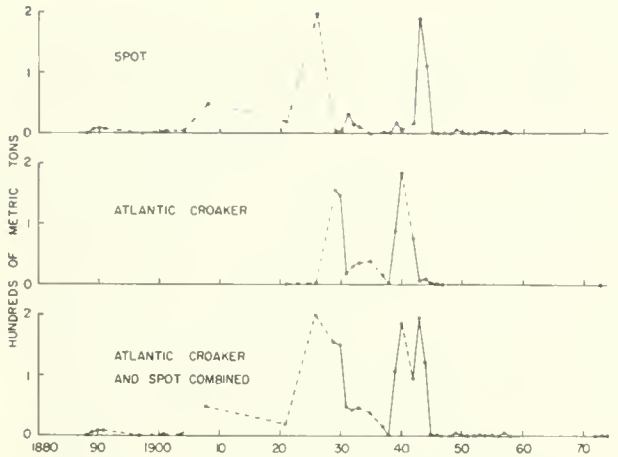


Figure 23.—Annual commercial landings of Atlantic croaker and spot in New York 1888-1975.

ginia, where croaker once was extremely abundant, relative abundance was lowest in 1931, highest in 1939 and 1943, and had dropped virtually to zero by 1945 (McHugh and Bailey 1957). This undoubtedly was a period of unusual abundance of croaker, and a period of heavy exploitation also (Perlmutter 1959), which may account at least partially for the sharp drop in landings after World War II. Croaker also are notoriously variable in abundance, and the magnitude of such fluctuations would be expected to be greatest at the extremes of the geographic range. Recent rising commercial catches in New Jersey and an isolated landing in 1973 in New York, the first reported since 1946, are suggestive of local increases in abundance. In Maryland phenomenally successful croaker spawnings have been reported in 1974 and 1975 (Boone 1976), after two decades of virtual spawning failures. This may presage continued improvement in local catches of croaker.

Atlantic croaker was mentioned neither by Earll (1887) nor by Mather (1887) as a species taken in New Jersey and New York fisheries in the 1880s. The desirability of croaker as a food fish was not recognized widely at that time. Either circumstance, temporary low abundance, or lack of demand could account for the apparent absence of Atlantic croaker from the New York Bight area at that time.

According to the national saltwater angling surveys the recreational catch of Atlantic croaker now is considerably larger than the commercial (Table 24). This catch plus attrition from incidental catches in various commercial gears may be responsible for continued small commercial landings.

Croaker is essentially a species of shallow coastal waters. June and Reintjes (1957) found that it was the fifth most important species in weight landed in the inshore otter trawl fishery off Delaware Bay in the period 1946-53, but it ranked only 11th in the offshore fishery. The inshore fishery operates within the 15-fathom (28 m) curve, the offshore fishery out to the edge of the continental shelf. The species has not been recorded in foreign catches but it is possible that small incidental catches could be made.

Table 24.--Estimated commercial and recreational catches of Atlantic croaker in the middle Atlantic region of the United States coast 1960-1975. Weights in metric tons.

Year	Commercial NJ-NC incl.	Commercial NJ only	Recreational NJ-NC incl.
1960	3,002	4	3,352
1961	2,242	26	
1962	1,348	2	
1963	1,089	-	
1964	1,026	-	
1965	1,491	-	2,152
1966	1,239	-	
1967	729	-	
1968	548	-	
1969	649	-	
1970	424	*	1,737
1971	551	-	
1972	2,084	*	
1973	2,611	17	
1974	3,510	20	
1975	(7,483)	401	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

The only catch of Atlantic croaker reported in New York in this period was a commercial catch of less than one metric ton in 1973.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

* Less than 0.5 metric ton.

Spot

Spot, *Leiostomus xanthurus* Lacépède, does not extend as far south as Atlantic croaker. Earll (1887) mentioned spot as important off the southern part of New Jersey in the 1880s, but not in the north. The species was not mentioned in Mather's (1887) account of New York fisheries. In New Jersey spot went by the quaint name "Cape May Goodies."

Landings of spot in New Jersey have been much smaller than croaker landings. The maximum recorded catch was about 600 metric tons in 1943 (Fig. 22). The species also is variable in abundance, but the magnitude of fluctuations in landings has been somewhat less than for croaker, and fewer years of no landings have been recorded. A slight increase in commercial landings in New Jersey in 1975 is suggestive of increased abundance.

In New York spot have appeared in commercial landings for more years than croaker and maximum landings have been somewhat greater, 198 metric tons in 1926 and 190 in 1943 (Fig. 23). Spot have not been reported in commercial landings in New York since 1957. Boone (1976) reported that abundance of young-of-the-year spot in Chesapeake Bay in 1975 was the greatest on

record, but that a massive winter kill may have reduced this dominant year class drastically.

This is an important recreational species in the middle Atlantic region (Table 25). The reported catch in 1970 was nearly 10,000 metric tons, considerably greater than any commercial catch on record.

Table 25.--Estimated commercial and recreational catches of spot in the middle Atlantic region of the United States coast 1960-1975. Weights in metric tons.

Year	Commercial		Recreational
	NJ-NC incl.	NJ only	NJ-NC incl.
1960	3,190	*	3,225
1961	1,474	-	
1962	1,631	*	
1963	1,091	-	
1964	2,033	*	
1965	1,209	-	2,214
1966	1,020	-	
1967	3,402	*	
1968	1,242	-	
1969	1,163	3	
1970	3,618	*	9,785
1971	778	1	
1972	3,139	*	
1973	7,989	4	
1974	3,586	5	
1975	(4,703)	27	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

No domestic commercial or recreational catches of spot were reported north of New Jersey from 1960 to 1975 inclusive. Unreported catches are possible.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

* Less than 0.5 metric ton.

Spot favor even shallower waters than croaker. The species was a minor component of inshore otter trawl catches off Delaware Bay from 1946 to 1953 inclusive (June and Reintjes 1957) but was not reported in offshore catches. It is not likely to be taken by foreign fishermen.

Although it is subject to much the same environmental stresses and fishing pressures as croaker, spot has shown no downward trend in abundance in the Middle Atlantic Bight as a whole, as croaker and many other coastal species have. Commercial landings have declined in New Jersey and New York and this apparently has not been balanced by increased sport catches, although in the middle Atlantic region the recreational catch was up sharply in 1970 (Table 24). Why spot has survived stresses in some areas that have driven many other species with similar habits to historically low levels of abundance is unknown.

Butterfish

The pattern of butterfish, *Peprilus triacanthus* (Peck)

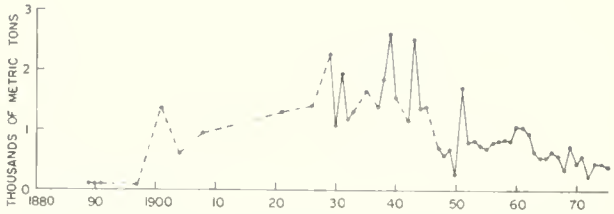


Figure 24.—Annual commercial landings of butterfish in New Jersey 1889-1975.

landings in New Jersey (Fig. 24) has been similar to that for New York (McHugh 1972a). Neither Earll (1887) nor Mather (1887) mentioned the species as occurring in New York Bight catches in the 1880s. A maximum was reached about 1940 in both states at levels of about 2,500 metric tons each. Landings dropped to a minimum about 1950, rose sharply immediately thereafter, and have trended downward ever since. Peaks in 1951 in New Jersey and in 1952 in New York were produced almost entirely by increased catches in otter trawls. This suggests that a relatively strong year class moved up the coast farther offshore than usual and that it reached New York waters a year later than New Jersey. This might have been a wave of older fish from a strong southern contingent. Colton (1972) reported that coastal water temperatures were higher than average at that time. He also concluded that butterfish respond to temperature change by shifting their range north or south.

Most butterfish landed in New Jersey are caught in otter trawls. In the period 1946 to 1953 inclusive June

Table 26.--Estimated commercial catches of butterfish in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

Year	Domestic commercial catch				ICNAF Foreign catch		
	NY	NJ	Me-NY incl.	NJ-NC incl.	5Z$_w$	5Z$_e$	6
1960	834	1,063	3,315	1,671			
1961	764	1,070	2,652	1,987			
1962	730	958	3,533	1,794			
1963	523	626	3,248	1,366	1,779		111
1964	484	539	1,785	1,164	169		316
1965	348	536	1,013	2,097	732		17
1966	269	669	806	1,882	3,865		-
1967	508	595	1,125	1,293	1,407		908
1968	442	330	930	703	948	648	3,513
1969	346	754	924	1,332	8,813	702	3,623
1970	237	441	563	1,229	1,203	916	6,906
1971	160	565	694	898	655	612	4,906
1972	187	224	365	380	556	1,298	3,720
1973	303	468	956	578	3,027	3,576	11,213
1974	362	444	1,243	1,453	3,192	3,006	4,087
1975	562	388	(1,438)	(521)	1,854	1,514	4,968

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of butterfish.

Foreign catches for 1975 are provisional. This species is included with the second tier quota for 1976.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

and Reintjes (1957) found that the species was more important in the offshore trawl fishery off Delaware Bay than inshore. Although butterfish will bite on small hooks, there is no significant recreational catch.

Butterfish is a semipelagic species not readily available to conventional gears like otter trawls, pound nets, or other gears traditionally used by U.S. fishermen. Edwards (1968) estimated that only about 3% of the standing crop was being harvested in the period 1963-65. Thus, declines in landings in New Jersey and New York up to that time could not have been caused by overfishing. From 1964 on, however, foreign catches in ICNAF subareas 5 and 6 have increased (Table 26), and it is possible that the resource is now fully utilized (R. L. Edwards pers. commun). Foreign catches in the early and middle 1960s probably were substantially larger than reported, for it is known that butterfish were discarded in some quantities by some vessels. Foreign fleets now take substantially larger quantities than the domestic fishery. Like scup, red and silver hake, and other species, butterfish is particularly vulnerable to fishing in winter and early spring at the edge of the continental shelf.

Blue Crab

Blue crab, *Callinectes sapidus* Rathbun, was abundant in coastal waters of the New York Bight area in the 1880s (Earll 1887; Mather 1887). The species supported commercial, subsistence, and recreational fisheries in most bays along the coasts of New Jersey and New York. It apparently was scarce at that time in some bays along the north shore of Long Island, but abundant in others, such as Huntington Bay. Blue crab also was abundant in New York harbor, but even in those days, nearly a century ago, fishermen described a coating of "coal tar" on the water and complained of oily flavors of blue crab and some fishes. Possibly for this reason, no commercial blue crab fishing was conducted in that area (Mather 1887).

Blue crab ranges along the east coast of North America from Nova Scotia to Texas in the Gulf of Mexico, and supports or has supported fisheries from southern New England to Texas. Chesapeake Bay has traditionally been the center of commercial production and landings north of Maryland have been relatively small and variable. Maximum commercial landings reported for New Jersey were slightly over 2,000 metric tons in 1939, but this was unusual, and since 1940 New Jersey landings have fluctuated about a level less than 500 metric tons and dropped to a low of less than 100 metric tons in 1968 (Fig. 25). Recently, however, various observers have noted increased abundance of blue crab from Delaware to Connecticut inclusive. This has been reflected in a sharp increase in commercial landings in New Jersey, from a low point of 61 metric tons in 1968 to 1,319 metric tons in 1975 (Table 27); this is the second largest commercial catch on record for the State.

Although it is eagerly sought by recreational crabbers wherever it is abundant, and sport catches probably are substantial, blue crab usually has been ignored in salt-

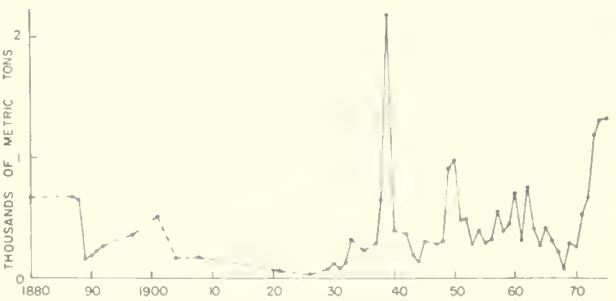


Figure 25.—Annual commercial landings of blue crab in New Jersey 1880-1975.

Table 27.--Estimated commercial landings of blue crab in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

Year	North Atlantic region		Middle Atlantic region	
	Me-NY incl.	NY only	NJ-NC incl.	NJ only
1960	2	*	40,571	703
1961	2	*	41,909	319
1962	1	-	46,476	753
1963	*	-	39,221	406
1964	*	-	47,022	263
1965	*	-	50,078	426
1966	-	-	53,214	313
1967	-	-	44,421	213
1968	-	-	34,296	61
1969	-	-	38,225	286
1970	*	-	41,810	253
1971	*	-	42,095	530
1972	-	-	41,734	658
1973	-	-	33,145	1,177
1974	1	1	39,252	1,302
1975	-	-	(34,450)	1,319

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of invertebrates.

Unrecorded commercial catches of blue crab were made in New York in 1975 (see text).

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

* Less than 0.5 metric ton.

water sport fishing surveys. Levenson (1971) found that blue crab was important in recreational fisheries of Hempstead Bay, Long Island. In numbers caught, blue crab ranked fifth in importance from 1966 to 1968 inclusive, exceeded only by winter and summer flounder, bluefish, and northern puffer. This was a period of low abundance in the New York Bight area, if commercial landings are a valid criterion (Table 27).

As already mentioned, Earll (1887) noted the recreational importance of blue crab in New Jersey coastal bays. Some idea of the intensive effort directed toward catching this resource is given by the statement that some 600,000 to 700,000 recreational crabbers over 18 yr operate in New Jersey tidal waters (Paul Hamer pers. commun.). Lane and Carlson (1968) observed that blue crab had not been of commercial importance in Connecticut waters since the 1930s, and linked the decline and

recent recovery of crab stocks with the decline and recent recovery of eelgrass beds.

Blue crab is an estuarine and coastal species, not caught far from shore north of Cape Hatteras. It is not reported in foreign catches and is not likely to be taken by foreign fleets in the Middle Atlantic Bight.

It is interesting to speculate on the reasons for the recent increase in abundance of blue crab in the New York Bight area. It has increased in abundance in coastal bays of New York State in the last few years, and in 1974 a small commercial catch was reported for the first year since 1961. Commercial catches were made in 1975 also, although none was recorded in official statistics. In Great South Bay, for example, clam rakers at times took substantial incidental blue crab catches, as much as 10-12 bushels per day (John MacNamara pers. commun.). Blue crab is notoriously variable in abundance in Chesapeake Bay, which produces most of the Atlantic coast catch, and it would be expected to be even more variable at the northern end of its geographic range. In Chesapeake Bay, despite wide variations in abundance from time to time, the trend of landings has been upward since 1890 (McHugh 1969b). It has been suggested that this has been the result of a real increase in abundance which might have been caused by increased nutrient supply in the estuaries. In the Middle Atlantic region, commercial landings showed a similar upward trend from 1931 to the 1950s, with much wider fluctuations, presumably of natural origin, but this was followed by a sharp and fairly steady decline from 1957 to a very low level in 1970 (McHugh 1972a). It was suggested that if the early rise were indeed stimulated by nutrient enrichment, the sharp decline in the late 1950s and the 1960s in this more densely populated section of the coast could contain a warning. Under no circumstances could a continued increase in nutrients be expected to present favorable conditions to the blue crab resource indefinitely, and the danger is heightened by the growing loads of industrial wastes, including heavy metals and pesticides, that go along with increased population. Crabs, being much more closely related morphologically and physiologically to insects than fishes are, can be expected to respond more readily to certain insecticides (Butler 1966). The unanswered question then arises: Is the recent sharp increase in abundance of blue crab in the New York Bight area a transitory phenomenon, or has the ban on DDT and other organophosphates had some effect?

Atlantic Bonito

In New Jersey and New York Atlantic bonito, *Sarda sarda* (Bloch), has been taken almost entirely by pound nets. In common with other highly mobile pelagic fishes of the high seas it is caught erratically in fixed coastal gears (Fig. 26). The sharp decline in landings after the second world war probably was related mainly to the decline of the ocean pound net fishery. Landings in New York have shown generally the same pattern of fluctuations but the catch usually has been less than in New Jersey.

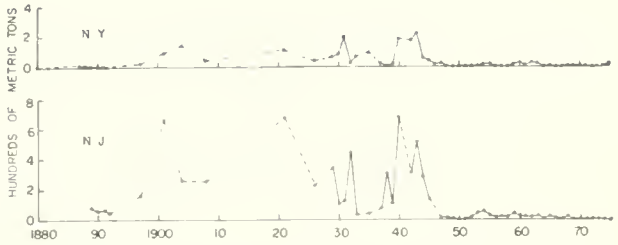


Figure 26.—Annual commercial landings of Atlantic bonito in New York and New Jersey 1880-1975.

Recreational catches of bonito usually have been larger than commercial catches, sometimes by an order of magnitude, but sport catches also have been highly variable (Table 28).

Table 28.--Estimated commercial and recreational catches of Atlantic bonito in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	North Atlantic region			Middle Atlantic region		
	Commercial		Recreational	Commercial		Recreational
Year	Me-NY incl.	NY only	Me-NY incl.	NJ-NC incl.	NJ only	NJ-NC incl.
1960	53	29	327	27	20	468
1961	33	12		29	19	
1962	62	30		13	10	
1963	68	18		28	25	
1964	20	3		9	3	
1965	43	6		39	23	37
1966	5	1		9	8	
1967	13	3		5	4	
1968	22	12		16	15	
1969	92	8		1	1	
1970	63	7		2	*	128
1971	29	3		*	*	
1972	18	1		1	*	
1973	33	2		2	*	
1974	44	3		1	1	
1975	(74)	17		(1)	1	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

* Less than 0.5 metric ton.

The species has not been reported separately in foreign catches in the Middle Atlantic Bight, and it can be concluded that it is not an important species in those fisheries. In the Atlantic Ocean and Mediterranean Sea, the average annual catch of bonito in the period 1963 to 1972 inclusive has been about 10,260 metric tons (Miyake et al. 1973).

Spanish Mackerel

Scomberomorus maculatus (Mitchill), Spanish mackerel, is primarily a southern fish. In the 1880s (Mather 1887) it was taken in the ocean off the eastern end and

south shore of Long Island, but although described as once plentiful, was scarce by 1880. Earll (1887) did not mention catches off New Jersey. The major commercial fishery is south of Cape Hatteras. Spanish mackerel, a schooling fish, makes annual migrations northward in summer. Modest commercial landings have been reported in New Jersey and New York, and as might be expected of a species of southern origin these landings were usually higher in New Jersey. Maximum recorded landings in New Jersey were about 107 metric tons in 1931, and 35 metric tons in New York in 1890. Since the middle 1940s catches in both states have been negligible. Since 1960 maximum landings in the middle Atlantic region (N.J. to N.C. inclusive) were 120 metric tons in 1970, less than 1 ton of which was reported from New Jersey.

Spanish mackerel is a popular sport fish where it is abundant. Reported recreational catches in the middle Atlantic region were 429 metric tons in 1970 and 76 tons in 1965. Commercial catches in the same area in the same years were 120 and 87 metric tons respectively.

This is a coastal species, unlikely to be taken by foreign fishermen. The life history is not well understood. Fluctuations in landings suggest that the species varies widely in abundance or availability, or both.

Northern Kingfish

Menticirrhus saxatilis (Bloch and Schneider), northern kingfish, is more important in the New York Bight area as a recreational than as a commercial species (Table 29). Maximum commercial landings in New Jersey were about 70 metric tons in 1939, and in New York about 35 metric tons in 1940. It is caught mostly by trawls fishing near shore and by pound nets.

In the sport fishery in the surf along the south shore of Long Island, Briggs (1962) found that northern kingfish was the dominant species from 1956 to 1960. According to later studies (Briggs 1965, 1968), it had become somewhat less abundant in New York waters. The species is a seasonal visitor, arriving in New York Bight in spring and leaving in fall. Like many seasonal migrants from the south its local abundance is highly variable (Fig. 27). This variability was noted also by Mather (1887) who described northern kingfish as less abundant in New York waters in 1880 than formerly.

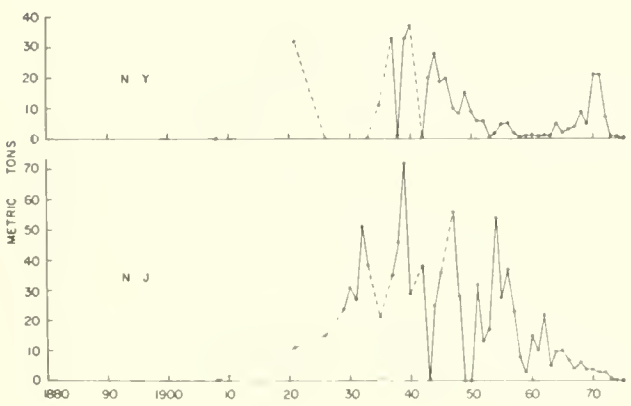


Figure 27.—Annual commercial landings of northern kingfish in New York and New Jersey 1908-1975.

Table 29.--Estimated commercial and recreational catches of northern kingfish in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	North Atlantic region			Middle Atlantic region		
	Commercial		Recreational	Commercial		Recreational
Year	Me-NY incl.	NY only	Me-NY incl.	NJ-NC incl.	NJ only	NJ-NC incl.
1960	1	1	363	470	15	713
1961	2	1		776	10	
1962	2	1		670	22	
1963	1	1		531	5	
1964	5	5		565	10	
1965	3	2	108	653	10	606
1966	4	3		379	7	
1967	4	4		397	4	
1968	10	9		335	6	
1969	6	5		405	4	
1970	22	21	1,568	306	4	1,090
1971	21	21		233	3	
1972	7	7		324	3	
1973	*	*		207	1	
1974	1	*		153	*	
1975	(*)	*		(109)	1	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

* Less than 0.5 metric ton.

In recreational fisheries along the New Jersey coast in 1952 and 1953 (June and Reintjes 1957), northern kingfish varied in importance. In numbers of fish caught it ranked about fifth in the surf fishery, fourth in the charter boat fishery, and sixth in the party boat fishery. In the surf fishery in Delaware in 1952 it ranked third.

No catches have been reported by foreign fleets. It is not likely that this shallow-water coastal species would be taken far out on the continental shelf. In the period 1946 to 1953 inclusive it was a minor species in the inshore trawl fishery off Delaware Bay but not listed in the offshore fishery (June and Reintjes 1957).

Atlantic Mackerel

The pattern of commercial mackerel, *Scomber scombrus* Linnaeus, landings in New Jersey (Fig. 28) has been similar to that in New York, with catches relatively large in the 1940s, very small in the 1950s and early 1960s, and increasing moderately in the last 10 yr. In most years, New Jersey landings have been substantially higher than New York. The sharp drop in the late 1940s was caused primarily by a sudden drop in abundance or availability (Hoy and Clark 1967). In the last few years, most of the New Jersey catch has been taken in otter trawls, most of the New York catch in pound nets. Increasing catches in the last decade, despite substantial declines in numbers

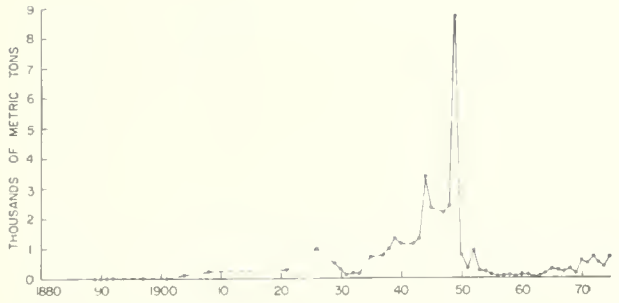


Figure 28.—Annual commercial landings of Atlantic mackerel in New Jersey 1889-1975.

of otter trawls and pound nets licensed in both states, reflect an increase in abundance of mackerel, as pointed out by Edwards (1968). Taylor et al. (1957) concluded that temperature was a major factor governing fluctuations in mackerel landings, but their argument is not very convincing. The domestic commercial fishery for mackerel is now relatively unimportant (Table 30) because demand is relatively poor. Despite the greater popularity of Atlantic mackerel as a food fish a century ago it was not mentioned by Earll (1887) or Mather (1887) as taken in the New York Bight area in the 1880s. New Jersey and New York combined presently receive 10-20% of total domestic commercial landings.

As would be expected from the known geographic distribution of Atlantic mackerel, sport catches are larger in the north Atlantic region (Table 30). The recent increase in abundance is reflected in recreational catches

Table 30.--Estimated commercial and recreational catches of Atlantic mackerel in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	64	79	1,079	317	4,581	377			
1961	36	114	1,068	298					
1962	38	10	863	78				111	
1963	36	46	1,192	83				843	293
1964	74	143	1,842	304				533	94
1965	41	294	1,475	489	8,168	417		2,487	53
1966	182	248	2,090	636				5,455	1,252
1967	163	182	3,356	509				12,691	6,295
1968	368	304	2,927	527			21,127	26,246	8,268
1969	223	134	3,781	260			38,742	25,259	43,176
1970	167	593	2,914	721	18,816	13,267	37,203	66,204	101,030
1971	228	444	1,831	504			38,592	64,621	231,491
1972	247	685	1,610	713			62,614	133,859	185,865
1973	147	524	1,276	539			159,201	155,006	65,153
1974	146	351	654	407			50,076	100,574	142,348
1975	162	679	(738)	(1,049)			46,998	119,109	82,611

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Foreign catches for 1975 are provisional. The total ICNAF 1976 quota for Atlantic mackerel in subareas 5 and 6 was 254,000 metric tons.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

in 1970, especially in the middle Atlantic region. Atlantic mackerel is important seasonally in certain ocean sport fisheries in New York Bight (Buchanan 1972). This increased resource now is being exploited very heavily, mostly by foreign fleets, and according to Grosslein et al. (1973, see footnote 7) may be overfished.

Hard Clam

Trends in hard clam, *Mercenaria mercenaria* (Linnaeus), landings in New Jersey have been similar in their major features to those in New York.

Hard clam was an important resource in most areas around the coasts of Long Island in the 1880s (Mather 1887) but apparently not in New Jersey, because the species was not mentioned by Earll (1887). Reported landings in both states were relatively high in the last two decades of the 19th century, dropped sharply and stayed relatively low until the 1930s, rose to maxima in the late 1940s and early 1950s, dropped sharply again, and subsequently rose in the 1960s (Fig. 29). In New Jersey the recent rise in landings reached a peak in 1967 and catches have been dropping since. In New York, landings began to drop after 1971, but 1975 was a record year. Experienced clam diggers on Great South Bay believe that clam abundance has decreased and that the resource is already overharvested. Total catches in New York have been holding up and were slightly higher in 1975 than in 1971, mainly because numbers of clammers have increased substantially (Table 31). In Rhode Island, once a major producer of hard clam, landings have declined to less than 20% of the maximum harvest of about 5 million pounds (2,300 metric tons) in 1955.

The sharp decline in New Jersey hard clam landings in the 1950s was caused at least in part by closing of certain polluted shellfish areas. The problem culminated in an outbreak of hepatitis in 1961, which affected the shellfish industry seriously through loss of public confidence (Dewling et al. 1972). The subsequent rise in the middle and late 1960s has been attributed to an improvement in public confidence and hence demand, increased abundance in some areas, depuration, and opening of some grounds previously closed by pollution.

Most hard clam production in New Jersey comes from

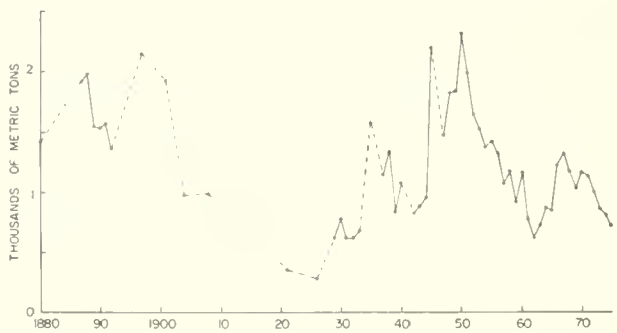


Figure 29.—Annual commercial landings of hard clam in New Jersey 1880-1975.

Table 31.--Estimated commercial landings of hard clam in the north and middle Atlantic regions of the United States coast 1960-1975. Weights of meats in metric tons.

Year	North Atlantic region		Middle Atlantic region	
	Me-NY incl.	NY only	NJ-NC incl.	NJ only
1960	4,052(28,773)	1,763(12,520)	2,405(17,075)	1,158(8,222)
1961	4,080(28,970)	1,946(13,819)	2,303(16,351)	765(5,434)
1962	3,882(27,559)	2,194(15,578)	1,831(13,003)	607(4,313)
1963	4,217(29,943)	2,409(17,103)	2,160(15,336)	718(5,101)
1964	4,083(28,992)	2,451(17,401)	2,428(17,238)	859(6,101)
1965	4,161(29,545)	2,698(19,153)	2,394(16,997)	849(6,030)
1966	4,424(31,411)	2,985(21,196)	2,361(16,762)	1,213(8,611)
1967	4,520(32,092)	3,205(22,757)	2,510(17,819)	1,306(9,272)
1968	4,353(30,908)	3,169(22,501)	2,391(16,975)	1,158(8,222)
1969	4,635(32,908)	3,409(24,204)	2,426(17,224)	1,027(7,293)
1970	4,778(33,922)	3,586(25,460)	2,188(15,535)	1,169(8,300)
1971	5,023(35,661)	3,878(27,531)	2,262(16,060)	1,112(7,895)
1972	4,435(31,489)	3,856(27,375)	1,852(13,151)	996(7,073)
1973	3,858(27,389)	3,287(23,338)	1,699(12,059)	859(6,101)
1974	4,081(28,975)	3,642(25,856)	1,641(11,651)	790(5,609)
1975	4,450(31,595)	3,932(27,914)	1,384(9,828)	735(5,218)

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of invertebrates. Recreational catches of hard clam probably are substantial.

Live weights are given in parentheses for comparability with ICNAF statistics.

the bays of the outer coast. In the early days, Raritan and Sandy Hook bays were important clamming grounds, but the entire area is now closed for shellfish harvesting except in Sandy Hook Bay and adjacent waters, where a special permit is needed. Since 1900, landings in New Jersey have been roughly half the volume produced in New York. In 1975 New Jersey produced only 735 metric tons of meats compared with 3,932 metric tons in New York.

Although both states, or local communities in these states, have sponsored programs to transplant clams from polluted to clean waters, management of the hard clam resource has been primarily negative management. That is, waters over shellfish beds are monitored to assess water quality, and grounds are closed when fecal coliform counts reach certain levels. There is reason to believe that commercial landings are underestimated, and in both states there are substantial unrecorded recreational and subsistence clam fisheries. Programs to assess the magnitude of standing crops, recruitment, and removals by natural mortality and harvesting are badly needed. Clams and other nonmigratory resources should be considered the most valuable living marine resources of a state because management of such resources does not require cooperation from adjacent states or other nations. If the state or local community desires to maintain the resource in healthy condition and to manage the harvest for maximum yield, it has the power to do so. This is not possible with migratory resources. Therefore, if management of living marine coastal resources is to succeed, coastal states like New Jersey and New York should demonstrate their good intentions, and establish model fishery management programs, by concentrating first on their valuable estuarine shellfish resources. The Town of Islip on Long Island, which shares with the State of New York control over some 22,000 acres of bottom in Great South Bay, recently has started such a research and management program. A cooperative program with adjacent towns also is under consideration. Several other towns on Long Island have shellfish management programs in various stages of development.

In Great South Bay, N.Y., and possibly also in the coastal bays of New Jersey, recent increases in abundance of blue crab may have reduced the supply of hard clam. Crabs, especially blue crab, are serious predators of clams, and this may account for indications of reduced recruitment of young clams in the past few years.

Soft Clam

In the 1880s soft clam, *Mya arenaria* Linnaeus, was abundant in most bays of the New Jersey coast and around Long Island (Earll 1887; Mather 1887). From past experience it was recognized that the resource was highly variable in abundance, as it is today. Except for the period prior to the beginning of the 20th century, trends in soft clam landings in New Jersey have been generally similar to those in New York except for 1947 and 1948, when landings rose sharply in New Jersey (Fig. 30). From a level below 100 metric tons of meats per year in the early part of the century landings rose in the 1930s and remained relatively high until the late 1940s, then dropped abuptly and have fluctuated about a very low level ever since (Table 32). In the 1930s and 1940s landings in both states rose well above the levels of the 1920s, then fell off in the 1950s to even lower levels.

New England has traditionally been the major producer of soft clam, but production there fell off after 1940 and this stimulated production in states farther south. However, neither in New Jersey nor New York have landings reached levels comparable to Maryland, where the fishery began in the 1950s, probably because Maryland has a much greater area of bottom suitable for this species, and also because Maryland allows more efficient harvesting methods. In face of the reduced supply in New England and continued demand for soft clam it is likely that continued attrition will hold the resouce in the New York Bight area at a relatively low level of abundance. Although there is no positive evidence one way or the other, it is possible that the resource has been over-

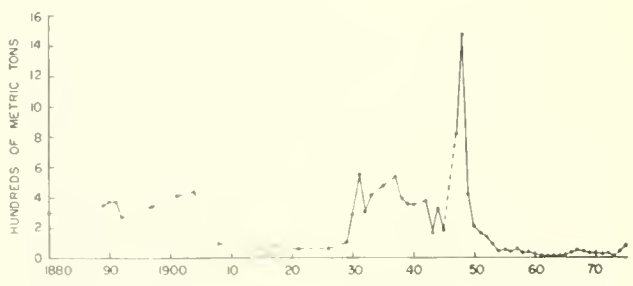


Figure 30.—Annual commercial landings of soft clam in New Jersey 1880-1975.

Table 32.--Estimated commercial landings of soft clam in the north and middle Atlantic regions of the United States coast 1960-1975. Weights of meats in metric tons.

Year	North Atlantic region		Middle Atlantic region	
	Me-NY incl.	NY only	NJ-NC incl.	NJ only
1960	1,345(5,244)	69(269)	2,547(9,941)	20(78)
1961	1,201(4,684)	65(253)	2,139(8,350)	10(39)
1962	1,183(4,614)	42(164)	3,078(12,016)	8(31)
1963	1,307(5,097)	45(175)	3,110(12,172)	7(27)
1964	1,290(5,031)	82(320)	3,713(14,492)	10(39)
1965	1,541(6,009)	93(363)	3,587(14,001)	15(58)
1966	2,012(7,848)	128(499)	3,394(13,248)	35(136)
1967	2,028(7,910)	120(468)	2,427(9,473)	49(191)
1968	2,130(8,308)	92(359)	2,574(10,046)	41(160)
1969	2,495(9,729)	87(339)	3,620(14,130)	32(125)
1970	2,997(11,690)	33(129)	2,853(11,138)	30(117)
1971	3,001(11,706)	70(273)	2,737(10,682)	21(82)
1972	2,844(11,093)	43(168)	912(3,561)	28(109)
1973	3,350(13,065)	47(183)	295(1,150)	8(31)
1974	2,751(10,729)	46(179)	846(3,299)	39(152)
1975	3,006(11,722)	28(111)	556(2,169)	77(299)

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of invertebrates.

Live weights are given in parentheses for comparability with ICNAF statistics.

harvested in the New York Bight area. Soft clam is known to be much more susceptible to the effects of water pollution than hard clam is, thus pollution also could be a cause. Even if the resource recovers in New England it may be difficult to compete against the less costly Maryland industry which permits harvesting with hydraulic dredges (Merrill and Tubiash 1970).

Chub Mackerel

Like several other active pelagic fishes of the high seas, chub mackerel, *Scomber japonicus* Houttuyn, appears infrequently and erratically in domestic commercial landings. Most of the catch is taken in pound nets, and landings in New Jersey have been somewhat greater than in New York. The period of greatest landings in both states (up to 600 metric tons in New Jersey) was in the early 1940s which appears to lend some credence to the relative accuracy of statistics for the two states. The actual catch probably is much larger than the recorded catch, because this species often is taken with Atlantic mackerel and reported as such.

In saltwater sport fishing surveys chub mackerel is not listed separately, but is included with Atlantic mackerel. It is assumed that the recreational catch of chub mackerel is not large. The species is not listed in ICNAF catches.

Frigate Mackerel

Frigate mackerel, *Auxis* spp.,[13] has never been a major commercial species in the New York Bight area. It is discussed here because, according to official statistics, it was recorded in commercial fishery landings only for a short period and because the record of landings is remarkably similar for New Jersey and New York. Maximum reported catches were about 75 metric tons in each state. Almost all the catch was taken in pound nets.

Frigate mackerel was first recorded in New Jersey landings in 1932 and in New York in 1931. The latest catches recorded were for 1951 in New Jersey and 1949 in New York. Catches in each state show three peaks, in the mid-1930s, early 1940s, and late 1940s. The species may have been included with unclassified food fishes prior to the 1930s.

Two possible explanations of the relatively brief appearance of frigate mackerel in New York Bight landings are suggested. Either the species was unusually abundant in the period from about 1932 to 1950, so that it spread beyond its usual geographic range, or oceanographic conditions during that period were such that this pelagic oceanic species came closer to shore than usual. Frigate mackerel also were recorded briefly in pound-net landings in Massachusetts and Rhode Island at about the same time. Arnold (1951) reported large numbers in the vicinity of Point Judith, R.I. in 1949, as well as other warm water species.

Frigate mackerel has not been listed in saltwater sport fish catches. The species is included in the ICNAF category "Other fish," but landings have not been reported separately. It is assumed that the foreign catch is negligible. The species was not listed by Bigelow and Schroeder (1953) or by Hildebrand and Schroeder (1928), which suggests that it is an infrequent visitor.

Scup

Scup, *Stenotomus chrysops* (Linnaeus), was not mentioned by Earll (1887) as an important species in the fisheries of New Jersey in the 1880s. However, it was listed by Mather (1887) as important at the two ends and along the south shore of Long Island. Mather noted that scup had decreased in abundance, but by 1880 was increasing again. Earll did mention sheepshead, *Archosargus probatocephalus* (Walbaum), a closely related species, as being caught off the coast of New Jersey. This species, once abundant enough off New York to have a bay named after it, now is scarce north of Cape Hatteras.

As in New York (McHugh 1972a), scup was the leading species by weight in New Jersey food fish landings for a considerable period. It ranked first by weight from 1948 to 1965 inclusive except for 2 yr: 1949, when an unusually large catch of Atlantic mackerel was made (Fig. 28) and mackerel ranked first; and 1956, when scup was less abundant for a period (Fig. 31). The reduction in abundance in the mid-1950s may not have been as great as the drop in commercial landings would make it appear. Fishermen may have turned in that period to the higher priced summer flounder, which at that time was temporarily abundant. Scup ranked first or second by weight of all food finfishes landed in New Jersey for 23 con-

[13] Probably *Auxis thazard* (Lacépède) and *A. rochei* (Risso).

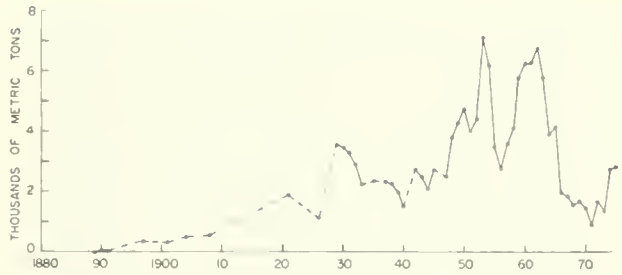


Figure 31.—Annual commercial landings of scup in New Jersey 1889-1975.

secutive years, 1948 to 1970 inclusive. In New York scup was first by weight for 19 yr, from 1948 to 1966 inclusive.

The recreational catch is substantial, especially along the coasts of New Jersey and Long Island, but the commercial catch is larger (Table 33). In the last few years, including 1974, sport fishermen have been reporting scup as abundant in coastal waters, especially off New York. Reported commercial landings seem to support this view. There is evidence that the fish off New York and northward belong to a separate stock from those that come seasonally to the New Jersey coast (Neville and Talbot [1964]; Paul Hamer pers. commun.).

Wide fluctuations in abundance have been typical of the scup resource since the early days of the fishery (Neville and Talbot [1964]). Although no detailed study of the evidence is available for the period since 1933, it is assumed that the sharp drop in New Jersey landings from 1953 to 1956 and the subsequent rise to a maximum in 1962 was caused by a real decline in abundance, although it is possible that variations in oceanographic conditions could have reduced the availability of the resource to fishermen. The appendix figure in Neville and Talbot shows a similar drop in the Chesapeake region. A similar, but much less pronounced, drop shows in the record of commercial scup landings in New York.

Foreign catches of scup are relatively small, but the stocks of scup in this region have recently been so small that even incidental foreign catches may place significant stresses on the resource. The species migrates close inshore in spring and remains in coastal waters and bays until fall, then moves southward along the coast and spends the winter in relatively deep water at the edge of the continental shelf (Neville and Talbot [1964]). Bilateral agreements with the USSR and other nations which prohibit fishing at the edge of the shelf in winter and early spring were designed to protect the remaining scup resource as well as other species. Grosslein et al. (1973, see footnote 7) expressed the view that, since scup is particularly vulnerable to foreign trawling at the edge of the shelf in winter and spring, the existing area closed to fishing in winter and early spring should be maintained or even expanded.

Table 33.--Estimated commercial and recreational catches of scup in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	5,883	6,201	9,906	12,392	6,088	1,443			
1961	5,468	6,209	9,635	11,468					
1962	4,852	6,749	8,973	12,991					
1963	4,222	5,774	8,746	10,224				3,191	1,231
1964	3,785	3,879	8,269	9,159				-	459
1965	3,419	4,126	8,620	7,611	4,604	1,925		1,371	718
1966	1,849	1,967	6,154	6,681				257	566
1967	1,492	1,823	4,810	4,148				347	549
1968	1,271	1,552	3,954	2,757			538	1,224	469
1969	742	1,642	1,872	3,074			177	30	278
1970	552	1,414	2,114	2,454	1,041	965	132	51	108
1971	599	917	2,145	1,890			148	74	773
1972	598	1,655	1,923	2,261			551	205	891
1973	1,317	1,347	3,160	1,734			507	200	1,076
1974	1,648	2,740	3,901	2,986			138	51	769
1975	1,738	2,843	(1,760)	(3,174)			62	292	318

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Foreign catches for 1975 are provisional. This species is included with the second tier quota for 1976.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

Black Sea Bass

The historic pattern of landings of black sea bass, *Centropristis striata* (Linnaeus), in New Jersey (Fig. 32) is remarkably similar to New York landings (McHugh 1972a). Catches were relatively low until the mid-1940s, reached a peak early in the 1950s, and dropped sharply and fairly steadily thereafter. On the average, New Jersey landings have been three to four times as great as New York landings. Most of the domestic commercial catch is made in pots (inshore) and otter trawls (offshore). A brief review of the fishery along the Atlantic coast of the United States was published by Frame and Pearce (1973). They concluded that the decline in the 1960s was primarily a drop in trawl catches. They drew no conclusions about the reasons for the decline. It is surprising that neither Earll (1887) nor Mather (1887) mentioned black sea bass as an important species in the 1880s in the New York Bight area.

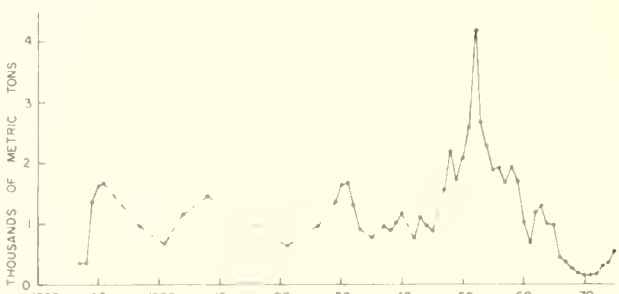


Figure 32.—Annual commercial landings of black sea bass in New Jersey 1887-1975.

Black sea bass is an important sport fish in the New York Bight area (Table 34). The estimated recreational catch usually has exceeded the domestic commercial catch. Total recreational catches in the north and middle Atlantic regions have declined since 1960, despite an increase in numbers of sport fishermen.

Black sea bass has not been recorded in foreign catches in the area except for about 1,500 metric tons in 1964 in ICNAF division 5Z. This may have been an error in recording. It is possible that incidental catches are made, especially in winter when the species has moved to deeper water. Grosslein et al. (1973, see footnote 7) believed that the resource is vulnerable to foreign trawlers, especially when the water is unusually warm in winter.

Table 34.--Estimated commercial and recreational catches of black sea bass in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	238	1,001	379	2,781	675	4,722			
1961	142	679	262	2,486					
1962	238	1,189	340	3,799					
1963	262	1,276	334	3,707					
1964	227	996	313	3,241				1,494	
1965	173	973	233	3,742	957	3,215			
1966	100	436	151	1,962					
1967	50	370	75	1,984					
1968	30	245	54	1,567					
1969	31	178	50	1,523					
1970	32	140	66	1,438	279	3,043			
1971	25	134	52	849					
1972	20	192	59	956					
1973	48	315	97	1,337					
1974	44	353	136	1,480					
1975	59	533	(200)	(1,950)					

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

The one record of a fairly large foreign catch is questionable. Incidental catches of black sea bass are suspected, but no other catch has been specifically reported.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

Flounders

The major species of flounder in New Jersey landings has been summer flounder, *Paralichthys dentatus* (Linnaeus). Winter flounder, *Pseudopleuronectes americanus* (Walbaum), more abundant to the northward, and much more important in the New York fishery, has never contributed much to New Jersey landings (Fig. 33). Yellowtail flounder, *Limanda ferruginea* Storer), was of no great importance in New Jersey until the 1970s, when scarcity of other species and better prices encouraged south New Jersey trawlers to fish heavily for yellowtail (LoVerde 1971, 1972).

Flounders were among the most important finfishes taken in coastal bays in the 1880s (Mather 1887) but were

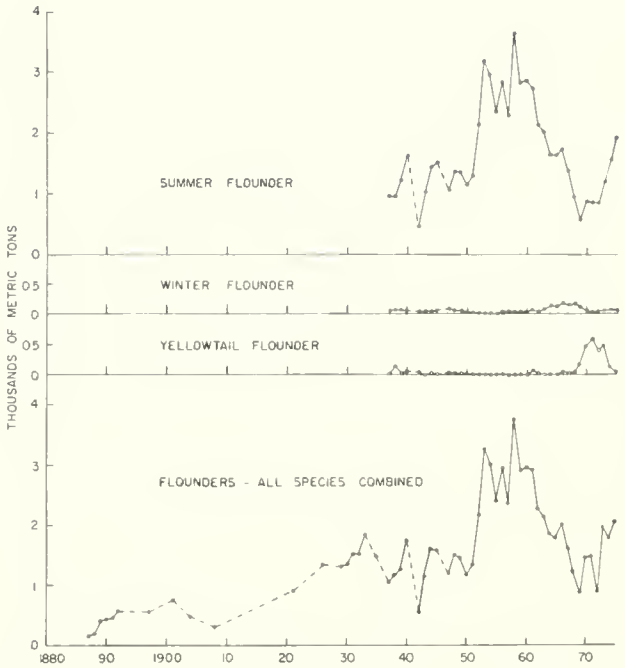


Figure 33.—Annual commercial landings of flounders in New Jersey 1887-1975.

considered to be much less abundant than formerly. The species were not listed separately until the 1930s. Flounders apparently were not highly regarded as food fishes in the early days (Mather 1887).

Summer flounder.—As in New York, flounder landings in New Jersey were not listed separately until 1937. However, since landings of other species in New Jersey probably were negligible before that date, historic landings of all species combined (Fig. 33) probably were predominantly summer flounder landings. The history of the fishery is similar to that in New York, with peak catches in the 1950s and a sharp decline thereafter. Peak landings were higher in New Jersey than in New York, but the recent decline in New Jersey has been much sharper. A moderate increase has taken place since 1969 (Fig. 33). Most of the catch is made in otter trawls.

Estimated sport catches of summer flounder have been about equivalent to the domestic commercial catch in the mid-Atlantic region, but 5-10 times the domestic commercial catch in the north Atlantic region (Table 35). Recreational catches dropped 25-30% from 1965 to 1970.

Catches of summer flounder reported by foreign fleets have been small. The species does, however, migrate offshore to deeper waters in winter where it concentrates at the edge of the continental shelf from Hudson Canyon to Cape Hatteras (Grosslein et al. 1973, see footnote 7). It could be vulnerable to offshore trawling at that time.

Winter flounder.—Winter flounder is a minor commercial species south of New York. It usually inhabits relatively shallow waters near shore, and the ban on

Table 35.--Estimated commercial and recreational catches of summer flounder in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

Year	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	1,139	2,882	4,397	5,167	18,285	5,616			
1961	1,054	2,736	3,932	4,870					
1962	721	2,154	2,806	4,208					
1963	592	2,016	1,910	4,266					-
1964	841	1,665	1,838	3,713					-
1965	1,112	1,642	1,582	5,025	8,676	4,756		22	-
1966	1,119	1,737	1,486	4,914				31	-
1967	891	1,377	1,436	4,429				72	-
1968	552	970	815	3,291			31	4	-
1969	260	578	428	2,610			245	19	30
1970	409	891	555	3,465	5,266	3,512	21	4	11
1971	495	839	675	3,571			497	346	61
1972	500	840	659	3,920			127	266	-
1973	828	1,403	1,168	6,432			19	3	-
1974	1,128	1,587	3,032	8,679			-	-	-
1975	1,466	1,957	(3,185)	(9,136)			-	-	-

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data for individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

The 1960 recreational catch was all flounders combined.

Foreign catches for 1975 are provisional. The total ICNAF 1976 quota for all flounders except yellowtail in subareas 5 and 6 was 20,000 metric tons.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

Landings in N.C. include other flounder species.

- An unreported catch is possible.

trawling within 2 miles of the New Jersey coast may have helped to keep the catch down.

The reported recreational catch of winter flounder is much larger than the commercial catch in the mid-Atlantic region (Table 36), and about equal to the domestic commercial catch in the north Atlantic region. Winter and summer flounders are among the most important and sought-after recreational species in the shallow coastal waters of New York and New Jersey.

Foreign catches of winter flounder, except in 1969, have been relatively small (Table 36).

Yellowtail flounder.—The yellowtail flounder fishery of the north and middle Atlantic regions went through a wide fluctuation in landings, from a peak in the early 1940s to a low in the 1950s, and a subsequent rise to intermediate levels in the 1960s and early 1970s. These fluctuations are similar to variations in New York landings (McHugh 1972a). The relation between these fluctuations in catch and abundance of yellowtail flounder on the continental shelf was confirmed by Colton (1972). The species was particularly abundant off New York and New Jersey in the late 1960s, but Colton concluded that this was related to greater abundance and not to a shift in geographic range. Prior to the middle 1930s, yellowtail was regarded as a scrap fish (U.S. Fish and Wildlife Service 1945), and landings were small and prices low. The fishery began when winter flounder catches off New York and farther north declined.

According to Lux (1963) there are three stocks of yellowtail, the most southerly of which occupies the southern New England region. The catch in this region, which for ICNAF regulatory purposes includes the waters over the continental shelf west and south of long. 69°W, has been controlled by quota since 1971. The total allowable catch in ICNAF subareas 5 and 6 for 1976 has been set at 20,000 metric tons.

Royce et al. (1959) concluded that the sharp decline in landings of yellowtail from the southern New England stock from the early 1940s to the middle 1950s was not caused by overfishing, but by a shift in the location of the stock. Landings in New York dropped to very low levels (McHugh 1972a, fig. 22) then recovered in the 1960s. A similar cycle occurred in New Jersey, but landings there were much smaller, and the decline is not clearly evident in Figure 33. The difference in landings between the two states is not so much a reflection of differences in the size of the trawler fleets as an indication that Long Island is about the southern limit of the range of this species. Usually, the numbers of vessels in the New Jersey trawl fleet have not been much different from those in the New York fleet. The magnitude of landings in the two states and the remarkable decline and subsequent rise in catches are illustrated in Table 37. The recent high levels of landings in New Jersey may indicate another southward shift, although it is possible that a distinct stock inhabits waters off southern New Jersey. Grosslein et al. (1973, see footnote 7) suggested that a fourth stock might exist in the Middle Atlantic Bight. Landings of yellowtail flounder dropped abruptly in 1974 and 1975 in both

Table 36.--Estimated commercial and recreational catches of winter flounder in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

Year	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	744	48	9,016	56	18,285	5,616			
1961	769	69	8,714	80					
1962	737	57	9,086	69				26	
1963	836	84	9,050	106				139	
1964	653	162	10,233	215				146	
1965	1,018	127	11,394	227	9,905	3,145		511	
1966	1,480	199	14,332	363				320	
1967	1,333	166	11,680	618				438	
1968	830	192	8,929	601			783	431	
1969	734	122	10,940	329			6,452	350	166
1970	784	53	11,149	136	11,197	5,843	422	104	8
1971	782	29	11,520	59			917	1,094	114
1972	654	43	9,013	55			818	1,707	14
1973	529	72	8,716	75			793	707	33
1974	253	64	7,185	66			89	94	32
1975	266	48	(7,800)	(48)			1	528	48

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

The 1960 recreational catch was all flounders combined.

Foreign catches for 1975 are provisional. The total ICNAF 1976 quota for all flounders except yellowtail in subareas 5 and 6 was 20,000 metric tons.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

Table 37.--Estimated commercial landings of yellowtail flounder in New Jersey and New York 1937-1975. Annual average for approximately five-year periods in metric tons.

Years	New Jersey	New York	Total
1937-42	53	2,555	2,608
1943-47	15	1,987	2,002
1948-52	13	583	596
1953-57	4	59	63
1958-62	21	746	767
1963-67	17	1,892	1,909
1968-73	363	2,606	2,969
1/1974-75	81	700	781

1/ Two years only.

states, suggesting that the effects of foreign fishing are now being felt in the New York Bight region.

Yellowtail flounder is a species of relatively deep water, although most of the catch is made in water shallower than 100 m. For this reason the species does not support an important recreational fishery. Some hardy sport fishermen do seek the species, however, and a small winter recreational fishery has developed off Long Island (Ahern 1974).

Grosslein et al. (1973, see footnote 7) concluded that the equilibrium maximum sustainable yield for the southern New England stock of yellowtail flounder is about 15,800 metric tons and that present quotas will allow the stock to return to equilibrium. The large foreign catch in 1969 (Table 38) came almost entirely from Nantucket Shoals, but this heavy exploitation was not associated with a decline in domestic catches in New

Table 38.--Estimated commercial catches of yellowtail flounder in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	Domestic commercial catch				ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	526	5	14,151	5			
1961	928	78	17,793	78			
1962	1,765	16	27,468	16		27	
1963	2,118	6	37,503	6		262	
1964	1,616	5	37,576	6		300	
1965	1,666	10	36,396	10		1,395	
1966	1,582	44	30,340	44		294	
1967	2,479	18	26,241	18		2,456	
1968	2,547	44	31,708	44	1,261	2,188	
1969	2,131	177	31,527	177	17,722	1,836	683
1970	2,126	495	32,670	495	2,592	468	118
1971	3,285	588	27,944	588	339	831	829
1972	3,261	394	32,261	405	1,269	4,150	117
1973	2,283	478	29,261	478	181	260	197
1974	784	121	24,806	121	62	190	16
1975	594	41	(19,470)	(41)	-	83	3

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of yellowtail flounder.

Foreign catches for 1975 are provisional. The total ICNAF 1976 quota for yellowtail flounder in subareas 5 and 6 combined was 20,000 metric tons.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

York Bight until 1974. What relation the resource being harvested by southern New Jersey fishermen bears to the New England stock is not known. Past experience and what is known about the life history of the species would suggest that the allowable catch will be variable and that this will not become a major New Jersey fishery.

Little Tunny

Euthynnus alletteratus (Rafinesque), little tuna or tunny, was important in the commercial fisheries of New Jersey for only about 8 yr, from 1945 to 1952 inclusive. Maximum landings reported were about 328 metric tons (722,000 pounds) in 1952 (Fig. 34). A minor peak in commercial landings was reported in 1921. Landings reported in New York have been smaller, but two peaks also appear in the statistical record, from 1921 to 1930 with a maximum of 27 metric tons (60,000 pounds) in 1930, and from 1946 to 1949 with a maximum of 45 metric tons (99,000 pounds) in 1949. Most of the commercial catch in both states is taken in pound nets, which were a much more important gear in the 1920s than in the late 40s and early 50s, although there was a brief postwar increase in numbers of pound nets licensed (Knapp in press). Little tunny is primarily a fish of ocean waters, probably highly erratic in its migrations to shallow waters. The two peaks in landings, coming at approximately the same time in both states, with about a decade of zero catches intervening, suggest that the species either was especially abundant at these times, or that oceanographic conditions were favorable for inshore migrations. Tunas are grouped in the national saltwater angling survey reports. Thus, it is not possible to compare sport and commercial catches of little tunny.

No foreign catches of this species have been reported. It is possible that little tunny is taken by foreign longliners, but it may be too small to be caught with longline hooks.

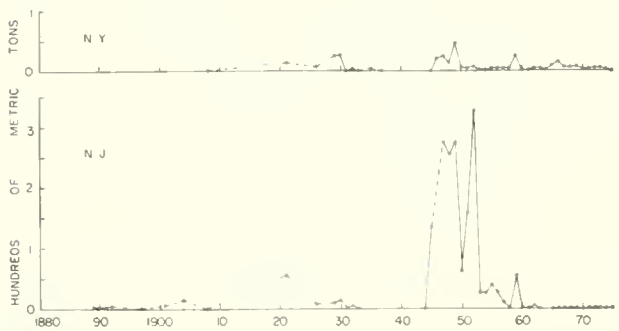


Figure 34.—Annual commercial landings of little tunny in New York and New Jersey 1889-1975.

Surf Clam

Surf clam, *Spisula solidissima* (Dillwyn), has been landed in small quantities in New Jersey and New York since 1900, but this was a minor fishery until the middle

1940s in New York and until the middle 1950s in New Jersey. The modern fishery began off the south coast of Long Island, N.Y. Stocks of surf clam on the original grounds soon were reduced in abundance, and the fleets began to range more widely in search of new grounds. A large area closed to shellfishing in the apex of New York Bight removed some surf clam stocks from the fishery. A much larger resource was discovered off the New Jersey coast, and from 1949 to 1966 landings in New Jersey increased more than hundredfold, from 185 metric tons of meats to nearly 20,000 (Fig. 35). In weight of meats landed, this has been the most important food fishery in New Jersey since 1955.

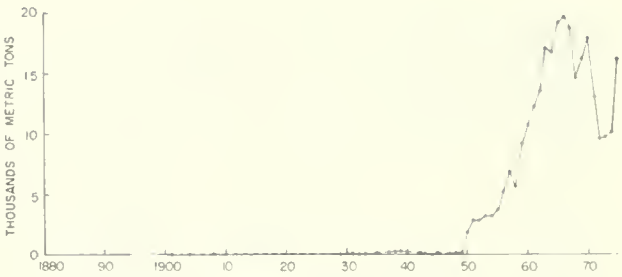


Figure 35.—Annual commercial landings of surf clam in New Jersey 1901-1975.

Following the peak year 1966 surf clam landings in New Jersey have decreased irregularly but sharply. Landings in 1972 and 1973 were about half the maximum and landings in 1974 only slightly higher, but in 1975 jumped substantially. The evolution of the fishery has been typical of coastal fisheries everywhere. The fleets have ranged south, first off Delaware, then to Maryland and Virginia (Ropes et al. 1972), and have contemplated extending their operations north to the Canadian coast, where plentiful surf clam resources have been reported (LoVerde 1969). Production was increased by improving the efficiency of operations at sea and by steady additions of vessels to the fleet. The short-lived rise in landings in 1969 and 1970 was attributed to production from a new ground on the Delaware side of Delaware Bay (LoVerde 1970). New Jersey and New York, which received 99.8% of the Atlantic coast catch in 1966 (Table 39), now receive less than 50%, and surf clam grounds off the two states produce only a small part of the total catch. It appears probable that as new beds are located and exhausted the total catch may begin to fall. Thus, the surf clam resource, like many other coastal fishery resources, eventually could decline to minor importance. How long it would take to reach this stage in the evolution of the fishery will depend upon the magnitude of the total resource, demand for the product, and costs of harvesting and processing. The recently established State-Federal Cooperative Surf Clam Study, if successful, may prevent a repetition of the sorry history of so many other domestic coastal fisheries.

Table 39.--Estimated commercial landings of surf clam in the north and middle Atlantic regions of the United States coast 1960-1975. Weights of meats in metric tons.

	North Atlantic region		Middle Atlantic region	
Year	Me-NY incl.	NY only	NJ-NC incl.	NJ only
1960	329(2,334)	328(2,327)	11,043(78,407)	10,636(75,512)
1961	333(2,362)	328(2,327)	12,142(86,210)	12,109(85,976)
1962	386(2,739)	381(2,703)	13,610(96,631)	13,531(96,070)
1963	442(3,135)	442(3,135)	17,061(121,133)	17,032(120,927)
1964	559(3,966)	553(3,923)	16,744(118,884)	16,726(118,756)
1965	683(4,852)	682(4,845)	19,315(137,136)	19,190(136,250)
1966	850(6,037)	834(5,923)	19,613(139,250)	19,584(139,044)
1967	1,053(7,476)	1,045(7,420)	19,384(137,626)	18,862(133,923)
1968	1,373(9,746)	1,365(9,690)	17,022(120,856)	14,597(103,640)
1969	1,563(11,094)	1,557(11,052)	20,925(148,564)	16,348(116,068)
1970	1,971(13,996)	1,896(13,464)	28,565(202,810)	17,994(127,758)
1971	1,750(12,428)	1,673(11,875)	27,309(193,893)	13,028(92,495)
1972	1,290(9,158)	1,231(8,739)	27,487(195,156)	9,676(68,702)
1973	1,514(10,747)	1,501(10,691)	35,830(254,396)	9,792(69,526)
1974	1,796(12,755)	1,792(12,723)	41,785(296,673)	10,277(72,967)
1975	2,082(14,778)	2,077(14,749)	38,280(271,788)	16,125(114,490)

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of invertebrates.

Live weights are given in parentheses for comparability with ICNAF statistics.

Occupying about the same geographic range, but in deeper water, is another possible alternate, ocean quahog or mahogany clam, *Arctica islandica* (Linnaeus). A limited fishery for ocean quahog has operated for a number of years off Rhode Island and since 1968 landings have been rising. Landings of this species were first reported in Massachusetts in 1968 and in Connecticut in 1969. Ocean quahog is abundant from Georges Bank to the outer continental shelf off Chespeake Bay (Merrill and Ropes 1969). Surf clam is preferred because it is larger and produces a greater yield of meats, and is distributed in somewhat shallower water closer to shore. There also have been problems with dark color and off-flavor of meats of ocean quahog.

Surf clam is known to occur off the coast from the Gulf of St. Lawrence to Cape Hatteras. To the north it is found mostly in shallow waters near shore, although it is distributed only sparsely over Georges Bank (Merrill and Ropes 1969). The depth of greatest abundance increases toward the south. Most surf clam are found at depths between 12 and 43 m, but they have been reported as deep as 128 m. From New York northward a possible alternative resource is the smaller *Spisula polynyma* (Stimpson). South of Cape Hatteras is an even smaller species, *Spisula raveneli* (Conrad), according to Jacobson and Old (1966).

No foreign fleet has been known to harvest surf clam, which was declared by the United States a creature of the continental shelf under the terms of the 1958 Geneva Convention and now is further protected by the Fishery Conservation and Management Act of 1976 (U.S. House of Representatives 1976).

Bluefin Tuna

Tuna purse seiners began fishing in New Jersey waters in 1963 (LoVerde 1964). Catches of Atlantic bluefin tuna,

Thunnus thynnus thynnus (Linnaeus), were very erratic (Fig. 36). Fishing effort has been increasing thoughout the North Atlantic Ocean, and it is generally conceded that the resource has been seriously overfished (Stroud 1974; Mather 1974). It has even been proposed that Atlantic bluefin tuna be placed on the endangered species list. It is prohibited to take fish less than 14 pounds (6.4 kg) or in excess of 115 pounds (52.2 kg) but less than 300 pounds (136.1 kg) except as incidental catches, also specified as to amount. The following annual catch quotas also have been set: bluefin tuna taken by purse seine, 1,000 short tons (907 metric tons) of fish between 14 and 115 pounds, and 180 short tons (163 metric tons) of fish over 300 pounds; taken by methods other than purse seining, 2,000 fish over 300 pounds; anglers, daily bag limit 4 fish between 14 and 115 pounds, on fish over 300 pounds a bag limit of one fish per day per vessel through August 13, and a limit of seven fish per vessel thereafter until the quota of 2,000 fish is reached.

Small quantities of bluefin tuna have been landed in New Jersey and New York for many years. Most of these were caught in pound nets or by hook and line. This tuna is a popular sport fish, although it has not been listed separately in the national saltwater angling surveys. In 1970 about 1,685 metric tons of tunas were estimated to have been taken by sport fishermen in the north Atlantic region, and about 400 metric tons in the middle Atlantic region (Deuel 1973).

In 1970 the foreign catch of bluefin tuna in ICNAF subareas 5 and 6, the sport catch, and the domestic commercial catch were of the same orders of magnitude (Table 40).

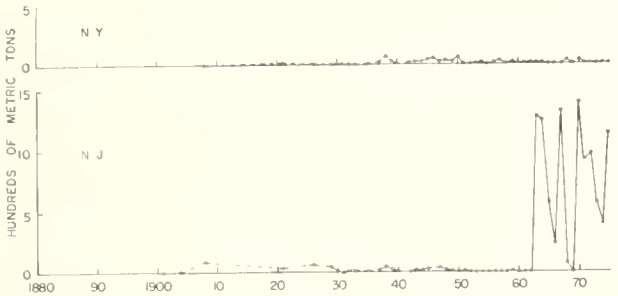


Figure 36.—Annual commercial landings of bluefin tuna in New York and New Jersey 1901-1975.

Table 40.--Estimated commercial and recreational catches of Atlantic bluefin tuna in the north and middle Atlantic regions of the United States coast for the period in which recreational or foreign catch estimates are available. Weights in metric tons.

	Domestic commercial catch				Recreational catch		ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	4	2	634	2	254	8,249			
1961	5	1	1,073	1					
1962	8	2	3,207	2					
1963	10	1,283	2,999	1,542			331		
1964	9	1,251	998	1,923			230		
1965	1	571	1,147	973	456	22	48		
1966	1	237	883	243					
1967	1	1,323	1,060	1,459					
1968	13	65	742	65					
1969	5	2	1,224	2					
1970	13	1,398	1,474	1,398	1,684	402			1,160
1971	3	917	1,409	917			374	53	486
1972	2	976	698	976			-	12	166
1973	3	567	771	567			-	2	102
1974	5	396	632	396			-	4	144
1975	4	1,141	(830)	(1,141)			-	-	295

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Recreational catches were given under the general category "tunas," which probably includes other species in addition to bluefin.

Foreign catches for 1975 are provisional.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

Atlantic Sea Scallop

The U.S. Atlantic northern sea scallop, *Placopecten magellanicus* (Gmelin), fishery began off New England in the 19th century and shifted to beds off Long Island, N.Y. in the 1920s. The fishery did not reach full development until after the second world war, when major stocks on Georges Bank were heavily exploited (Merrill and Tuhiash 1970). The New England fishery reached its peak in 1961 with total landings of nearly 11,000 metric tons of meats, mostly in Massachusetts and Maine. Relatively large catches in 1961 and 1962 were mostly of survivors of an unusually large recruitment on Georges Bank in 1959 (Graham 1968).

Scallop landings in New Jersey and New York have

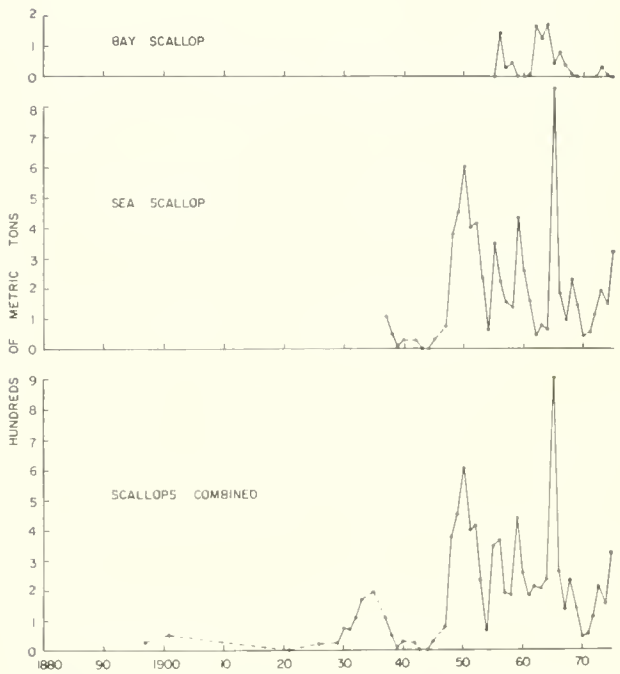


Figure 37.—Annual commercial landings of scallops in New Jersey 1897-1975.

been relatively small and variable, and do not necessarily reflect catches by vessels based in those states. For example, in 1962 most scallop draggers from New Jersey landed their catch in New York (LoVerde 1963). The sharp increase in New Jersey in 1965 (Fig. 37, Table 41) came mostly from catches off Cape Henry, Va. (LoVerde 1966). New Jersey draggers returned to waters off Virginia in 1966 but abundance had dropped substantially. As in the surf clam fishery, when abundance declined on traditional grounds the fleets ranged farther from their home ports in search of new grounds. It probably was inevitable that sea scallop landings in New Jersey would decline (Fig. 37) soon after the New England scallop catch dropped from a combination of heavy fishing and poor spawning success.

Canada is the only other country which harvests scallops off the United States coast. The Canadian fishery on Georges Bank began with the advent of the strong 1959 year class. Canadian interests built a new fleet to work on Georges Bank. When scallop stocks declined there they extended their area of operations to the southward where they were competing with scallopers from New York and New Jersey.

Table 41.--Estimated commercial catches of Atlantic sea scallop in the north and middle Atlantic regions of the United States coast 1960-1975. Weights of meats in metric tons.

	Domestic commercial catch				ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	1,266	257	11,454	610	-		
1961	1,370	158	12,154	302		4,565(37,889)	
1962	1,233	44	11,087	87		5,715(47,434)	
1963	873	79	8,944	100		5,898(48,957)	
1964	927	64	7,520	152		5,922(49,156)	
1965	1,323	860	6,918	2,144		4,434(36,803)	
1966	965	182	6,022	1,225		4,878(40,489)	2,791(23,165)
1967	622	97	3,809	837		5,019(41,657)	6(50)
1968	671	226	4,272	1,203	3(22)	4,820(40,002)	424(3,517)
1969	271	143	2,588	774	-	4,318(35,836)	2(15)
1970	242	45	2,268	386	-	4,097(34,006)	-
1971	183	51	2,154	299	-	3,908(32,434)	-
1972	101	112	2,107	548	-	4,161(34,535)	16(135)
1973	69	187	1,860	538	-	4,223(35,055)	-
1974	93	149	2,184	544	-	6,137(50,934)	-
1975	122	322	(3,334)	(898)	-	7,414(61,536)	-

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of invertebrates.

Foreign catches for 1975 are provisional.

For simplicity the ICNAF statistics, given in live weights (in parentheses) have been reduced to weights of meats by dividing by 8.3, rather than showing live weights for domestic catches also.

Domestic figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is probable.

Atlantic Bay Scallop

Argopecten irradians (Lamarck), bay scallop, has been esteemed as a delicacy along the Atlantic coast for a very long time. It lives in shallow protected waters and at some stages of its life history is often assocated intimately with eelgrass (*Zostera*). Most *Zostera* beds along the Atlantic coast were reduced or eliminated in 1931-32 by disease and the concurrent sharp decline of the bay scallop fishery has been attributed to destruction of eelgrass beds. Marshall (1947), however, noted abundant scallop populations in the absence of eelgrass. Merrill and Tubiash (1970) reported that a major factor in decline of bay scallop landings after 1935 was the "explosive expansion" of the sea scallop industry. The effect shows very clearly in the record of bay scallop landings in New York State (McHugh 1972a, fig. 11). In New Jersey commercial landings of bay and sea scallops were lumped until 1937 (Fig. 37). Some bay scallop may have been included in the earlier records, but from 1937 to 1955 inclusive apparently no catches were made. Small and variable catches have been reported for most years from 1951 to 1973 inclusive (Table 42). The potential for bay scallop production apparently is much less in New Jersey than in New York. In the recent period of abundance maximum reported landings were 171 metric tons in 1964 in New Jersey and 449 metric tons in 1962 in New York.

Because it lives its entire life history in shallow waters, bay scallop is subject to rigorous environmental conditions and it is hardly surprising that it is extremely variable in abundance. But, because its life span is not much longer than 1 yr, management strategy is relatively simple. It is necessary only to protect the young until they have a chance to spawn, then permit unlimited harvesting. This should achieve the maximum sustainable yield, but it will be a highly variable yield over which man cannot have much further control under natural en-

Table 42.--Estimated commercial landings of Atlantic bay scallop in the north and middle Atlantic regions of the United States coast 1960-1975. Weights of meats in metric tons.

	North Atlantic region		Middle Atlantic region	
Year	Me-NY incl.	NY only	NJ-NC incl.	NJ only
1960	864(7,171)	383(3,176)	31(257)	-
1961	678(5,627)	359(2,977)	80(663)	32(266)
1962	1,095(9,088)	449(3,724)	242(2,007)	166(1,377)
1963	315(2,614)	138(1,144)	270(2,239)	124(1,028)
1964	523(4,341)	312(2,588)	325(2,695)	171(1,418)
1965	610(5,063)	402(3,334)	216(1,791)	44(365)
1966	543(4,507)	144(1,194)	261(2,164)	79(655)
1967	280(2,324)	74(613)	206(1,708)	39(324)
1968	314(2,606)	91(754)	298(2,471)	8(66)
1969	644(5,345)	113(937)	278(2,305)	-
1970	665(5,519)	166(1,377)	59(490)	-
1971	1,001(8,308)	65(539)	27(224)	-
1972	42(349)	42(349)	58(481)	-
1973	77(639)	77(638)	45(373)	28(232)
1974	308(2,556)	308(2,556)	107(887)	7(58)
1975	201(1,668)	201(1,668)	63(525)	-(-)

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catchas of invertebrates.

Live weights are given in parentheses for comparability with ICNAF statistics.

- An unreported catch is possible.

vironmental conditions provided that he preserves the quality of the coastal zone.

American Lobster

In the 1880s the southern limit of the North Atlantic lobster fishery, according to Earll (1887) was at Squan River (probably the Manasquan), just north of Barnegat Bay. A few lobster were caught in Long Island Sound, but lobster landings at the eastern end of Long Island apparently came from Marthas Vineyard (Mather 1887). At one time lobster was taken in New York harbor, but by 1880 the catch had dropped to zero.

As in New York, the trend in American lobster, *Homarus americanus* Edwards, landings in New Jersey has been upward since the early 1950s (Fig. 38). At first, most of the increase was caused by conversion of fish trawlers to lobster trawling, as the existence of a substantial resource on the continental shelf became commonly known. From 1957 to 1961 about 90% of lobster landings in New Jersey were taken by trawlers operating between Hudson and Veatch canyons on the continental shelf (LoVerde 1963). By 1964 (LoVerde 1965) about 35 trawlers were taking lobster specifically. Landings dropped from 1962 to 1967 and many fishermen concluded, from the scarcity of lobster on these grounds and a substantial decline of lobster size, that the resource had been overharvested. From this evidence alone, that conclusion was not necessarily warranted. The subsequent rise in catches to even higher levels (Fig. 38) came about through another change in harvesting strategy, this time a switch from sea bass to lobster by pot fishermen. It is possible, although by no means conclusive, that the decline in size of lobster might have been caused by an unusually successful year class or classes at this time.

These changes in fishing strategy are typical of coastal fisheries, illustrated particularly well by the interactions between lobster fishing and other kinds of fishing. The sequence was, first of all, a shift from fish to lobster by trawlers, then a shift by trawlers back to finfishing, especially for summer flounder when lobster catches dropped (LoVerde 1967), and finally another set of shifts in the pot fisheries, from sea bass to lobster. Thus, trends in the catches of all these species are interrelated and not independent phenomena. These changes are related to prices and costs of operation, as well as to relative abundance of the various species. By 1971, about 40% of New Jersey lobster landings were taken in pots, and the sea bass pot fishery had declined almost to nothing (LoVerde 1972).

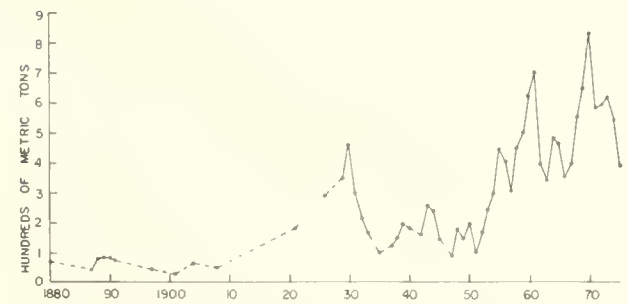


Figure 38.—Annual commercial landings of American lobster in New Jersey 1880-1975.

It is reasonably well established that a part of the increase in lobster landings in the New York Bight area and farther south was caused by a real increase in abundance. It has been suggested that this increase was associated with falling water temperatures, which caused the species to shift its geographic range. Table 43 illustrates not only that New York landings have been following an upward trend since the early 1960s, but also that they have been rising more rapidly than in the north Atlantic region as a whole. Similarly, New Jersey landings of American lobster have been rising, but landings to the south of New Jersey have been rising more rapidly. In the 5-yr period, 1961-65, landings in New York made up less than 2% of the entire north Atlantic region catch, in the period 1966-70 nearly 4%. In the same two periods New Jersey landings rose also, but in the first period this was about 97% of total landings in the middle Atlantic region, in the second period only 87%. In the last several years, however, landings in New Jersey and New York have been dropping. Local lobstermen believe not only that the resource is less abundant, but also that the fishery has been overcapitalized.

Taylor et al. (1957) postulated a relationship between catches or availability of lobster along the Atlantic coast and water temperatures. In a period of rising air temperatures (presumably correlated with ocean temperatures) from about 1920 to 1950 they found that lob-

Table 43.--Estimated commercial catches of American lobster in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	Domestic commercial catch				ICNAF Foreign catch		
Year	NY	NJ	Me-NY incl.	NJ-NC incl.	$5Z_w$	$5Z_e$	6
1960	230	622	13,502	637			
1961	228	703	11,990	710			
1962	143	395	12,974	407			
1963	173	340	13,384	351			
1964	248	482	13,547	496			
1965	295	463	13,235	484			
1966	331	347	13,036	365			
1967	399	400	11,633	499			
1968	530	550	14,153	615			
1969	642	650	14,573	753			
1970	747	832	14,542	949			
1971	812	582	14,548	714	1	102	25
1972	520	593	10,950	1,014	2	204	17
1973	405	618	10,134	733	2	228	5
1974	332	540	10,549	694	-	178	-
1975	304	386	(10,743)	(454)	-	219	-

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of invertebrates.

Public Law 93-242, enacted in January 1974, declared American lobster a creature of the continental shelf. Thereafter, it became illegal for fishermen of other nations to catch lobster off U.S. coasts. Foreign catches for 1975 (Canadian) are provisional.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

ster landings in New England rose, while those in the middle Atlantic states dropped. They inferred a cause-and-effect relationship but did not explain the mechanisms. Dow (1969) also has maintained that lobster abundance and distribution along the coast, and hence catches, are a function of water temperature trends.

Some lobster are taken by recreational fishermen but this catch has not been recorded in the national surveys.

Lobster is taken incidentally by trawlers fishing primarily for other species. Catches reported by foreign fleets have been relatively small (Table 43), and there is no information at present that fisheries specifically for lobster have been established by other nations in the area, except for the Canadian lobster fishery on southeastern Georges Bank (Grosslein et al. 1973, see footnote 7). Nevertheless, a good deal of concern has arisen in some quarters about the possibility of unannounced lobster catches by some nations fishing in the area, and there have been some difficult gear conflicts. Effects of foreign fishing on the lobster fisheries of the New York Bight area probably have been negligible, at least until very recently. In 1974, by Congressional action, American lobster was declared a creature of the shelf. This action was not consistent with the definition contained in the 1958 Geneva Convention, because lobster can swim. Nevertheless, foreign fishing vessels with lobster aboard have been detained and the operators penalized in U.S. courts. Fines have been paid despite the questionable legality of the U.S. declaration. When the United States declared unilateral jurisdistion over resources out to 200 miles from the coast under the provisions of The Fishery Conservation and Management Act of 1976, this weakness in the regulations was removed. Edwards (1968) estimated that the standing crop of lobster in the region from the Gulf of Maine to Hudson Canyon beyond 12 miles was about 50 million pounds (23,000 metric tons).

Swordfish

Fishing for swordfish, *Xiphias gladius* Linnaeus, off New Jersey was a relatively recent development. Commercial landings were insignificant until the 1960s (Fig. 39), when a longline fishery developed (LoVerde 1964, 1965, 1966, 1967). Landings were made by New Jersey longliners in other states and some vessels from other states in New Jersey ports, but apparently the success of fishing was variable. The decline of this short-lived fishery undoubtedly was hastened by national hysteria about residues of mercury in some large pelagic fishes like swordfish and tunas, and action by the Food and Drug Administration to prohibit transport of swordfish in interstate commerce.

A commercial swordfish fishery has been underway in New York for much longer. Landings were first recorded in 1904. Except for 1908, landings have been reported for every year except 1972 (Fig. 39). This was at first a harpoon fishery, but beginning in 1963 a shift was made to longlines. By 1967 harpoons were no longer used, and except for small catches reported on handlines, this had become a longline fishery. The advantage was probably that longlines took other species as well.

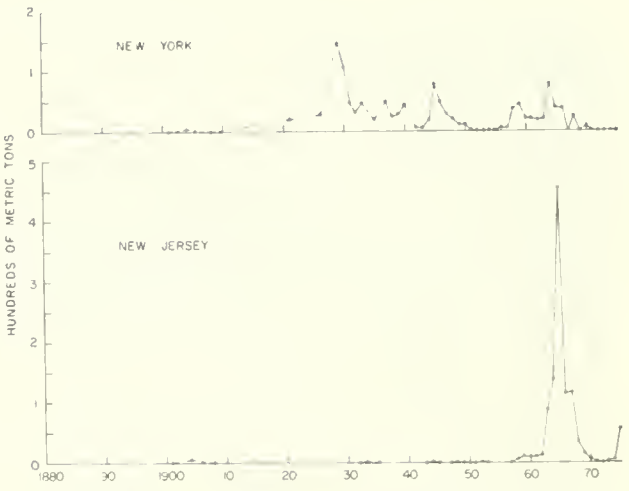


Figure 39.—Annual commercial landings of swordfish in New York and New Jersey 1901-1975.

Swordfish has been included with billfishes in the national saltwater sport fish surveys but estimates are not available prior to 1970. In 1970 the total recorded catch of billfishes in this area was 326 metric tons in the middle Atlantic region (Table 44), none in the New England region. Thus, it appears that the recreational catch of swordfish is relatively small.

Swordfish has not been reported separately in ICNAF landings. Some probably are taken by longline and perhaps other gears by foreign fishermen.

Table 44.--Estimated commercial landings of swordfish in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	North Atlantic region		Middle Atlantic region	
Year	Me-NY incl.	NY only	NJ-NC incl.	NJ only
1960	450	22	9	9
961	399	22	10	10
1962	412	19	12	12
1963	1,079	21	171	88
1964	738	78	646	139
1965	398	40	828	454
1966	426	38	190	115
1967	292	1	183	117
1968	202	25	72	33
1969	153	1	17	14
1970	130	8	-	7
1971	35	2	•	•
1972	88	-	-	-
1973	275	-	3	2
1974	1,352	•	34	3
1975	(1,856)	-	(120)	55

Recreational catches were included under the general category "billfishes." The only recorded catch was 326 metric tons in 1970 in the middle Atlantic region. No foreign catches have been recorded.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

- An unreported catch is possible.

• Less than 0.5 metric ton.

Striped Bass

The history of striped bass, *Morone saxatilis* (Walbaum), landings in New Jersey (Fig. 40) has been similar to landings in all the coastal states, where the trend has been irregularly upward since the early 1930s. Landings in New Jersey have been less than in New York and the fluctuations have been much greater. Whereas the commercial catch in New York has been primarily in haul seines, the New Jersey commercial fishery since 1960 has been almost exclusively an otter trawl fishery in coastal waters in winter. I am informed that the very wide fluctuations in New Jersey landings of striped bass may reflect success of law enforcement rather than abundance of fish, especially after the winter trawl fishery for this species became important. This fishery began when it was discovered that along the New Jersey coast striped bass often spend the winter in relatively shallow waters off the coast rather than in bays and estuaries. It is illegal in New Jersey to trawl within 2 miles of the coast, but facilities for enforcement of marine fishery laws in that State are inadequate, as they are in most Atlantic coastal states. Activity of enforcement agents may depend on how the authorities react to public pressures, especially from sport fishermen.

According to national saltwater sport fishing surveys, the recreational catch of striped bass is relatively large (Table 45). In the 3 yr for which estimates are available, in the north Atlantic and middle Atlantic regions combined, the total sport catch was more than six times the total commercial catch. Sport catch estimates also support the hypothesis that abundance of striped bass has increased over this period, for the sport catch has grown about twice as much as the number of sport fishermen. These figures, if they are reasonably accurate, contradict many of the assertions used in the chronic conflict between recreational and commercial striped bass fishermen, and do not support the argument that commercial fishing for this species should be curtailed or prohibited. In other words, regulations, if they are to be successful, must be applied to all segments of the fishery. There is no scientific rationale for termination of commercial fishing (Retzsch 1975).

Striped bass is not recorded in foreign catches, although it is remotely possible that small incidental catches could be made by trawls beyond 12 miles. This migratory coastal species, like weakfish and some others, is not threatened by foreign fishing and should be amenable to management by the coastal nation-state. In view of its vulnerability, as an anadromous species, to damage from domestic overfishing and other human agencies, and the patent failure generally of domestic efforts to manage coastal fisheries, it is remarkable that the striped bass resource has survived and flourished. It has been suggested (Mansueti 1961; McHugh 1972a) that this species has been able to take advantage of enrichment of its estuarine nursery grounds by man. If so, the effect must be reversible at some higher level of enrichment. On the other hand, if increased nutrient loads in the estuaries have been favorable for striped bass production, then pollution abatement may lead to a reduction in abundance.

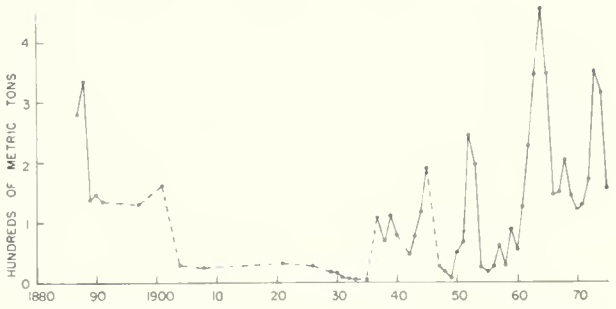


Figure 40.—Annual commercial landings of striped bass in New Jersey 1887-1975.

Table 45.--Estimated commercial and recreational catches of striped bass in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

	North Atlantic region			Middle Atlantic region		
	Commercial		Recreational	Commercial		Recreational
Year	Me-NY incl.	NY only	Me-NY incl.	NJ-NC incl.	NJ only	NJ-NC incl.
1960	428	332	5,597	3,451	52	11,254
1961	592	413		3,699	125	
1962	607	298		3,298	224	
1963	569	306		3,644	342	
1964	738	452		3,387	452	
1965	576	336	21,773	2,920	345	3,334
1966	858	477		3,258	143	
1967	1,100	739		3,646	148	
1968	1,151	675		3,886	208	
1969	1,233	661		4,391	141	
1970	1,261	586	20,795	3,790	118	12,366
1971	931	526		2,601	128	
1972	587	371		3,505	169	
1973	1,107	759		4,747	348	
1974	841	626		3,662	324	
1975	(685)	516		(2,724)	155	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

A recent report from Maryland (Boone 1976) states that the last dominant year class of striped bass was produced in 1970 and that small fish are becoming scarce. This may mean reduced catches in the New York Bight area in the near future.

Conch

Two species of conch, *Busycon carica* (Gmelin), knobbed whelk, and *B. canaliculatum* (Linnaeus), channeled whelk, are used in the New York Bight area as bait for sport fishing and are canned in limited quantities for human food. The pattern of landings in New Jersey differs from that in New York, where the peak came in the 1940s, probably as a result of protein shortages during

the war. In New Jersey (Fig. 41) the increase in landings came in the 1950s and a peak was reached in the early 1960s. According to LoVerde (1964, 1968) demand for conch meats increased at this time, but also scarcity of finfishes encouraged some fishermen to turn to this resource. Fluctuations in landings (Table 46, Fig. 41) probably were related more to market demand than to abundance of conch.

In the New York Bight area conch are taken mostly in pots, and the catch is to some extent incidental to the sea bass pot fishery. The recent downward trend in conch landings may have been caused by the decline of the sea bass fishery.

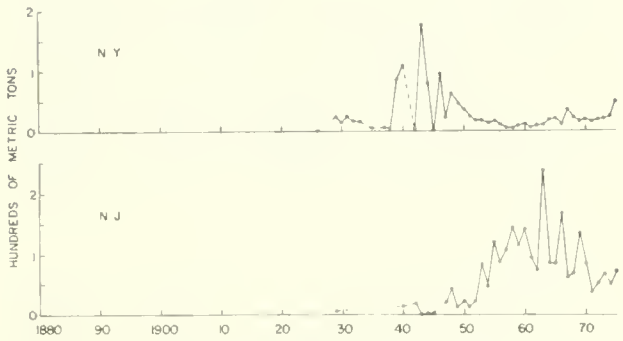


Figure 41.—Annual commercial landings of conch in New York and New Jersey 1926-1975.

Table 46.--Estimated commercial landings of conch in the north and middle Atlantic regions of the United States coast 1960-1975. Weights of meats in metric tons.

Year	North Atlantic region		Middle Atlantic region	
	Me-NY incl.	NY only	NJ-NC incl.	NJ only
1960	83(324)	12(47)	224(873)	142(554)
1961	59(230)	6(23)	187(728)	95(370)
1962	84(328)	8(31)	262(1,021)	75(292)
1963	93(363)	10(39)	398(1,551)	238(927)
1964	85(331)	19(74)	220(857)	87(339)
1965	80(312)	20(78)	199(775)	84(328)
1966	126(491)	11(43)	420(1,637)	169(659)
1967	113(441)	35(136)	249(970)	62(242)
1968	92(359)	22(86)	269(1,048)	68(265)
1969	170(662)	17(66)	275(1,071)	136(530)
1970	183(713)	18(70)	251(978)	84(328)
1971	195(759)	15(58)	73(285)	36(140)
1972	170(662)	19(74)	167(650)	52(203)
1973	173(674)	20(78)	272(1,060)	68(265)
1974	144(562)	24(94)	596(2,324)	49(191)
1975	160(624)	49(193)	609(2,375)	73(286)

The national saltwater angling surveys for 1960, 1965, and 1970 did not include recreational catches of invertebrates.

Live weights are given in parentheses for comparability with ICNAF statistics.

Northern Puffer

Sphoeroides maculatus (Bloch and Schneider) has never been of great importance as a commercial fish in New Jersey. Prior to the second world war scarcely any landings were reported. A peak of about 60 metric tons in 1948 probably was related to the scarcity of meat at the end of the war. According to LoVerde (1963) the labor of skinning the fish deterred local fishermen and puffer were landed only when other species were scarce. He also said that the increase in landings in the 1960s, to a peak of about 70 metric tons in 1963, was stimulated by development of out-of-state markets. These may have been markets created by the rapidly developing fishery in Chesapeake Bay, which reached its peak in 1965. The subsequent decline of the commercial fishery in New Jersey may have been caused by overproduction of puffer in Chesapeake Bay, which led to a decline in prices. This was the reason advanced for the parallel decline in puffer landings in New York (McHugh 1972a). But the decline to zero landings in the 1970s apparently reflects a real scarcity of fish in New Jersey (Paul Hamer pers. commun.). In New York, greatest landings were in the middle and late 1940s, when landings rose to a maximum of over 1,000 metric tons. The secondary peak in the 1960s was general in the Middle Atlantic Bight, caused by a temporary increase in abundance (Table 47). Northern puffer presently is extremely scarce along the coast.

Although puffer is not a popular sport fish, recreational fishermen catch large quantities at times of abundance (Table 47). In the middle Atlantic region the recreational catch probably comes mostly from Chesapeake Bay and the North Carolina sounds.

Northern puffer is a coastal fish which never migrates far from shore. It has not been recorded in foreign catches and probably is never taken by foreign fleets.

Table 47.--Estimated commercial and recreational catches of northern puffer in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

Year	North Atlantic region			Middle Atlantic region		
	Commercial		Recreational	Commercial		Recreational
	Me-NY incl.	NY only	Me-NY incl.	NJ-NC incl.	NJ only	NJ-NC incl.
1960	143	136	1,461	774	15	771
1961	223	223		693	34	
1962	246	244		822	66	
1963	430	430		1,252	73	
1964	250	250		2,524	59	
1965	183	183	5,870	5,897	24	4,924
1966	103	103		3,825	16	
1967	32	32		3,687	2	
1968	102	102		1,850	3	
1969	118	118		2,176	1	
1970	89	89	3,583	744	•	7,515
1971	55	55		284	-	
1972	3	3		60	-	
1973	2	2		8	-	
1974	4	4		1	-	
1975	(2)	2		(•)	-	

The national saltwater angling surveys for 1960, 1965, and 1970 did not give data by individual states. New York was included with the New England states and New Jersey with the other middle Atlantic states.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

An unreported catch is possible.

• Less than 0.5 metric ton.

Tilefish

The interesting history of the tilefish, *Lopholatilus chamaeleonticeps* Goode and Bean, fishery has been described in detail by Bigelow and Schroeder (1953), and was reviewed briefly by McHugh (1972a). The species apparently is distributed in a narrow band of relatively warm bottom water at the edge of the continental shelf. It is taken incidentally by trawlers fishing primarily for other species, but recently in New Jersey a specialized longline fishery has developed; this accounts for the sharp increase in landings (Fig. 42, Table 48) in the last 3 yr. No parallel increase occurred in New York landings, but north of New York landings have increased about as sharply as in New Jersey. In both states limited deep water handline sport fisheries have developed recently.

The only foreign catch of tilefish reported by ICNAF was 1 metric ton in 1972. It is likely that incidental catches are made fairly regularly by foreign fleets fishing at the edge of the continental shelf.

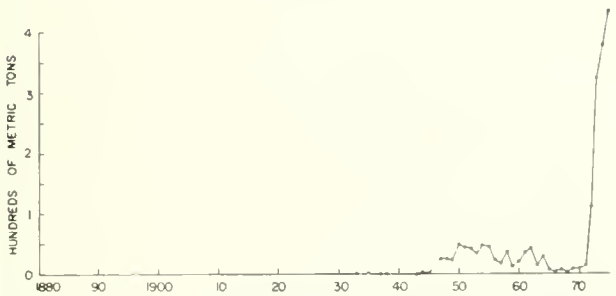


Figure 42.—Annual commercial landings of tilefish in New Jersey 1933-1975.

Table 48.--Estimated commercial landings of tilefish in the north and middle Atlantic regions of the United States coast 1960-1975. Weights in metric tons.

Year	North Atlantic region		Middle Atlantic region	
	Me-NY incl.	NY only	NJ-NC incl.	NJ only
1960	1,039	35	25	20
1961	338	46	50	37
1962	115	57	53	42
1963	101	13	20	14
1964	565	37	32	30
1965	604	20	10	9
1966	435	55	3	3
1967	37	8	13	8
1968	27	3	3	3
1969	20	5	10	10
1970	47	3	11	10
1971	46	25	16	15
1972	11	6	111	111
1973	71	3	323	323
1974	206	22	380	380
1975	(277)	2	(434)	434

A specialized recreational fishery for tilefish in deep water has developed recently.

Probably some incidental foreign catches are taken on the outer continental shelf. One metric ton was reported in 1972 in subarea 6.

Figures for 1975 in parentheses assume that unavailable landings in N.H., Conn., and Del. equal the average of recent years.

SUMMARY AND CONCLUSIONS

Study of trends in landings of some 48 species of fishes and shellfishes in New Jersey has shown that the history of the marine fisheries of the State closely parallels the history of the marine fisheries of New York. Maximum total weight of landings in New Jersey was reached in 1956, followed by a secondary peak in 1962, and a subsequent sharp decline to a low in 1969 at only about 16% of the 1956 high.

Over most of the recorded history of New Jersey fisheries, menhaden has dominated the catch, especially after the 1930s. The recent rise in landings after 1969 has been caused primarily by a resurgence of the menhaden fishery. When food finfishes and food shellfishes are considered separately the patterns are different. The greatest recorded weight of landings of food finfishes was in 1901, but the statistics prior to 1929 were for the most part widely spaced in time and probably were less reliable. The next greatest was 1945, the peak year of a period (1929-49) which marked the most prosperous era of the otter trawl fisheries of New Jersey. Subsequently, landings of food finfishes declined rather steadily to an all-time low in 1968 which was about 30% of the 1945 high.

Landings of food shellfishes showed a downward trend from 1880 to 1944, then rose sharply to a maximum historic high in 1966, and fell off abruptly thereafter. The recent rise is somewhat misleading, for it was caused by development after the second world war of the surf clam fishery. If surf clam catches were not included in food shellfish landings, the downward trend continues, as it has in New York.

The postwar decline in food finfish landings in New Jersey, which was similar to the decline in New York, is significant in the light of the popular belief that foreign fishing is the cause of all the problems of the domestic marine fisheries. Foreign fishing did not extend southward of Cape Cod and Georges Bank until the mid-1960s, when the decline of domestic landings was already well underway. This suggests that other factors had important effects on total landings. Foreign fishing certainly has reduced recently the abundance of a number of living resources important to domestic fishermen in New York Bight, and thus created problems for domestic fishermen. But it is a dangerous oversimplification to believe that all the problems of the domestic fisheries will be solved by extending national jurisdiction to 200 miles. Resolution of foreign fishing problems off the U.S. coast will bring realization that even more difficult unsolved problems remain. Preoccupation with "the Russians" has led many people to forget that extremely complex domestic fishery problems of long standing exist, and that the United States has made little progress in solving them. As Gates and Norton (1974) have observed, foreign fishing is a symptom of what is wrong with the domestic fishing industry, not a cause. Smith (1975), with reference to a west coast trawl fishery, noted that the well-being of domestic fishermen did not change significantly as foreign fishing developed in their area, yet

domestic fishermen perceived foreign fishing as a major threat.

In New Jersey about 25 species of fishes and shellfishes produced landings of 1,000 metric tons or more at one time or another in recorded history. Of these 25 species 13 are estuarine and coastal resources not vulnerable to foreign fishing. Landings of an additional eight species reached peaks between 1930 and 1958. Thus, the subsequent declines in landings of these eight species were not caused by foreign fishing. Another two species have never produced major landings in New Jersey because demand is low. The remaining two, bluefin tuna and unsorted industrial fishes, reached peak landings in 1970 and 1966 respectively, but the subsequent declines were caused by domestic overfishing in the one case and by domestic economic conditions in the other.

In New York also, some 25 species of fishes and shellfishes yielded landings of 1,000 metric tons or more in 1 yr or another since 1880. With six exceptions these were the same species on the New Jersey list. Of these 25 species 10 are estuarine and coastal, not subject to foreign fishing. Of the remaining 15, all of which have been taken by foreign fleets recently, two have been in low demand in the United States.

In both states, landings of species not vulnerable to foreign fishing have declined more sharply since peak landings were reached than have domestic landings of species also taken by foreign fleets (Table 49). This demonstrates clearly that domestic fishery management has not been successful in maintaining landings in the two states bordering on New York Bight, and that although foreign fishing has taken large quantities of some species important in domestic catches, foreign fishing has not been the only factor, or even the major factor, responsible for the decline of domestic fisheries in New York Bight. This is further substantiated by the history of marine fisheries in Rhode Island (Olsen and Stevenson 1975); in that State total landings have been increasing since 1964, and the rise has been attributed to successful management.

The history of commercial fishery landings in the New York Bight area is illustrated by comparing combined landings for New York and New Jersey of 27 major species in the catch (Fig. 43). The species have been arranged from bottom to top approximately in chronological order of years of peak landings. The series illustrates rather well how the industry shifted from traditional inshore resources (oyster to weakfish) in the late 1920s and the 1930s to demersal resources (haddock to yellowtail flounder) as the offshore trawl fishery developed. Next came increased landings of a variety of species, stimulated by meat shortages and high fish prices during the later years of the second world war and immediately after (hard clam to Atlantic mackerel). The final period, continuing to today, was characterized by concentration on certain resources temporarily abundant (sea scallop, black sea bass, summer flounder, scup, American lobster, and striped bass), but also including the period of rapid growth and subsequent decline of the industrial fisheries (menhaden and unclassified species) and the surf clam fishery. As in New York (McHugh 1972a), these changes were in response to changing abundance or availability of traditional species and changing economic conditions. Despite the obvious capacity of the industry to respond fairly quickly to such changes it was not possible to maintain maximum historic levels of total landings (Fig. 3), even of food fishes and edible shellfishes (figs. 5 and 2 respectively in McHugh 1972a).

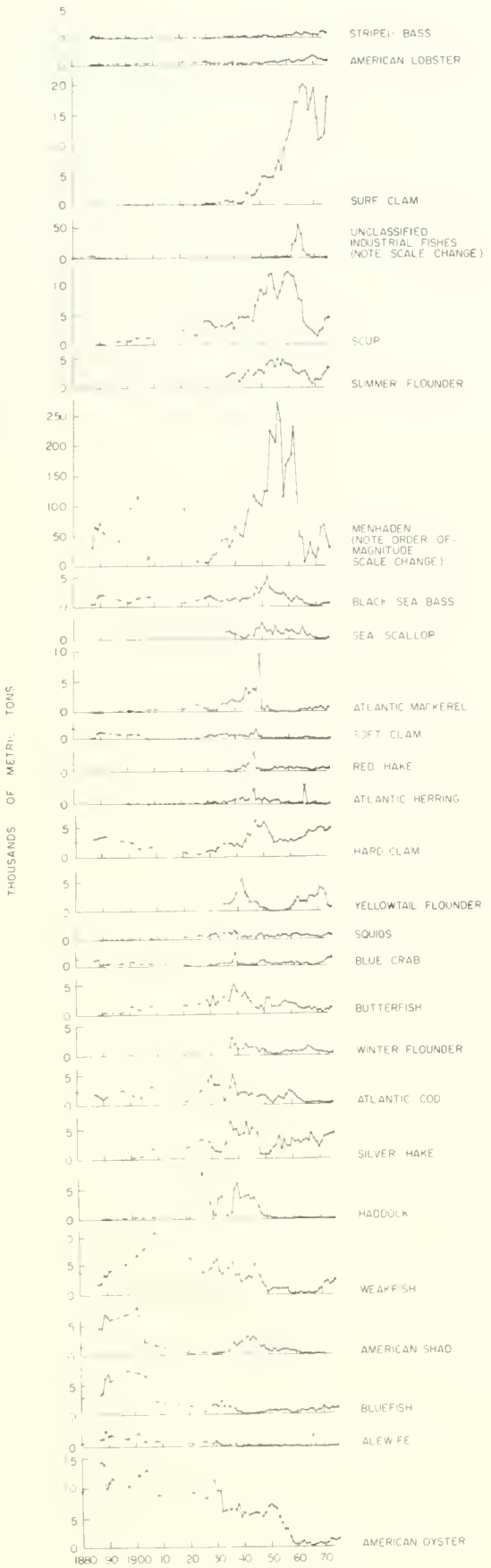
It is obvious that the declining fisheries of the New York Bight area have some predominantly domestic causes, not shared by some neighboring states to the north. In Rhode Island, for example, following a sharp decline in total landings from the late 1950s to 1964, the trend in total landings has been up. Most of the decline up to 1964 can be accounted for by a decline in industrial groundfish landings. Olsen and Stevenson (1975) described the commercial fishing industry in Rhode Island as thriving, and capable of expansion and diversification.

Even in New England, the epitome of a depressed

Table 49.--Historic trends in domestic landings of major commercial fishery resources of New York Bight (NY and NJ combined) since 1929, comparing resources not available to foreign fishermen with those vulnerable to foreign fishing. Weights in metric tons.

Landings in absolute values	Maximum catch (year)		Minimum subsequent catch (year)		Average catch since minimum	
	New Jersey	New York	New Jersey	New York	New Jersey	New York
Resources not available to foreign fleets:						
Food finfishes	8,745(1937)	3,362(1945)	552(1967)	347(1967)	1,520	1,033
Food shellfishes	21,468(1966)	9,881(1946)	12,136(1972)	2,314(1959)	12,664	4,453
Industrial species	220,639(1956)	62,713(1962)	5,918(1970)	291(1967)	34,448	2,479
Subtotals	232,105(1956)	66,391(1962)	28,115(1966)	5,067(1967)	52,218	9,093
Resources vulnerable to foreign fishing:	18,644(1949)	22,222(1939)	5,441(1969)	5,188(1970)	7,702	6,371

Percentage changes in landings	Percent decline from historic maximum to subsequent minimum		Percent decline from historic maximum to average for period following minimum	
	New Jersey	New York	New Jersey	New York
Resources not available to foreign fleets:	87.9	92.4	77.5	86.3
Resources vulnerable to foreign fishing:	70.8	76.7	58.7	71.3



American fishery, opinion is divided as to how bad things are. Substantial investment is being made in new domestic fishing vessels, and some experienced observers point out that energetic and hardworking fishermen are doing well (Townes 1975). They attributed most of this success to the Point Judith Fishermen's Cooperative and to the rise of Newport as a trawler port. Thus, the healthy conditions described refer largely to the otter trawl industry. Some other fisheries in Rhode Island appear to be much less healthy. The hard clam industry, for example, has declined by more than 80% from peak landings of about 2,300 metric tons of meats (5 million pounds) in 1955 to less than 400 metric tons (less than 850,000 pounds) in 1974. Olsen and Stevenson (1975) said that the hard clam resource is large and underutilized but also that if present trends in the fishery continue the harvest will continue to decline. The reasons for this apparent contradiction are not entirely clear. Certainly there is no scarcity of markets for hard clam if the upward trend in production from New York waters is any criterion. In this respect the commercial fishing industry is in better condition in the New York Bight area (especially New York State) than in Rhode Island.

The major domestic problems of commercial fisheries in the New York Bight area are sociopolitical and economic, aggravated by wide fluctuations in abundance of individual resources from natural causes. To a degree the industry has been able to cope with resource fluctuations by shifting from one species to another and by using different methods of fishing. An outstanding example of changes in fishing strategy in both states was the virtual replacement of fixed pound nets in the shore zone by more flexible otter trawls (Knapp in press) in the past 40 yr. This development not only allowed fishermen to follow the major species during their seasonal migrations, but also lengthened the fishing season from about 6 mo to a full year. This improvement in efficiency may have contributed to declining catches of some species by overfishing those resources. Development of a domestic trawl fishery proved to be an evolutionary trend in fishing strategy which eventually was adopted by much more efficient and massive foreign fleets in the 1960s, to the detriment of some domestic fisheries in the New York Bight area, including some recreational fisheries.

Domestic fishermen in the area have been handicapped by restrictive state laws, usually justified as conservation measures, but in reality serving only to perpetuate inefficiency and increase the cost of locating and catching fishes and shellfishes. Some of this legislation has been passed at the insistence of recreational fishermen, who want improved access to certain living resources and a greater share of the catch (Ginter 1974a, b). This question of who gets the catch has been pushed to extremes in repeated attempts in both states to declare striped bass a game fish and prohibit completely commercial fishing for that species. The rationale behind

Figure 43.—Historic landings of major species in the New York Bight area (New York and New Jersey).

the striped bass controversy is emotional, having nothing to do with scientific management. In fact, all available evidence points to the conclusion that, historically, fishing has not had an adverse effect on the striped bass resource. However, the history of the striped bass fishery and attempts to control fishing is an excellent example of the failure of domestic management to address itself to the central issue, namely, control of coastal fisheries for maximum benefit to the public and to the economy. Neither scientists, nor fishermen, nor legislators, nor fishery administrators have demonstrated a recognition that obtaining essential management information should have top priority.

In some ways an even better example of failure by the states to manage coastal fisheries is provided by the history of the surf clam industry. This began as a major fishery in the middle 1940s off New York and New Jersey. Peak landings were reached in the two states combined in 1966, but by 1973 and 1974 landings had dropped by about 43%. Meanwhile, the fishery has shifted steadily to the southward, as stocks on northern grounds have been reduced and new resources have been discovered. Most of the catch is now made off Virginia. This is a typical example of the evolution of an unregulated fishery, a history that has been repeated all too often around the coasts of the United States. The decline cannot be attributed, as declines of other molluscan shellfisheries have been, to water pollution, for most of the resource inhabits the continental shelf, away from coastal contamination.

One encouraging recent development has been that several coastal species have supported increasing catches in the 1970s, and these increases clearly have been made possible by increases in abundance. Major species in New York Bight which have shown such increases are scup, summer flounder, bluefish, weakfish, striped bass, and blue crab (McHugh 1976b). The reasons for these increases are not known, and there is no guarantee that they will continue. Some people have speculated that pollution abatement in the coastal zone has been a factor (Clark in press; McHugh in press b), but there is no proof that this is true. Recent agreements with other nations, which have reduced catches of certain food fishes of major importance to American fishermen, have been a step in the right direction. But the major unsolved problem is to improve incentives of the individual states to manage domestic marine fisheries wisely and to provide the means of achieving successful management of living resources of the coastal zone. Perhaps the recently developed State-Federal fishery management program will provide the incentive. Now that the United States has extended its jurisdiction to 200 miles, the states will be obliged to improve their scientific knowledge of coastal fishery resources and their fishery management capabilities.

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LITERATURE CITED

AHERN, M.
1974. Fish now for yellowtail! Long Island Fisherman Jan. 31, 9(5):8-9, 18.

ANONYMOUS.
1972. U.S. firm flies eels to Britain. Commer. Fish. Rev. 34(3-4): 8.

ARNOLD, E. L., JR.
1951. Northward dispersal of warm-water marine fishes in southern New England during the summer of 1949. Copeia 1951:87-88.

BIGELOW, H. B., and W. C. SCHROEDER.
1953. Fishes of the Gulf of Maine. U.S. Fish Wildl. Serv., Fish. Bull. 53, 577 p.

BOONE, J. V.
1976. Maryland's tidewater fishing forecast for 1976. Md. Dep. Nat. Resour., Commer. Fish. News 9(3):1, 3.

BRIGGS, P. T.
1962. The sport fisheries of Great South Bay and vicinity. N.Y. Fish Game J. 9:1-36.
1965. The sport fisheries for winter flounder in several bays of Long Island. N.Y. Fish Game J. 12:48-70.
1968. The sport fisheries for scup in the inshore waters of eastern Long Island. N.Y. Fish Game J. 15:165-185.

BUCHANAN, C. C.
1972. A comparison of sport fishing statistics from man-made and natural habitats in the New York Bight. Coastal Plains Center for Marine Development Services, Wilmington, N.C. Semin. ser. 1:27-37.

BURDICK, G. E.
1954. An analysis of the factors, including pollution, having possible influence on the abundance of shad in the Hudson River. N.Y. Fish Game J. 1:188-205.

BUTLER, P. A
1966. The problem of pesticides in estuaries. *In* A symposium on estuarine fisheries. Am. Fish. Soc., Spec. Publ. 3:110-115.

CLARK, J. R
[1962.] The 1960 salt-water angling survey. U.S. Dep. Interior, Bur. Sport Fish. Wildl., Circ. 153, 36 p.
In press. Status of estuarine ecosystems in relation to sportfish resources. U.S. Environ. Prot. Admin., Trienn. Rep. to Congr.

COLTON, J. B., JR.
1972. Temperature trends and the distribution of groundfish in continental shelf waters, Nova Scotia to Long Island. Fish. Bull., U.S. 70:637-657.

COOK, G. H
1857. King crabs or horse-feet. *In* Geology of County of Cape May, State of New Jersey, Part II., Economic Geology, p. 105-112.

DEUEL, D. G.
1973. 1970 salt-water angling survey. U.S. Dep. Commer., Natl. Mar. Fish. Serv., Curr. Fish. Stat. 6200, 54 p.
DEUEL, D. G., and J. R. CLARK.
1968. The 1965 salt-water angling survey. U.S. Fish. Wildl. Serv., Resour. Publ. 67, 51 p.
DEWLING, R. T., K. H. WALKER, and F. T. BREZENSKI.
1972. Effects of pollution: Loss of an $18 million/year shellfishery. *In* M. Ruivo (editor), Marine pollution and sea life, p. 553-559. Fishing News (Books) Ltd., London.
DOW, R. L.
1969. Cyclic and geographic trends in seawater temperature and abundance of American lobster. Science (Wash., D.C.) 164:1060-1063.
DRYFOOS, R. L., R. P. CHEEK, and R. L. KROGER.
1973. Preliminary analyses of Atlantic menhaden, *Brevoortia tyrannus*, migrations, population structure, survival and exploitation rates, and availability as indicated from tag returns. Fish. Bull., U.S. 71:719-734.
EARLL, R. E.
1887. New Jersey and its fisheries. *In* G. B. Goode, The fisheries and fishery industries of the United States, Sect. II, Part VII, p. 381-400. U.S. Gov. Print. Off., Wash., D.C.
EDWARDS, R. L.
1968. Fishery resources of the North Atlantic area. *In* D. Gilbert (editor), The future of the fishing industry of the United States. New Ser. 4:52-60. Univ. Wash. Pub. Fish.
EDWARDS, R. L., and F. E. LUX.
1958. New England's industrial fishery. Comm. Fish. Rev. 20(5): 1-6.
FOLSOM, W. B.
1973. Japan's eel fishery. Mar. Fish. Rev. 35(5-6):41-45.
FRAME, D. W., and S. A. PEARCE.
1973. A survey of the sea bass fishery. Mar. Fish. Rev. 35(1-2): 19-26.
GATES, J. M., and V. J. NORTON.
1974. The benefits of fisheries regulation: A case study of the New England yellowtail flounder fishery. Univ. R.I. Mar. Tech. Rep. 21, 35 p.
GINTER, J. J. C.
1974a. Marine fisheries conservation in New York State: Policy and practice of marine fisheries management. N.Y. State Sea Grant Program, Albany, N.Y., NYSSGP-SS-74-012, 64 p.
1974b. A catalog of marine fisheries legislation in New York State. N.Y. State Sea Grant Program, Albany, N.Y., NYSSGP-RS-74-013, 109 p.
GRAHAM, H. W.
1968. Trends in the marine fisheries of the Continental Shelf of the eastern United States. Trans. Am. Fish. Soc. 97:77-82.
HARKNESS, W. J. K., and J. R. DYMOND.
1961. The lake sturgeon: The history of its fishery and problems of conservation. Ont. Dep. Lands and Forests, 121 p.
HASKIN, H. H., L. A. STAUBER, and J. G. MACKIN.
1966. *Minchinia nelsoni* n. sp. (Haplosporida, Haplosporidiidae): Causative agent of the Delaware Bay oyster epixoötic. Science (Wash., D.C.) 153:1414-1416.
HENRY, K. A.
1971. Atlantic menhaden (*Brevoortia tyrannus*) resource and fishery—Analysis of a decline. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF 642, 32 p.
HILDEBRAND, S. F., and W. C. SCHROEDER.
1928. Fishes of Chesapeake Bay. U.S. Bur. Fish., Bull. 43, 366 p.
HOY, D. L., and G. M. CLARK.
1967. Atlantic mackerel fishery, 1804-1965. U.S. Fish Wildl. Serv., Fish. Leafl. 603, 9 p.
ICNAF (International Commission for the North Atlantic Fisheries).
1973. Annual report, Vol. 23, for the year 1972/73. Dartmouth, N.S., Can. 108 p.
JACOBSON, M. K., and W. E. OLD, JR.
1966. On the identity of *Spisula similis* (Say). Am. Malacol. Union, Ann. Rep. 1966:30-31.
JENSEN, A. C.
1972. The cod. Crowell, N.Y., 182 p.
1974. Sport fishing for cod. The Conservationist. N.Y. State Dep. Environ. Conserv. 28(6):15-19.
JUNE, F. C.
1958. Variation in meristic characters of young Atlantic menhaden, *Brevoortia tyrannus*. Cons. Perm. Int. Explor. Mer, Rapp. P.-V. Reun 143:26-35.
JUNE, F. C., and J. W. REINTJES.
1957. Survey of the ocean fisheries off Delaware Bay. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 222, 55 p.
KNAPP, W. E.
In press. Marine commercial fisheries of New York State: An analysis by gear. N.Y. State Sea Grant Institute, Albany, N.Y.
LANE, A. K., and R. C. CARLSON.
1968. An overview of the Connecticut industry. *In* Study of means to revitalize the Connecticut fisheries industry, chap. 2:2-1 to 2-44. John S. Burlew, Director. Marine Sci. Sect., R&D Dept., Electric Boat Div., Gen. Dynamics Corp. for the Connecticut Research Commission under contract No. RSA-66-8, Jan. 1968.
LEVENSON, A. M.
1971. Evaluation of recreational and cultural benefits of estuarine use in an urban setting. Center for Business and Urban Research, Hofstra Univ., Hempstead, N.Y., 121 p.
LoVERDE, E. A.
1963-1972. Commercial fisheries of New Jersey. *In* New Jersey landings, annual summaries. Natl. Mar. Fish. Serv. and N.J. Dept. Envir. Prot., Current Fish. Stat.
LUX, F. E.
1963. Identification of New England yellowtail flounder groups. U.S. Fish Wildl. Serv., Fish. Bull. 63:1-10.
LYLES, C. H.
1968. Fishery statistics of the United States 1966. U.S. Fish Wildl. Serv., Stat. Dig. 60, 679 p.
MANSUETI, R. J.
1961. Effects of civilization on striped bass and other estuarine biota in Chesapeake Bay and tributaries. Proc. Gulf Caribb. Fish. Inst., 14th Ann. Sess., p. 110-136.
MARSHALL, N.
1947. An abundance of bay scallops in the absence of eelgrass. Ecology 28:321-322.
MATHER, F.
1887. New York and its fisheries. *In* G. B. Goode, The fisheries and fishing industries of the United States, Sect. II, Part VI:341-377. U.S. Gov. Print. Off., Wash., D.C.
MATHER, F. J., III.
1974. The bluefin tuna is in trouble! Natl. Fisherman, Yearb. Issue 1974, p. 6-7, 110-112.
McHUGH, J. L.
1969a. Comparison of Pacific sardine and Atlantic menhaden fisheries. Fiskeridir. Skr. Ser. Havunders. 15:356-367.
1969b. Fisheries of Chesapeake Bay. Proceedings of the Governor's Conference on Chesapeake Bay, Wye Inst., Centreville, Md. II:135-160.
1972a. Marine fisheries of New York State. Fish. Bull., U.S. 70: 585-610.
1972b. Jeffersonian democracy and the fisheries. *In* Brian J. Rothschild (editor), World fisheries policy-multidisciplinary views, p. 134-155. Univ. Washington Press, Seattle.
1974. Biological consequences of alternative regimes. *In* G. Pontecorvo (editor), Fisheries conflicts in the North Atlantic: Problems of management and jurisdiction, p. 71:90. Ballinger Publ. Co., Cambridge, Mass.
In press a. Recreational use of shellfishes: Issues and conflicts. *In* Proc. seminar on coastal recreational resources in an urbanizing environment. Coop. Ext. Serv., Univ. Massachusetts.
In press b. Limiting factors affecting commercial fisheries in the middle Atlantic estuarine area. U.S. Environ. Prot. Admin., Triennn. Rep. Congr.
McHUGH, J. L., and R. S. BAILEY.
1957. History of Virginia's commercial fisheries. Va. J. Sci., New Ser. 8:42-64.
McHUGH, J. L., and A. D. WILLIAMS.
1976. Historical statistics of the fisheries of the New York Bight

area. New York Sea Grant Institute, Albany, N.Y., NYSSGP-RS-76-013, 73 p.

MEDEIROS, W. H.
1975. The Hudson River shad fishery: Background, management problems, and recommendations. New York Sea Grant Institute, Albany, NYSSGP-RS-75-011, 54 p.

MERRILL, A. S., and J. W. ROPES.
1969. The general distribution of the surf clam and the ocean quahog. Proc. Natl. Shellfish Assoc. 59:40-45.

MERRILL, A. S., and H. S. TUBIASH.
1970. Molluscan resources of the Atlantic and Gulf coast of the United States. Proc. Symp. Mollusca, p. 925-948.

MIYAKE, M. P., C. G. TIBBO, and J. MANNING.
1973. Statistical Bulletin, Vol. 3, Int. Comm. Conserv. Atl. Tunas, Madrid, 103 p.

NEVILLE, W. C., and G. B. TALBOT.
[1964.] The fishery for scup with special reference to fluctuations in yield and their causes. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 459, 61 p.

OLSEN, S. B., and D. K. STEVENSON.
1975. Commercial marine fish and fisheries of Rhode Island. Univ. R.I., Coastal Resour. Cent., Mar. Tech. Rep. 34, 117 p.

PEARSON, J. C.
1932. Winter trawl fishery off the Virginia and North Carolina coasts. [U.S.] Bur. Fish., Invest. Rep. 10, 31 p.

PERLMUTTER, A.
1959. Changes in the populations of fishes and in their fisheries in the Middle Atlantic and Chesapeake regions, 1930 to 1955. Trans. N.Y. Acad. Sci., Ser. II, 21:484-496.

RATHJEN, W. F.
1973. Northwest Atlantic squids. Mar. Fish. Rev. 35(12):20-26.

REINTJES, J. W., and C. M. ROITHMAYR.
1960. Survey of the ocean fisheries off Delaware Bay—Supplement Report, 1954-57. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 347, 18 p.

RETZSCH, W. C.
1975. A legislative and management plan for the recreational and commercial striped bass fisheries of New York State. New York State Assembly, Public Service Legislative Studies Program, Albany, 128 p.

ROPES, J. W., A. M. BARKER, and G. E. WARD, JR.
1972. The Atlantic coast surf clam fishery—1971. Mar. Fish. Rev. 34(11-12):48-54.

ROYCE, W. F., R. J. BULLER, and E. D. PREMETZ.
1959. Decline of the yellowtail flounder (*Limanda ferruginea*) off New England. U.S. Fish Wildl. Serv., Fish. Bull. 59:169-267.

SCHAAF, W. E.
1975. Status of the Gulf and Atlantic menhaden fisheries and implications for resource management. Mar. Fish. Rev. 37(9):1-9.

SHUSTER, C. N., JR.
1957. Xiphosura (with especial reference to *Limulus polyphemus*). Geol. Soc. Am., Mem. 67, 1:1171-1174.
1960. Xiphosura. *In* Encyclopedia of science and technology 14: 563-567. McGraw-Hill Book Co., Inc.

SMITH, C. L.
1975. Observed and perceived impacts of distant water fishing: Oregon otter trawl case. Mar. Fish. Rev. 37(4):13-15.

SMITH, H. M.
1915. Otter trawl fishery. Letter from the Secretary of Commerce transmitting communication from the Commissioner of Fisheries submitting a report on the otter trawl fishery. House Reps., 63rd Cong. 3rd Sess., Doc. 1519, Gov. Printing Off., Wash., D.C., 99 p.

STROUD, R. H.
1974. Bluefin tuna down the seine. Sport Fish. Inst. Bull. 251:1-2.

SUTHERLAND, D. F.
1963. Variation in vertebral numbers of juvenile Atlantic menhaden. U.S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. 435, 21 p.

TAYLOR, C. C., H. B. BIGELOW, and H. W. GRAHAM.
1957. Climatic trends and the distribution of marine animals in New England. U.S. Fish Wildl. Serv., Fish. Bull. 57:293-345.

TOWNES, B.
1975. New England fishing—Back from the brink? Natl. Fisherman Yearb. Issue 1975:22-23, 146.

U.S. DEPARTMENT OF COMMERCE.
1952-75. New Jersey landings. Curr. Fish. Stat.
1954-75. New York landings. Curr. Fish. Stat.

U.S. DEPARTMENT OF STATE.
1970a. Fisheries—Agreement between the United States of America and the Union of Soviet Socialist Republics. Treaties Other Int. Acts Ser. 7009, 7 p.
1970b. Fisheries in the Western Region of the Middle Atlantic Ocean. Agreement between the United States and Poland. Treaties Other Int. Acts Ser. 6890, 17 p.
1973a. Fisheries—Agreement between the United States of America and the Union of Soviet Socialist Republics. Extending the Agreement of December 11, 1970, and the Protocol of February 2, 1971, as extended. Treaties Other Int. Acts Ser. 7574, 3 p.
1973b. Fisheries in the Western Region of the Middle Atlantic Ocean. Agreement between the United States of America and the Polish People's Republic. Extending and Amending the Agreement of June 13, 1970, as Extended. Treaties Other Int. Acts Ser. 7659, 57 p.
1973c. Fisheries in the Western Region of the Middle Atlantic Ocean. Agreement between the United States of America and the Socialist Republic of Romania. Treaties Other Int. Acts Ser. 7761, 23 p.

U.S. FISH AND WILDLIFE SERVICE.
1945. Fishery Resources of the United States. U.S. Senate, 79th Congr., 1st Sess., Doc. 51, 135 p.

U.S. HOUSE OF REPRESENTATIVES.
1976. Fishery Conservation and Management Act of 1976. 94th Congr., 2nd Sess., Rep. No. 94-948, 60 p. U.S. Gov. Print. Off., Wash., D.C

WIGLEY, R. L.
1960. Note on the distribution of Pandalidae (Crustacea, Decapoda) in New England waters. Ecology 41:564-570.

WILLIAMS, A. B.
1974. Marine flora and fauna of the northeastern United States. Crustacea: Decapoda. U.S. Dep. Commer., NOAA Tech. Rep NMFS Circ. 389, 50 p.

WILLIAMS, A. D.
1975. Effects of foreign fishing on the coastal marine fisheries of New York State. N.Y. State Assembly, Public Service Legislative Studies Program, Albany, 140 p.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1977—797-197/113 REGION 10

388. Proceedings of the first U.S.-Japan meeting on aquaculture at Tokyo, Japan, October 18-19, 1971. William N. Shaw (editor). (18 papers, 14 authors.) February 1974, iii + 133 p. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

389. Marine flora and fauna of the northeastern United States. Crustacea: Decapoda. By Austin B. Williams. April 1974, iii + 50 p., 111 figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

390. Fishery publications, calendar year 1973: Lists and indexes. By Mary Ellen Engett and Lee C. Thorson. September 1974, iv + 14 p., 1 fig. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

391. Calanoid copepods of the genera *Spinocalanus* and *Mimocalanus* from the central Arctic Ocean, with a review of the Spinocalanidae. By David M. Damkaer. June 1975, x + 88 p., 225 figs., 4 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

392. Fishery publications, calendar year 1974: Lists and indexes. By Lee C. Thorson and Mary Ellen Engett. June 1975, iv + 27 p., 1 fig.

393. Cooperative Gulf of Mexico estuarine inventory and study—Texas: Area description. By Richard A. Diener. September 1975, vi + 129 p., 55 figs., 26 tables.

394. Marine Flora and Fauna of the Northeastern United States. Tardigrada. By Leland W. Pollock. May 1976, iii + 25 p., figs. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

395. Report of a colloquium on larval fish mortality studies and their relation to fishery research, January 1975. By John R. Hunter. May 1976, iii + 5 p. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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