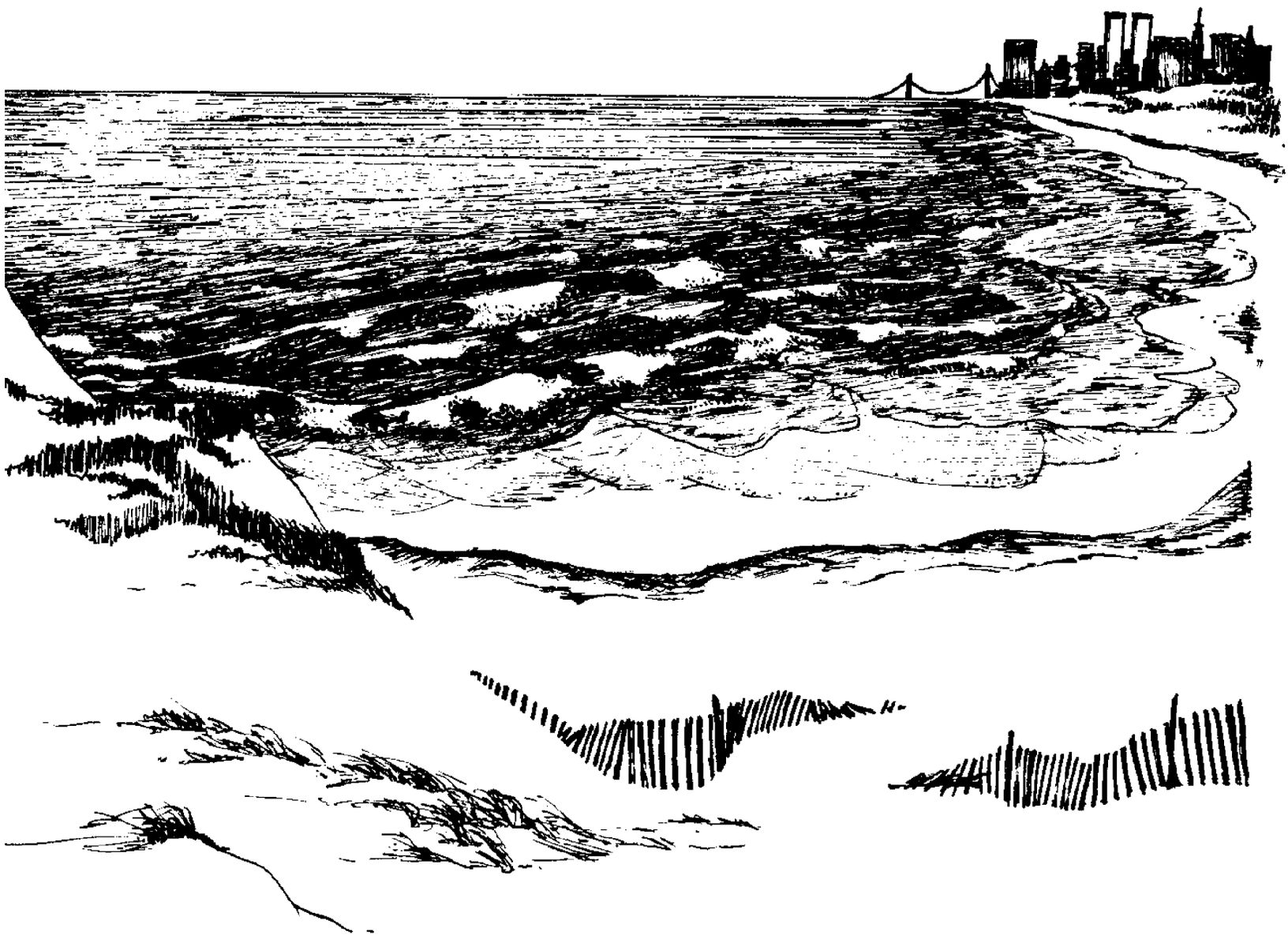
Fisheries

J.L. McHugh
Jay J.C. Ginter



MESA NEW YORK BIGHT ATLAS MONOGRAPH 16

The offshore water in the bend of the Atlantic coastline from Long Island on one side to New Jersey on the other is known as New York Bight. This 15,000 square miles of the Atlantic coastal ocean reaches seaward to the edge of the continental shelf, 80 to 120 miles offshore. It's the front doorstep of New York City, one of the world's most intensively used coastal areas—for recreation, shipping, fishing and shellfishing, and for dumping sewage sludge, construction rubble, and industrial wastes. Its potential is being closely eyed for resources like sand and gravel—and oil and gas.

This is one of a series of technical monographs on the Bight, summarizing what is known and identifying what is unknown. Those making critical management decisions affecting the Bight region are acutely aware that they need more data than are now available on the complex interplay among processes in the Bight, and about the human impact on those processes. The monographs provide a jumping-off place for further research.

The series is a cooperative effort between the National Oceanic and Atmospheric Administration (NOAA) and the New York Sea Grant Institute. NOAA's Marine EcoSystems Analysis (MESA) program is responsible for identifying and measuring the impact of man on the marine environment and its resources. The Sea Grant Institute (of State University of New York and Cornell University, and an affiliate of NOAA's Sea Grant program) conducts a variety of research and educational activities on the sea and Great Lakes. Together, Sea Grant and MESA are preparing an atlas of New York Bight that will supply urgently needed environmental information to policy-makers, industries, educational institutions, and to interested people.

ATLAS MONOGRAPH 16 describes the New York Bight area fisheries. First, McHugh provides details of trends in landings and their causes for major and minor food and industrial finfishes and shellfishes. Through a series of maps and graphs, McHugh presents the history of domestic commercial and recreational fisheries and foreign fisheries in the Bight area. The history of total domestic commercial landings is dominated by the menhaden catch. Food finfish landings have been dropping since 1939, whereas shellfish landings have been rising irregularly since 1942. Second, Ginter presents the history, composition, and regulation of foreign fisheries along the continental shelf from Georges Bank to Cape Hatteras. Ginter analyzes NMFS surveillance data for August 1969 through January 1977 for trends in seasonal movements, numbers of vessels, and national representation in the foreign fishing fleet. The numbers of foreign vessels have steadily decreased since 1972. The seasonal pattern has been basically northward in summer and autumn and southward in winter and spring, reflecting migrations of certain species.

Credits

Marjory Scarlet Simmons monograph editor
April Shelford, Paula Krygowski, Terry Slocum, Peter Croswell, L.J. List, and Kathleen Grove cartographers
Graphic Arts, SUNY Central Administration composition and pasteup
SUNY Print Shop printers
Mimi Kindlon cover and text design

ERRATA

MESA New York Bight Atlas Monograph 16
Fisheries

Page 5, Acknowledgments

Add the following two paragraphs:

Preliminary analyses were made under support of a fellowship with the Woodrow Wilson International Center for Scholars, Washington, DC, in the summer of 1971.

This monograph is contribution 203 of the Marine Sciences Research Center, State University of New York at Stony Brook.

Page 9, column 2, last paragraph

Line 10 should read: fisheries beyond 3 nmi from the coast in the area between

Page 52, column 2

Title of illustration should read: **Short-finned Summer Squid**

Paragraph 1 subheading should read: **Short-finned Summer Squid** (*Illex illecebrosus*).

Marine EcoSystems Analysis (MESA) Program
MESA New York Bight Project

Fisheries

J.L. McHugh
Jay J.C. Ginter

MESA NEW YORK BIGHT ATLAS MONOGRAPH **16**

New York Sea Grant Institute
Albany, New York
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Jay J.C. Ginter, MS, studied marine fisheries management under Prof. J.L. McHugh, specializing in political aspects of domestic and international fisheries. He has worked for New York Sea Grant as assistant to the Director for Special Projects and for the NOAA Office of Marine Resources as Ocean Policy Study Intern. He is currently continuing his education in marine resource management at the University of Washington in Seattle.

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Historic Fish and Shellfish Landings and Trends

J.L. McHugh

Acknowledgments

Many people provided material and ideas and corrected errors, thereby adding to the usefulness and accuracy of this study. For recent data on domestic commerical landings we are indebted to John Wise and Frank Riley of the National Marine Fisheries Service. Information on foreign catches was supplied by Richard Hennemuth and Marvin Grosslein of the same organization.

Permission to use drawings of fish species previously published in the *Anglers' Guide to the United States Atlantic Coast* (Freeman and Walford 1974*a,b*) and fish and shellfish species from other sources was given by Bruce Freeman of the National Marine Fisheries Service. Illustrations of species not available from this source were drawn by J.L. McHugh from figures in Bigelow and Schroeder (1953) and other noncopyrighted sources.

To the many who helped in various ways but are not mentioned here by name I offer my sincere thanks.

Manuscript accepted January 1977, revised September 1977.

Abstract

The New York Bight area has been an important fishing ground since the seventeenth century. Records of domestic commercial landings in New York and New Jersey are available from 1880 for many marine fish and shellfish species; records of saltwater sportfish catches are available for 1960, 1965, 1970, and not yet available in detail for 1974. Recreational catches are by broader sections of the coast, not by states.

Bight area foreign fishing began on the continental shelf in the area in the 1960s; annual records are available since that time. Total domestic commercial landings in the two Bight area states reached a peak of about 315,000 metric tons (694.6 million lb) as recently as 1956, but dropped to less than 30,000 metric tons (66 million lb) in 1975. Most of this decline was caused by the decline of the menhaden industry, based on a species not used for human food. The catch of food finfishes has been declining since 1939, but the catch of shellfishes has followed an upward trend since 1942. To some degree, the declining food finfish catch has been balanced by increases in saltwater sportfish catches. Details of trends in landings and their causes are given for 14 major food finfishes, 6 species or groups of species used primarily for industrial purposes (bait, oil, and fish meal), and 6 major crustacean and molluscan shellfish resources. Briefer accounts of 17 minor species are given.

Introduction

The New York Bight area has been an important fishing ground since colonial days. The first whaling by colonists of the new world began on Long Island, NY, about 1640; already the settlers had learned to use the abundant fishes and shellfishes around their shores. For a long time the *fisheries** were the most important source of income to Long Island and to most communities along the New Jersey coast. Agriculture in the area also benefited from the resources of the sea, for the unproductive sandy soil of the coastal lowlands was enriched by plowing in menhaden, horseshoe crab, and other fishes and shellfishes. Today, commercial and recreational fisheries still are important to the economy of the coastal regions.

The best historical records of the fisheries come from a series of commercial fishery statistics gathered and published by the federal government in coopera-

* Fishery is a generic term that can be applied to any aspect of catching or processing fishes and shellfishes. The term can be applied to catching with a certain type of gear (a trawl fishery), or to catching a certain species (a hard-clam fishery). A fishery may be identified in terms of the product (a shellfishery), or the term may even be applied to a geographic area (the fishery or fisheries of New York Bight).

tion with the states.* These records begin in 1880, but prior to 1929 only 12 scattered years of data exist. From 1929 inclusive the series is almost unbroken, with only four years missing. The records are published state by state; the best approximation to domestic commercial catches in the Bight is derived by combining landings for New York and New Jersey. This includes parts of Long Island Sound and Delaware Bay, not properly parts of the Bight. It may also include catches made outside of the Bight proper. To some extent, this may be balanced by catches made inside the Bight and landed elsewhere.

The distinction between catches and landings must be recognized. *Catches* are those fishes and shellfishes known to have been taken in the waters of an area. *Landings* are catches delivered to a port in the area, but not necessarily caught in local waters.

It would be preferable to base this section of the monograph on catches from the waters of the Bight, but the statistics, at least until recently, are based on commercial landings in New York and New Jersey ports. Undoubtedly some were fishes and shellfishes caught in other waters, perhaps taken by fishing vessels registered in other states. Some fishes and shellfishes caught in Bight waters, on the other hand, have been landed in other states.

Domestic commercial landings alone do not tell the whole story. Substantial recreational catches are made as well in the Bight. Recreational catches of some species apparently far exceed commercial catches of the same species. To some extent, the growing sport fisheries in this area have balanced declining commercial catches.

Records of saltwater sport fish catches are less satisfactory than commercial for two principal reasons. First, national surveys of recreational marine fishing have been made only four times—in 1960, 1965, 1970, and 1974. Only a brief preliminary report of the last survey has been published. Second, it is not possible to separate the Bight from other sections of the coast because recreational catches were reported by broader areas. New York was included with the North Atlantic region (Maine to New York inclusive) and New Jersey with the Middle Atlantic region (New Jersey to Cape Hatteras inclusive).

Also not to be ignored are the foreign fisheries in international waters of the Bight. These were of minor concern to New York and New Jersey until the middle 1960s, when fishing fleets from Europe, and later from much farther away, began to move south onto Georges Bank, and as far south as Cape Hatteras. Statistics on these catches have been published by the International Commission for the Northwest Atlantic Fisheries (ICNAF) since the early 1950s. Foreign catches in ICNAF Division 5Z (Georges Bank and Nantucket Shoals) and Subarea 6 (south and west of 5Z) are included in Maps 1-26. Beginning in 1968, Division 5Z was divided into a western (5Zw) and an eastern subdivision (5Ze).

Passage of Public Law 94-265, the Fishery Conservation and Management Act of 1976, has altered the situation. Among other things, PL 94-265 extended domestic fishery jurisdiction to 200 nautical miles (nmi) from the coast. As a consequence, the United States terminated its membership in ICNAF, effective 31 December 1976, and on 1 March 1977 assumed responsibility for management of all fisheries over the US continental shelf, domestic and foreign, unilaterally.

Maps 1-26 show the history of domestic commercial and recreational fisheries and foreign fisheries in the Bight from 1960-75. The series starts with 1960, the earliest year for which estimates of recreational catches are available. Prior to the early 1960s, no foreign fishing vessels except the Canadian sea-scallop fleet were operating on Georges Bank or south of Cape Cod. The full sweep of recorded history can be shown only for the domestic commercial fisheries illustrated in Figures 1-31. These show, for New York and New Jersey combined, all available data on commercial landings since 1880.

On Maps 1-26 commercial landings are given for New York and New Jersey separately to provide clues as to the geographic distribution of a species. If landings in New York are substantially larger than in New Jersey, the species is probably a northern species. If landings in New Jersey are much larger, the species probably is a southern, warm-water form. Domestic commercial landings for the North Atlantic and Middle Atlantic regions of the coast are also given because these correspond approximately to the regions for which recreational catches have been

* Most of the data on which this monograph is based came from statistical publications of the National Marine Fisheries Service (NMFS) of the US Department of Commerce, individual state landings produced jointly by federal and state governments, and statistical publications of the International Commission for the Northwest Atlantic Fisheries (ICNAF). Numerous other publications were consulted. Rather than list extensive references, the pertinent statistical publications are cited in the reference section, together with some recent publications and unpublished papers by the author, his students, and some others. These documents cover the subject matter in greater detail and include extensive lists of literature cited.

reported, thus allowing direct comparison. Foreign catches are given only for ICNAF Division 5Z and Subarea 6, because it is assumed that foreign fisheries in ICNAF areas farther north have not competed with domestic fisheries in the Bight, or if they did, such competition was negligible. ICNAF Division 5Ze is Georges Bank, 5Zw is Nantucket Shoals and vicinity, and Subarea 6 includes the Bight. Subarea 6 corresponds approximately to the Middle Atlantic region of domestic commercial and recreational landings, with the exception that New York is included in Subarea 6, whereas the New England region of recreational catch statistics includes New York.

Weights of mollusk shells have been added to domestic commercial landings to make them comparable to ICNAF figures. ICNAF statistics are given in live weight (nominal weight). Federal government statistics for domestic commercial fisheries do not include mollusk shells. Therefore, ICNAF statistics for US landings of all mollusks except squids are higher than official US figures. Neither method is totally satisfactory for comparison, because bivalve mollusks dominate the domestic commercial fisheries of the Bight, whereas they are a relatively minor component of foreign catches in the area. Available estimates of recreational landings do not include mollusks, and therefore are live weight. Figures 1-31 do not include the weight of mollusk shells.

Domestic catches of most fish and shellfish species are often reported inaccurately. It is generally accepted that domestic commercial landings are under-reported, whereas recreational catches are exaggerated. The degree to which the figures are in error is not known. In the commercial fishery, at least, the bias almost certainly varies from species to species and from fishery to fishery, depending on the degree of organization of that segment of the industry. Only in a few local fisheries, at a few places around the US coast, have attempts been made to estimate the accuracy of the figures. In Louisiana, for example, it was concluded that the blue crab catch is much larger than reported landings.

Other sources of error may exist. Recreational fishing pressure may shift from one resource to another as abundance varies, or for other reasons. The numbers of recreational marine fishermen have been increasing, which means that even in the absence of changes in abundance of the resource, the total catch would increase. Shifts in consumer preferences may affect commercial catches or landings. Size and composition of fishing fleets may vary with time, and they may shift to other fishing grounds for various reasons. Reporting systems may have improved, as they certainly have done for some of the more important species. These things mean that available statistics of gross landings or catches must be interpreted with caution, and then only by someone with considerable knowledge of the fisheries in question. Despite all these imperfections, sufficient evidence is available from other sources to convince this author that the major trends are meaningful and can be traced to their causes.

In 1973, ICNAF proposed a unique management plan for the fisheries of Subareas 5 and 6. Individual quotas (total allowable catches) were to be set for major species. On top of this, a second-tier quota, substantially less than the sum of the individual quotas, was to be imposed to make allowance for unavoidable incidental catches of the major species and for energy exchanges between stocks. It was hoped that this new method of regulation would correct interactions between the various species and stocks and the fisheries, leading not only to improvements in condition of the stocks most in need of regulation but also to an increase in total biomass (gross weight) of all living resources in the area. Such a two-tier quota was put into effect in 1974, and continued with modifications in 1975 and 1976. Individual quotas (Table 1), were set for major species or groups of species in 1976 which totalled 815,000 metric tons (1.8 billion lb), but the second-tier quota for all finfish species and squid combined was 650,000 metric tons (1.4 billion lb). These quotas were further subdivided and allocated by country (Table 2).

Beginning 1 March 1977, under the provisions of PL 94-265, management of domestic and foreign fishing in the 200 nmi zone became the responsibility of eight regional fishery management councils established under the act. The Mid-Atlantic Regional Fishery Management Council, with membership representing New York, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia, is responsible for developing fishery management plans for the major fisheries 3 nmi from the coast in the area between Montauk Point, LI, and Chesapeake Bay; for determining if a surplus exists over and above what US fishermen can catch and market, and; for approving permits to foreign fleets to take allowable surpluses. The 12 nmi limit of domestic fishery jurisdiction no longer applies. Beginning 1 March 1977 foreign fishing within 200 nmi of the US coast was allowed only by special permit.

Total Catches

The total domestic commercial catch of all species in the Bight has fluctuated widely over the last century. The historical record falls into three distinct periods. The first period, from 1880 to 1926, is difficult to interpret because so many years are missing from the record. Two principal features stand out, however: first, total landings fluctuated widely during this period and second, the trend was downward. A plausible explanation is that most of these variations were related to economic events rather than to a dwindling supply of fish and shellfish. Certainly, the low point in the next period, in the late 1920s and early 1930s, was caused by economic conditions, for this was the period of the great economic depression when organized fisheries declined all over the world. Each low point in total commercial landings in the 1880-1932 period coincided with a recorded economic contraction.

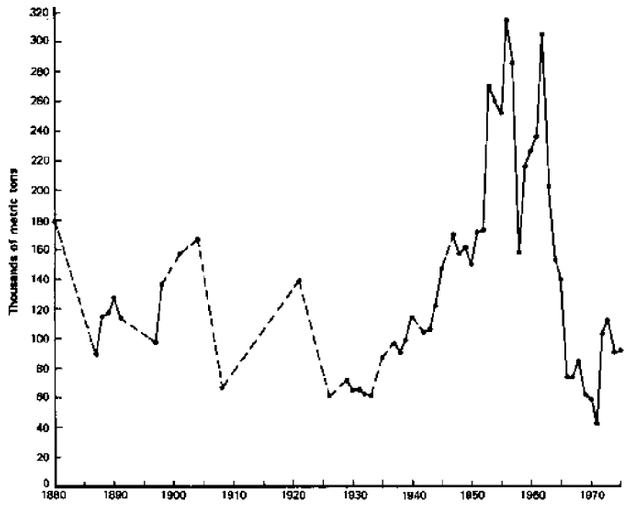


Figure 1. Total commercial landings of marine fishes and shellfishes in the New York Bight area, 1880-1975

The second period, 1929-62, was characterized by a sharp recovery from the depression low of 1933. The rise was stimulated by meat rationing during the 1940s, but it had its beginnings in the late 1920s when some enterprising fishermen found the wintering grounds of many coastal species on the outer continental shelf off Chesapeake Bay. A thriving offshore winter trawl fishery developed from this discovery. The even more rapid rise after 1945 was caused mainly by the phenomenal growth of the industrial fishery, based primarily on menhaden, which is manufactured into oil and meal. The stimulus for expansion of this fishery was the collapse of the Pacific Coast sardine industry in the 1940s, which opened up markets to Atlantic Coast producers. The sharp drop in total landings to 1958 and almost equally sharp recovery to 1962 were caused by wide fluctuations in the supply of menhaden, caused by variations in success of spawning.

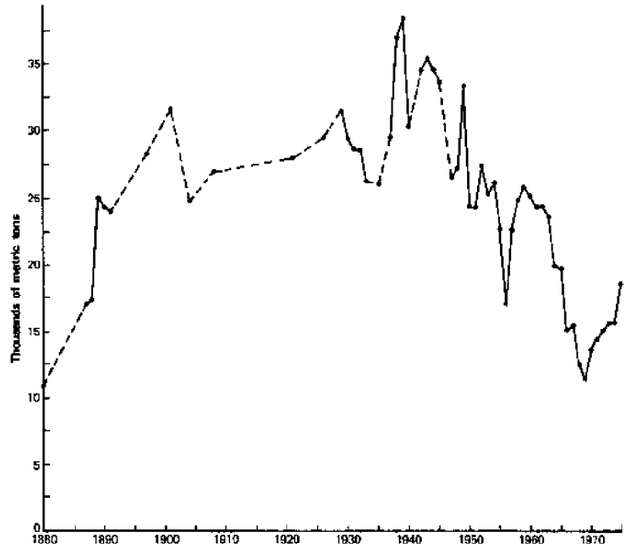


Figure 2. Total landings of commercial marine food finfishes in the New York Bight area, 1880-1975

The third period, 1962-75, showed a precipitous decline in total landings created by collapse of the menhaden industry in New York State and a substantial drop in New Jersey menhaden landings. During this period, most of the menhaden factories north of Virginia closed. Much of the rise after 1971 reflects a

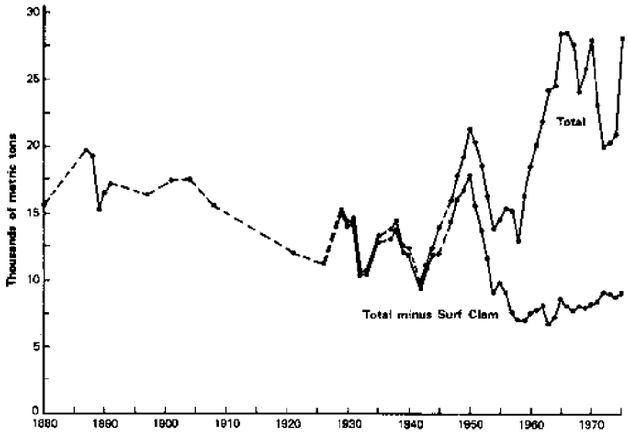
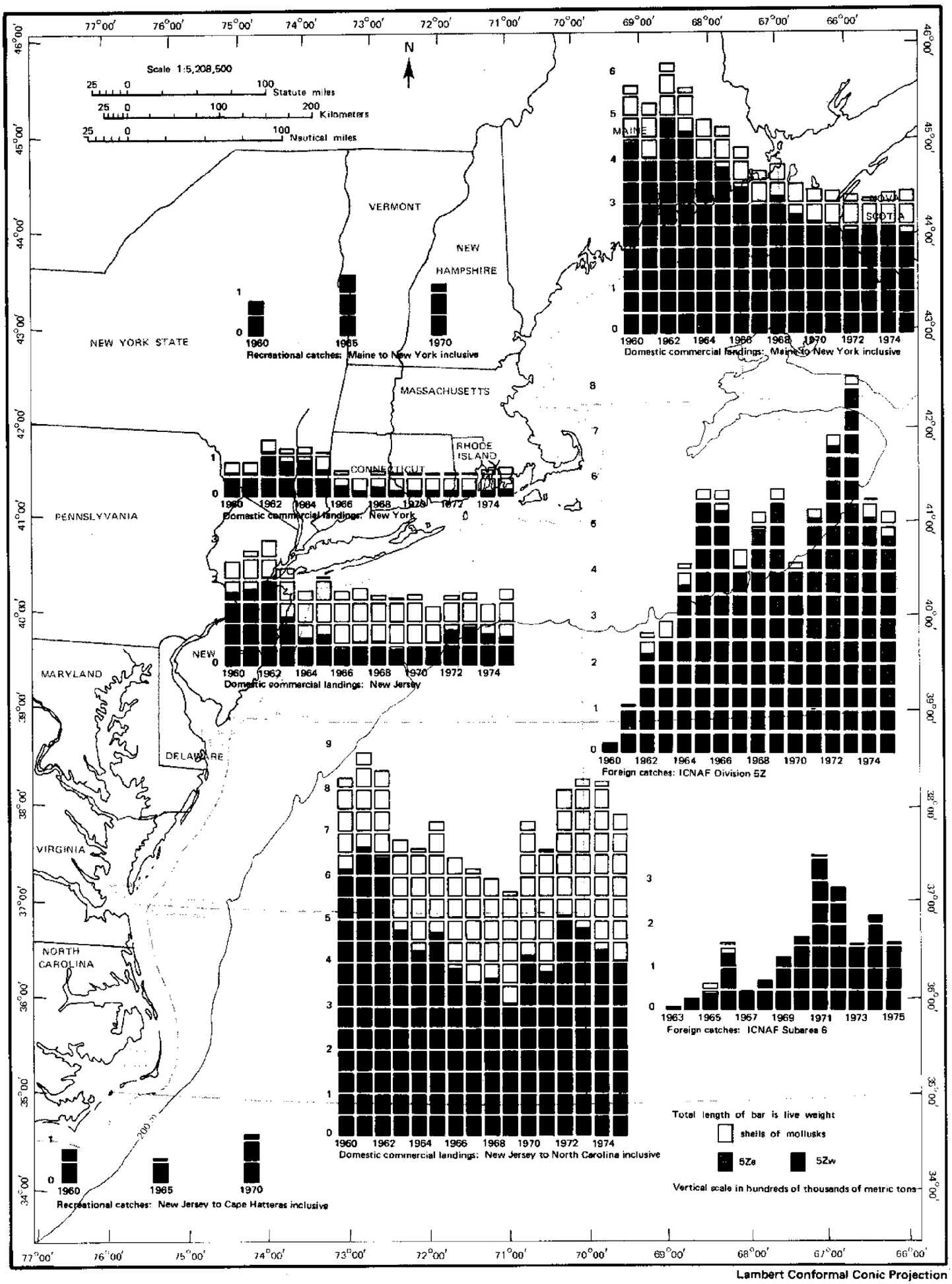


Figure 3. Total landings of commercial marine food shellfishes in the New York Bight area, 1880-1975

Map 1. Total catches



local and probably temporary resurgence of menhaden abundance. Contributing also to this rise were increases in abundance from unknown causes of several coastal species, like striped bass, scup, blue crab, hard clam, weakfish, bluefish, and summer flounder. The 1970s may mark the beginning of a new period in which some previously important food fishes will continue to increase in abundance if unilateral management measures contemplated by PL 94-265 succeed.

As already stated, the history of total domestic commercial landings is dominated by the menhaden catch. Fisheries for human food have had a different history. Food finfish landings have been dropping since 1939, whereas shellfish landings have been rising irregularly since 1942. The trend of shellfish landings almost certainly would have been downward also, had it not been for the phenomenal postwar growth of the surf clam industry.

The decline of the domestic commercial food fisheries in the Bight area cannot be attributed primarily to foreign fishing. Catches had dropped substantially before the postwar expansion of foreign fishing began. Foreign fishing was an added burden at a time when many segments of the domestic fisheries were already in trouble. The new extension of domestic jurisdiction to 200 nmi will at best eliminate a symptom, not a fundamental cause, of the major problems of US domestic fisheries. American fishermen were prevented from making catches only by economic and sociopolitical forces (higher costs and restrictive laws). These catches were taken instead by foreign fishermen.

The greatest total domestic commercial catch on record in the Bight was about 314,800 metric tons (694 million lb) in 1956, of which about 87% by weight was menhaden. Greatest landings of food fishes were in 1939, and greatest shellfish landings in 1965. About 70% by weight of the shellfish landings was surf clam meats. Shells of mollusks are not included in these figures, but are included in Map 1.

Landings and Catches by Species

Marine fishery statistics usually list finfishes and other marine animals separately. That practice has been followed here. In addition, it is useful to separate finfishes and shellfishes used as human food

Table 1. Quota arrangements for 1976 in ICNAF Subareas 5 and 6 set by ICNAF for finfishes and squids

Species or Group of Species	Total Allowable Catch by All Nations[a] (metric tons)
Yellowtail flounder	20,000
Other flounders	20,000
Atlantic cod	43,000
Atlantic mackerel	254,000
Haddock	6,000
Silver hake	103,000
Red hake	42,000
Atlantic herring	69,000
Squids	74,000
Pollock	17,000
Redfish	17,000
Other finfishes	150,000
Grand total (first-tier quota)	815,000
All species combined (second-tier quota)	650,000

[a]All finfish species including dogfish sharks and squids. Menhaden, billfishes, tunas, and large sharks are not included.

Source: Hennemuth 1975

Table 2. Allocation of second-tier quota for 1976 among nations in ICNAF Subareas 5 and 6 combined

	Metric Tons[a]
Bulgaria	14,400
Canada	18,000
Cuba	21,000
France	2,950
Federal Republic of Germany	14,900
German Democratic Republic	48,750
Italy	6,800
Japan	18,000
Poland	76,500
Romania	3,850
Spain	16,000
Soviet Union	177,250
United States	230,000
All others	1,600
Total	650,000

[a]All finfish species including dogfish sharks and squids. Menhaden, billfishes, tunas, and large sharks are not included.

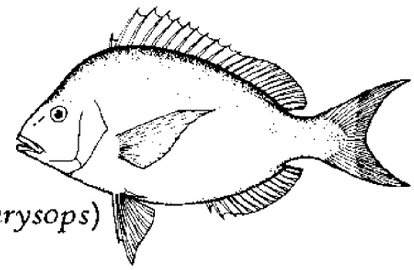
Source: Bowman and Smith 1976

from those used for industrial purposes, any uses other than as food for humans. Within each of these categories, species have been listed in descending order of weight of maximum historic domestic commercial landings in New York and New Jersey combined to provide a rough index of relative abundance in the area.

Food Finfishes

This category includes the major edible commercial fish species, many also important to saltwater sport fishermen. According to available estimates, for some of these species the recreational catch is much larger than the commerical catch.

Scup



(*Stenotomus chrysops*)

Scup or porgy was the most important food finfish in the New York Bight area from the late 1940s to the late 1960s. It has also been a leading saltwater sport fish. Combined commercial landings in New York and New Jersey reached a peak in 1960 of about 12,250 metric tons (27 million lb), then dropped to a low of about 1,360 metric tons (3 million lb) in 1971. Increased recreational and commercial catches since 1971 confirm observations that scup have increased in abundance recently in the Bight area.

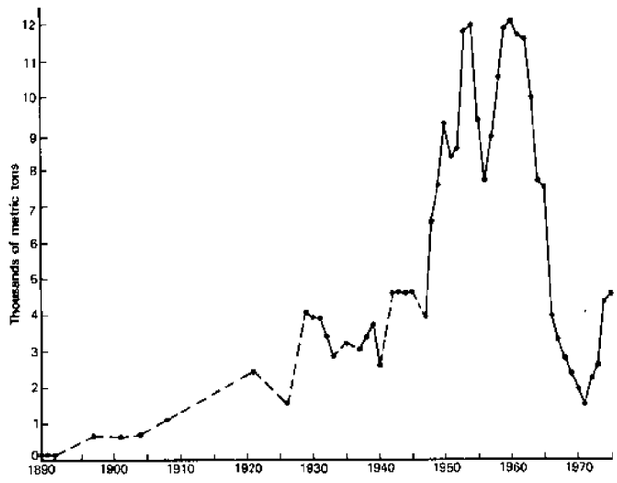


Figure 4. Commercial landings of scup in the New York Bight area, 1889-1975

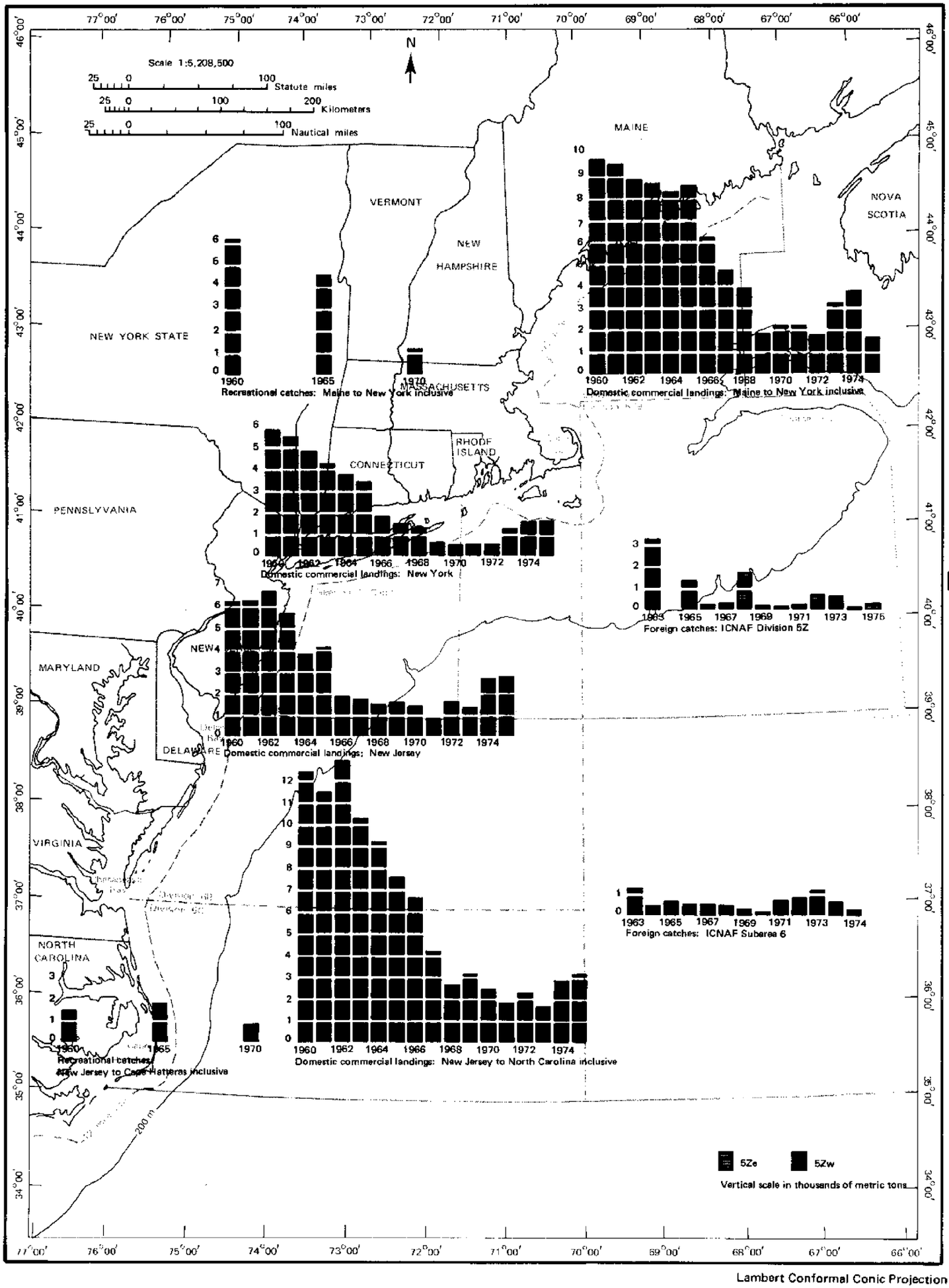
Foreign catches of scup have not been large according to ICNAF statistics, but foreign catches, however small, added to domestic catches impose a strain on the resource when abundance is low. ICNAF did not set a specific quota on scup catches, but the second-tier quota of 650,000 metric tons (1.4 billion lb) for 1976 was expected to limit the scup catch.

Scup spawn inshore in the Middle Atlantic Bight in early summer. Buoyant developing eggs drift with the water currents until they hatch. Adults and young remain in the coastal zone until late fall, then migrate southward and offshore to spend the winter in relatively deep water at the edge of the continental shelf from where they return to coastal waters in spring.

Scup is known to be sensitive to changes in environmental conditions; such changes affect spawning success. It is not known which environmental variables are most important. The recent sharp decline in commercial landings and sport catches reflected a real decrease in abundance. It is probable that the decline was caused by a combination of natural environmental change and effects of fishing. Water pollution could have been partly responsible, but no direct evidence for substantiation exists.

The future of the scup fishery and resource is impossible to predict. No estimate of *maximum sustainable yield* (the greatest catch that can be taken without affecting the capacity of the resource to renew itself) is available. The large uncontrolled recreational fishery will make management very difficult, and the combined effects of fishing and the environment on spawning success and future abundance will probably be the major determinants for some time to come.

Map 2. Scup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VIRGINIA
NORTH CAROLINA
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Domestic commercial landings: Maine to New York inclusive
Domestic commercial landings: New York
Foreign catches: ICNAF Division 5Z
Domestic commercial landings: New Jersey
Foreign catches: ICNAF Subarea 6
Recreational catches: New Jersey to Cape Hatteras inclusive
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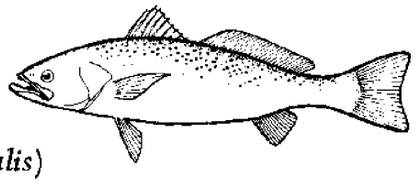
Weakfish



(*Cynoscion regalis*)

Weakfish, gray sea trout, or squeteague, is an esteemed migratory food fish of the coastal zone, prized by recreational and commercial fishermen. It is notably variable in abundance from natural causes, but the trend of commercial landings in the New York Bight area, as along the entire Atlantic coast, has been downward for at least 60 years. Toward the end of the nineteenth century, most of the Atlantic coast weakfish catch was landed, and probably caught, in the Bight. After a period of relatively great abundance and large catches in the 1940s, abundance dropped to an all-time low in the 1960s. For 11 years, reported annual commercial landings in New York State were less than 27 metric tons (100,000 lb). Recently, weakfish has become more abundant in the area and commercial and recreational catches have risen substantially. The species ranked nineteenth by weight in saltwater sport catches north of Cape Hatteras in 1960, twenty-third in 1965, tenth in 1970, and fifth in 1974. This is a temperate-water fish. Landings in New York have always been less than in New Jersey. The reported sport catch about equals the commercial catch.

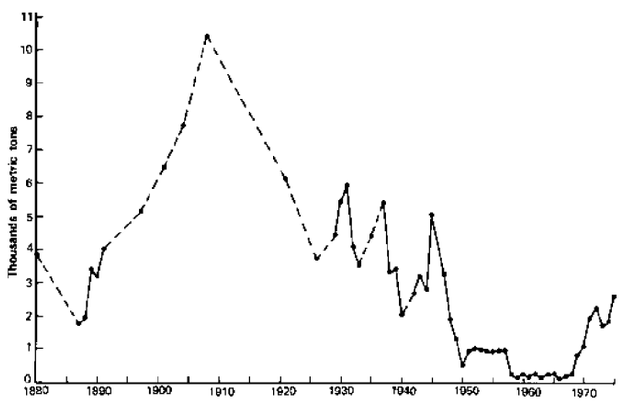


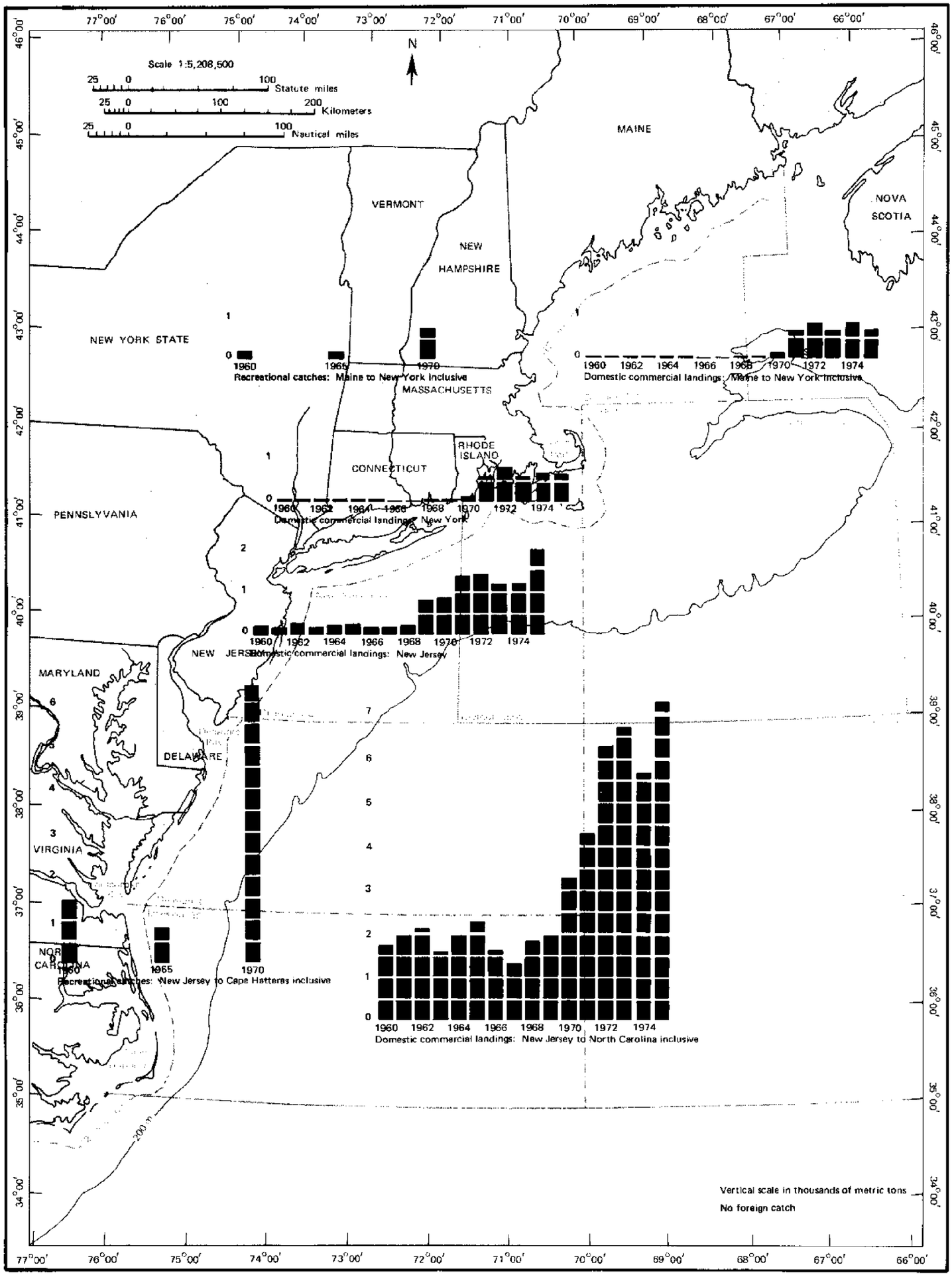
Figure 5. Commercial landings of weakfish in the New York Bight area, 1880-1975

Weakfish once was important in the domestic winter-trawl fishery on the continental shelf off Chesapeake Bay, but catches offshore decreased with declining abundance. The species has not been reported in foreign catches, but it is possible that some are taken incidentally on the continental shelf in fisheries directed at other species, especially in winter.

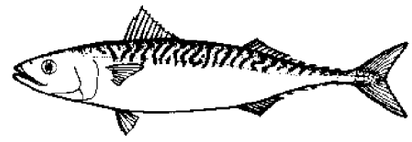
South of Cape Hatteras to Florida, weakfish is a year-round resident, but to the north it appears only in summer and early fall, migrating as far north as the Gulf of Maine. In the four surveys of saltwater angling, the average weight of weakfish taken in the Northern Atlantic region was somewhat greater than in the Middle Atlantic region, probably because older and larger fish migrate farther north, as do menhaden and some other migratory coastal species. Spawning occurs mostly in spring and early summer, often within the estuaries. Buoyant developing eggs drift with the water currents. It is believed that there are at least two stocks of weakfish, one in the Middle Atlantic Bight and one to the south.

Weakfish is taken by a variety of fishing gears, in all seasons, and at various parts of the coast, and there is a large recreational catch. For these reasons, the fishery will be very difficult to regulate. It is likely that wide variations in abundance will continue and that if the long-term downward trend in abundance levels off, as it appears to have done recently, the catch probably will reach a fluctuating equilibrium at a relatively low level. The long-term decline in commercial catches undoubtedly has been made up for in part by increased recreational catches.

Map 3. Weakfish



Atlantic Mackerel



(*Scomber scombrus*)

Mackerel was a very popular food fish in the nineteenth century. Records of catches for the entire Atlantic coast are available since 1804. The American mackerel fleet operated from the Gulf of St. Lawrence to Virginia. The maximum recorded catch was in 1884. In the twentieth century, demand for the species has declined, and the supply available to American fishermen has been erratic. South of Cape Cod, landings have been relatively small. In the New York Bight area, the largest domestic commercial landings on record were in 1949, when red meat was still somewhat scarce after the war. The fishery subsequently declined in importance, partly because the resource had temporarily decreased in abundance from natural causes. Since 1960, estimated recreational catches have exceeded domestic commercial catches considerably.

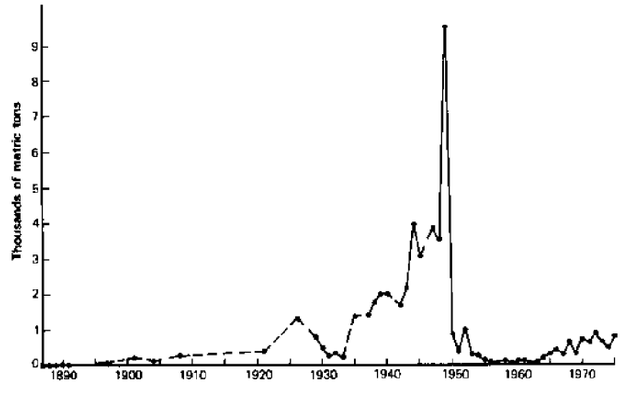


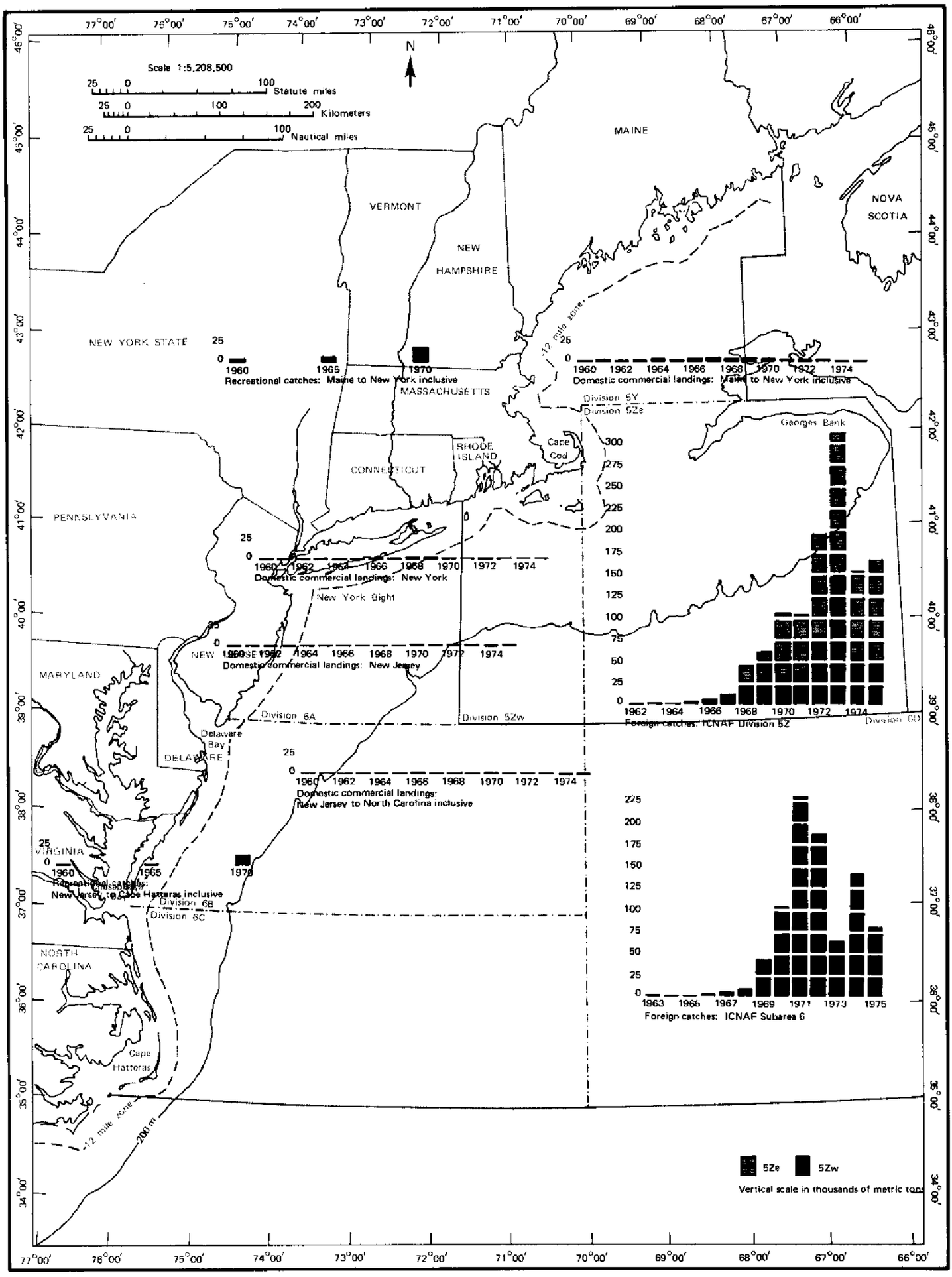
Figure 6. Commercial landings of Atlantic mackerel in the New York Bight area, 1887-1975

Since the mid-1960s, foreign catches of Atlantic mackerel have increased sharply. This is now one of the major species in foreign catches in the Northwest Atlantic. In ICNAF Subareas 5Z and 6, recent foreign catches have been four or more times as large as the greatest total US catch on record, and very much larger than recent domestic catches. Other nations fishing in this region shifted their attention in the late 1960s to Atlantic mackerel, Atlantic herring, and other pelagic species for which there have been limited domestic demand and relatively small domestic commercial fisheries. This carried the additional advantage that it required foreign fishermen to operate their nets at mid-depth or at the surface, easing the strain on traditional American stocks of groundfish. This solution may be less acceptable to recreational fishermen than it is to the domestic commercial fishing industry because many popular sportfish resources, including Atlantic mackerel, live in the upper waters of the ocean. The saltwater sport catch of Atlantic mackerel dropped from third to seventh place by weight from 1970 to 1974.

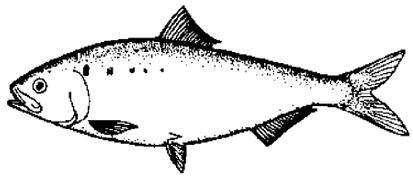
On the American side of the North Atlantic, Atlantic mackerel ranges from the Gulf of St. Lawrence to North Carolina. It spends the winter near the edge of the continental shelf and moves inshore in spring and summer, often in large, dense schools. Spawning occurs over a wide area of the continental shelf, usually in spring. Buoyant developing eggs drift with the water currents.

Commercial demand for mackerel in the United States is small, but the recreational catch is large. The ICNAF quota for 1976 was by far the largest for any species in the region, 254,000 metric tons (560 million lb) for Subareas 5 and 6 combined, most taken by foreign fishermen. By 1976, scientists were much less optimistic about the condition of the resource, and it is clear that in the future a quota much lower than that set for 1976 will be necessary. Some domestic fishermen, especially in the recreational fisheries, believe that the mackerel stocks should be allowed to build up as rapidly as possible. They propose that this be done by allowing no directed fishery for Atlantic mackerel by foreign fishermen. Scientists have estimated that the standing crop of mackerel in the area from Newfoundland to North Carolina has declined from 2.2 million metric tons (4.8 billion lb) in 1969 to about 600,000 metric tons (1.3 billion lb) at the beginning of 1977.

Map 4. Atlantic mackerel



American Shad



(*Alosa sapidissima*)

American shad is anadromous—running up coastal rivers in spring to spawn. The Hudson River has been an important spawning and nursery ground. Combined commercial catches in the Hudson by New York and New Jersey fishermen reached a maximum weight of about 1,724 metric tons (3.8 million lb) in 1944. Total catches for the two states combined were higher because substantial quantities were taken in the Delaware River and in coastal waters as well. Up to the early 1900s, most shad catches in the area were made outside the Hudson River, and in the early days maximum reported landings were considerably greater than the secondary maximum in 1944. The Connecticut River has had smaller, but also important, shad fisheries.

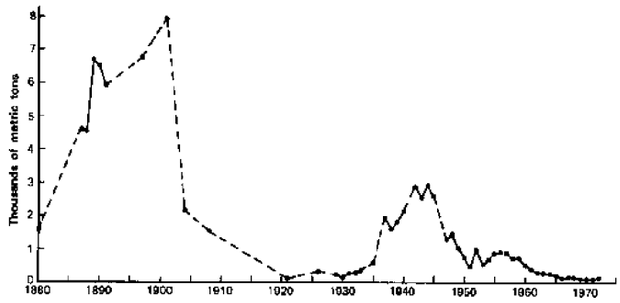


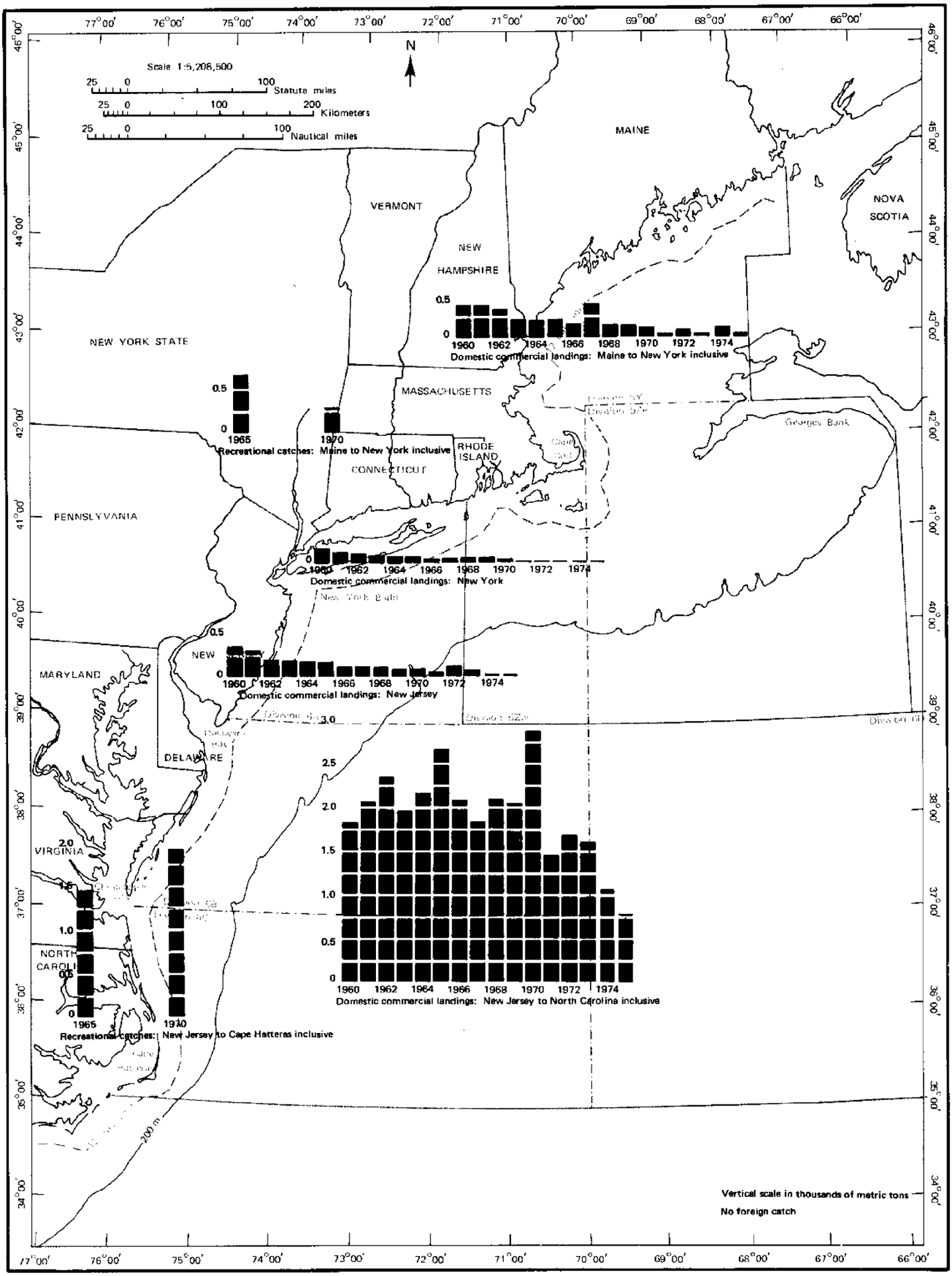
Figure 7. Commercial landings of American shad in the New York Bight area, 1880-1972

Resurgence of the shad fishery in the 1940s was caused principally by relaxations of management regulations during the war, when meat was scarce. Catches rose sharply in Connecticut, New York, and New Jersey. Fish prices also were relatively high in the war years, so the incentive to go fishing was great. This led to overfishing, but the continued decline in shad landings to the present, especially in the Hudson River, was caused primarily by economic conditions in the industry and not by scarcity of fish. With modern methods of preservation and transportation, shad is brought into the New York area from early runs in southern rivers. By the time spring arrives in the New York Bight area and the water is warm enough for shad runs to begin, the market has been saturated and prices have dropped to levels that make it unprofitable to fish. It is believed that the local shad resource could support a larger fishery. Perhaps one way to take advantage of this would be to find ways to stimulate growth of shad sport fisheries in the Hudson River. Recent problems with PCB residues, however, may affect the future of the fishery.

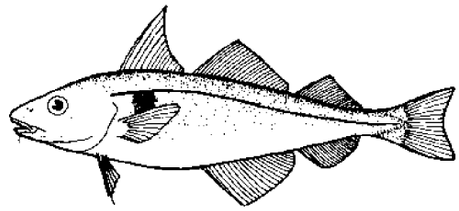
Although American shad is sometimes caught offshore by trawlers, foreign catches have not been reported. It is likely that some are taken by foreign fleets, and incidental catches may increase now that foreign vessels are concentrating on midwater resources like mackerel and herring.

Recreational fishing for shad has become a popular seasonal pastime along the coast since the end of the second world war. The sport catch in the North and Middle Atlantic regions about equals the commercial catch.

Map 5. American shad



Haddock



(*Melanogrammus aeglefinus*)

Except for a brief period in the late 1930s, early 1940s, and occasional years prior to that, haddock (small fish are called scrod) has not been important in the fisheries of the New York Bight area. Since the early 1950s, commercial landings in New York and New Jersey have been negligible.

Haddock is a cold-water fish of relatively deep water, which seldom comes close to shore, and in the adult stage remains at or near the bottom. The species is not very abundant south of Georges Bank, although it can be taken off the coasts of New York and New Jersey in winter. The drop in catches in the late 1920s and early 1930s was caused by a scarcity of haddock and flounders on Nantucket Shoals, and a consequent southward shift of the local trawl fleet to seek other species. Relatively high landings of haddock through the early 1940s reflect increased abundance on Nantucket Shoals, and the drop in the late 1940s, a northward retreat of the haddock stock. Coincident with declining availability of haddock close to ports in the Bight area, the trawl fleet began to concentrate on scup, which was extremely abundant in the area in the 1950s and early 1960s. A heavy Soviet fishery for haddock on Georges Bank, beginning in 1965, added to the US fishery, reduced the stock to a very low level. Subsequently, poor spawning success has so reduced the haddock stocks that ICNAF imposed a stringent catch quota of only 6,000 metric tons (13 million lb) for 1976 in Subareas 5 and 6 combined. In addition, through ICNAF and bilateral agreements with some nations, some areas were closed to haddock fishing entirely in certain seasons. The recreational catch of haddock has been very small, except in the mid-1960s, when fish from the extremely successful spawnings of 1962 and 1963 reached catchable size.

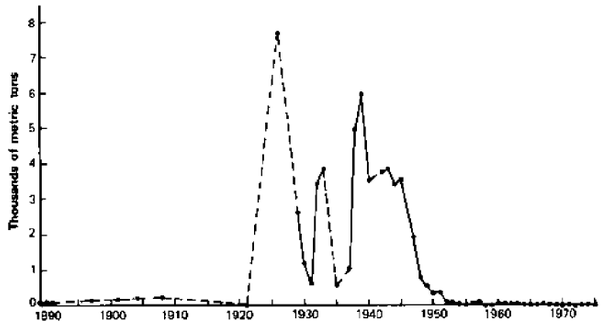
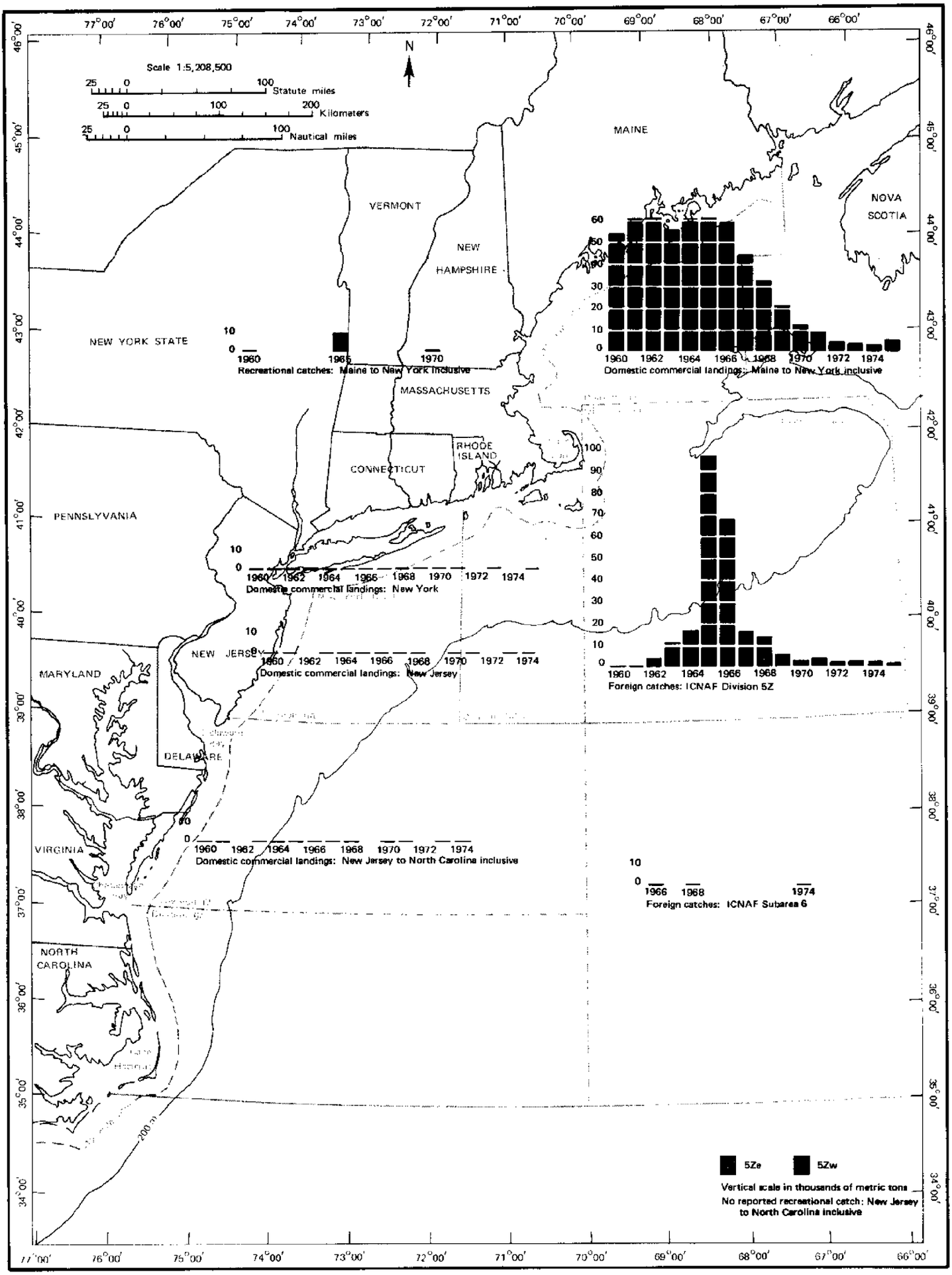


Figure 8. Commercial landings of haddock in the New York Bight area, 1889-1975

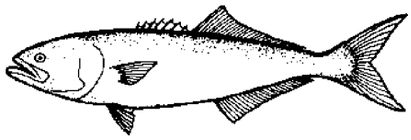
Haddock ranges on the American side of the North Atlantic from Newfoundland to Cape Hatteras, but it has never been very abundant south of Martha's Vineyard. Georges Bank has always been the most productive spawning ground. The spawning peak is usually in March, but spawning may commence in January and continue to July. Developing eggs are buoyant. The stock on Georges Bank, which extends into the Gulf of Maine and onto Nantucket Shoals, appears to be distinct from those stocks to the north.

The serious condition of the haddock resource in ICNAF Subareas 5 and 6 can be visualized by comparing the 1976 quota of 6,000 metric tons (13 million lb) with the maximum historic total catch in the same area of over 158,000 metric tons (348 million lb) in 1965. However, that catch was made at a time of unusual abundance of haddock, overfishing the resource. The estimated average maximum sustainable yield is 50,000 metric tons (110 million lb). It has been estimated that it will take at least seven years for the haddock resource to recover under this strict control, if at all. However, recent observations suggest that the haddock resource is increasing in abundance. Continued strict regulation will be necessary for further recovery. The New England and mid-Atlantic fishery management councils have recommended that no foreign fishing for haddock be allowed.

Map 6. Haddock



Bluefish



(*Pomatomus saltatrix*)

Bluefish (young are known as snappers) is a highly migratory oceanic fish much esteemed by anglers for its fighting qualities. The species migrates into New York Bight in large numbers in spring and remains until early November. Sometimes in winter, bluefish is taken by trawls in deep water, especially when unusually abundant, as it has been in the 1970s. Small foreign catches have been reported since 1971, and research vessels trawling in the Bight area recently have taken more bluefish than usual.

According to available estimates, the recreational catch of bluefish far exceeds the commercial catch. In 1965, 1970, and 1974, a greater weight of bluefish was taken by sport fishermen than of any other marine species. The species ranked second by weight in saltwater sport fish catches in 1960.

Abundance of bluefish in the Bight has varied widely, as illustrated by the history of commercial landings in New York and New Jersey combined. There is reason to believe that some of these fluctuations are related to changes in migratory habits, probably caused by changes in oceanographic conditions, related perhaps to variations in the path

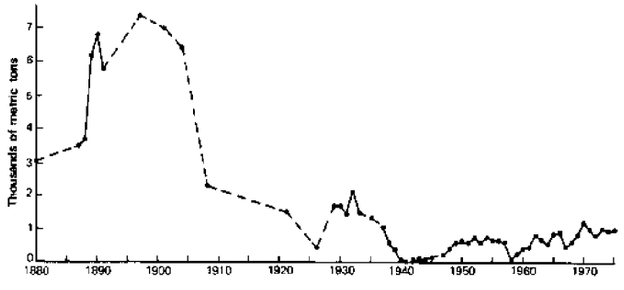


Figure 9. Commercial landings of bluefish in the New York Bight area, 1880-1975

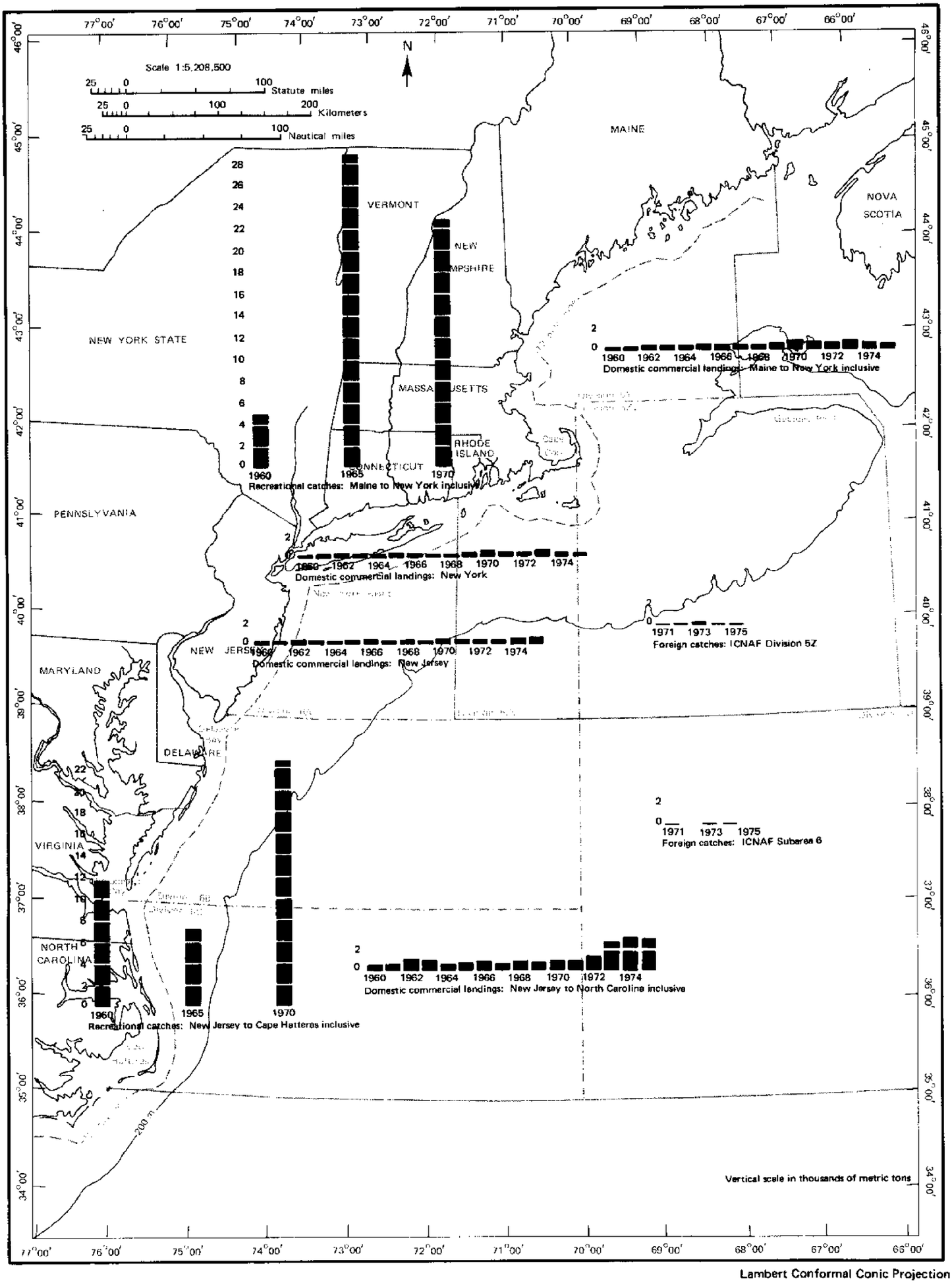
and velocity of the Gulf Stream. The apparent decline in abundance suggested by commercial landings is more than made up for by the growing recreational catch, even if allowance is made for the probability that sport catches are exaggerated and commercial catches underestimated.

There seems to be little basis for the fears of recreational fishermen that the bluefish resource is threatened by foreign fishing. However, foreign fleets have been shifting from *demersal* (bottom living) to *pelagic* (living above the bottom) resources. It is possible that this shift may make pelagic bluefish more vulnerable to foreign fishing, although at times bluefish also is found near the bottom.

Bluefish is very widely distributed in temperate and semitropical waters of the world ocean. On the North American side of the Atlantic it ranges from Nova Scotia to the Caribbean and Gulf of Mexico, and in the South Atlantic as far as Uruguay. Migrations along the US coast are north and inshore in summer, south and offshore in winter. Like menhaden and several other migratory species, the largest and oldest fish go farthest north. This is substantiated by the four saltwater angling surveys in which, on the average, bluefish caught in the North Atlantic region weighed about one-third more than bluefish in the Middle Atlantic region. Bluefish travels in schools. In the Bight area, bluefish is present from May through November, but is most abundant in late summer. Spawning is widespread over the continental shelf and appears to proceed in waves from offshore to inshore and from south to north, from spring to late summer. It is believed that two major stocks exist, one spawning principally in the Middle Atlantic Bight, the other to the south of Cape Hatteras. Tag returns show that some bluefish in the Bight area come from as far south as Florida, and suggest that fish return to this area year after year.

Little information is available for management of the bluefish fisheries. The very large and essentially unregulated recreational fishery adds greatly to the difficulties of management. It appears likely that for some time to come, bluefish abundance and the success of the fisheries will be largely a matter of chance.

Map 7. Bluefish



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Flounders

Several species of flounder are landed in New York and New Jersey. Prior to 1938, the individual species were not identified in published statistics, but it is probable that most of these early catches were summer flounder, since this is the largest and most popular of the three major species. The other important species are winter flounder and yellowtail flounder. Other species are named in Table 3.

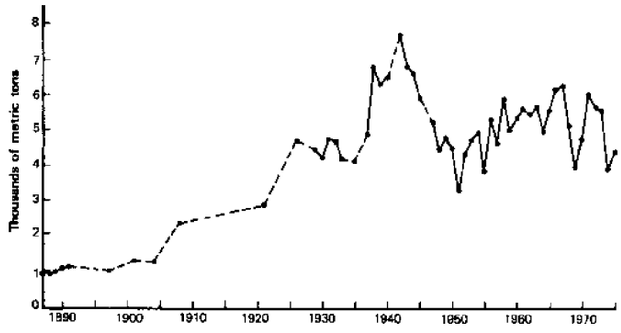
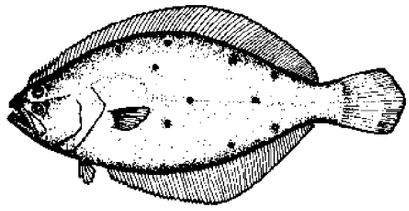


Figure 10. Commercial landings of flounders, all species combined, in the New York Bight area, 1887-1975

Summer Flounder



(Paralichthys dentatus).

Summer Flounder (*Paralichthys dentatus*). Summer flounder or fluke occurs as far south as the east coast of Florida, but it is especially abundant from Cape Cod to Cape Hatteras. Maine is the northern limit of its distribution. This is one of the favorites of saltwater anglers, who take large numbers in the estuaries and coastal waters. According to the four saltwater angling surveys, the recreational catch far exceeds the domestic commercial catch in the area from New York to Maine, and about equals the commercial catch from New Jersey south. In winter, this flounder migrates out to the edge of the continental shelf, where it may be vulnerable to trawlers operating in fairly deep water. The reported foreign catch is not large, but there may be a substantial unidentified incidental catch. Between 1965 and 1970, abundance of summer flounder in the New York Bight area dropped, as demonstrated by declines in commercial and recreational catches. In the last few years, sport fishermen have noted a steady and substantial increase in abundance. The species rose from eighth to third place by weight in the saltwater sport catch from 1970 to 1974. This is reflected also in a large recent increase in annual commercial landings. A part of this increase in domestic commercial landings in the Bight may have been caused by the recent concentration of New York and New Jersey trawl fleets on fishing grounds closer to shore. In fact, the increased abundance of summer flounder may have caused this shift.

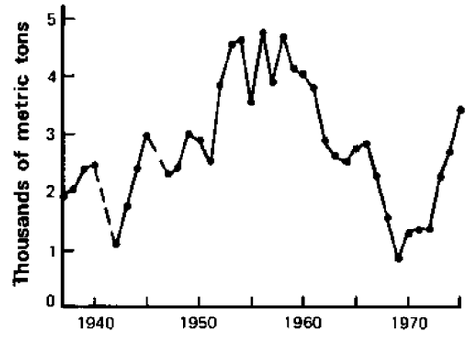
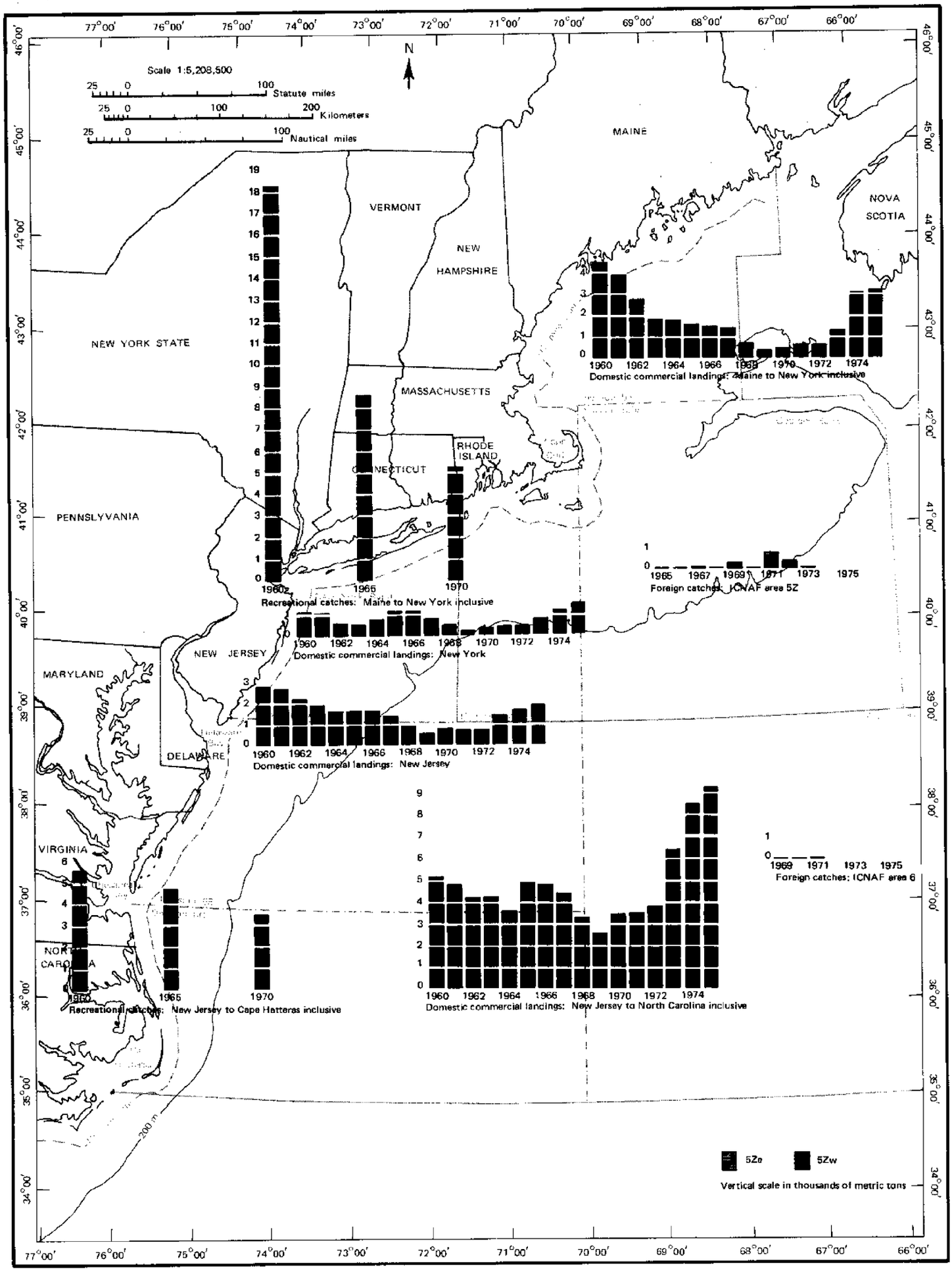


Figure 11. Commercial landings of summer flounder in the New York Bight area, 1937-75

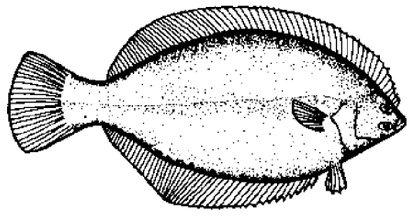
Spawning takes place from late fall to early spring over a wide area of the continental shelf. Buoyant developing eggs drift with the water currents. Like the larvae of other flounders, newly-hatched summer flounder resemble other fishes, swimming upright, with eyes symmetrically placed on either side of the head. During the later stages of larval development, the head becomes distorted and asymmetrical, and the eye on the right side moves over the top of the head to the left side. When this transformation is complete, the young "left-handed" summer flounder takes up a bottom-dwelling existence. This flounder remains active in a three-dimensional world, however, frequently chasing its prey off the bottom, sometimes to the sea surface.

Although ICNAF did not set an individual quota for summer flounder in 1976, the quota for all flounders other than yellowtail and the second-tier quota (Table 1) may have been sufficient to guard against overfishing. The large recreational fishery, however, is not under control. It has been suggested that the sport fishery alone is capable of taking the total allowable catch.

Map 8. Summer flounder



Winter Flounder



(Pseudopleuronectes americanus)

Winter flounder (*Pseudopleuronectes americanus*). Winter flounder, often called blackback flounder, and when it is heavier than about 1.6 kg (3.5 lb), lemon sole, is much less migratory than summer flounder, although coastal stocks move into bays and estuaries in winter and offshore to cooler waters in summer. Winter flounder tends to remain within certain bodies of water, and thus forms local stocks that do not intermingle or interbreed. The stock on Georges Bank, for example, is believed to be distinct from populations of winter flounder in other areas, as in Long Island Sound. Like summer flounder, this is a popular fish with recreational fishermen. The sport catch of winter flounder in New York waters, on the average, apparently is about the same in numbers of fish as the summer flounder catch. In the late 1960s, for example, it was estimated that about 1.5 million fish of each species were taken annually in Great South Bay alone. By weight, the recreational catch of winter flounder about equals or slightly exceeds the domestic commercial catch.

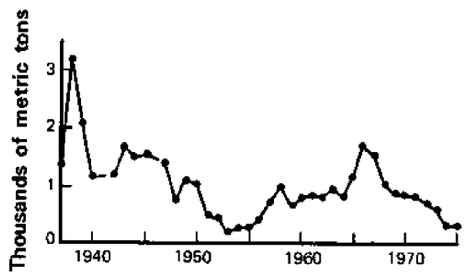


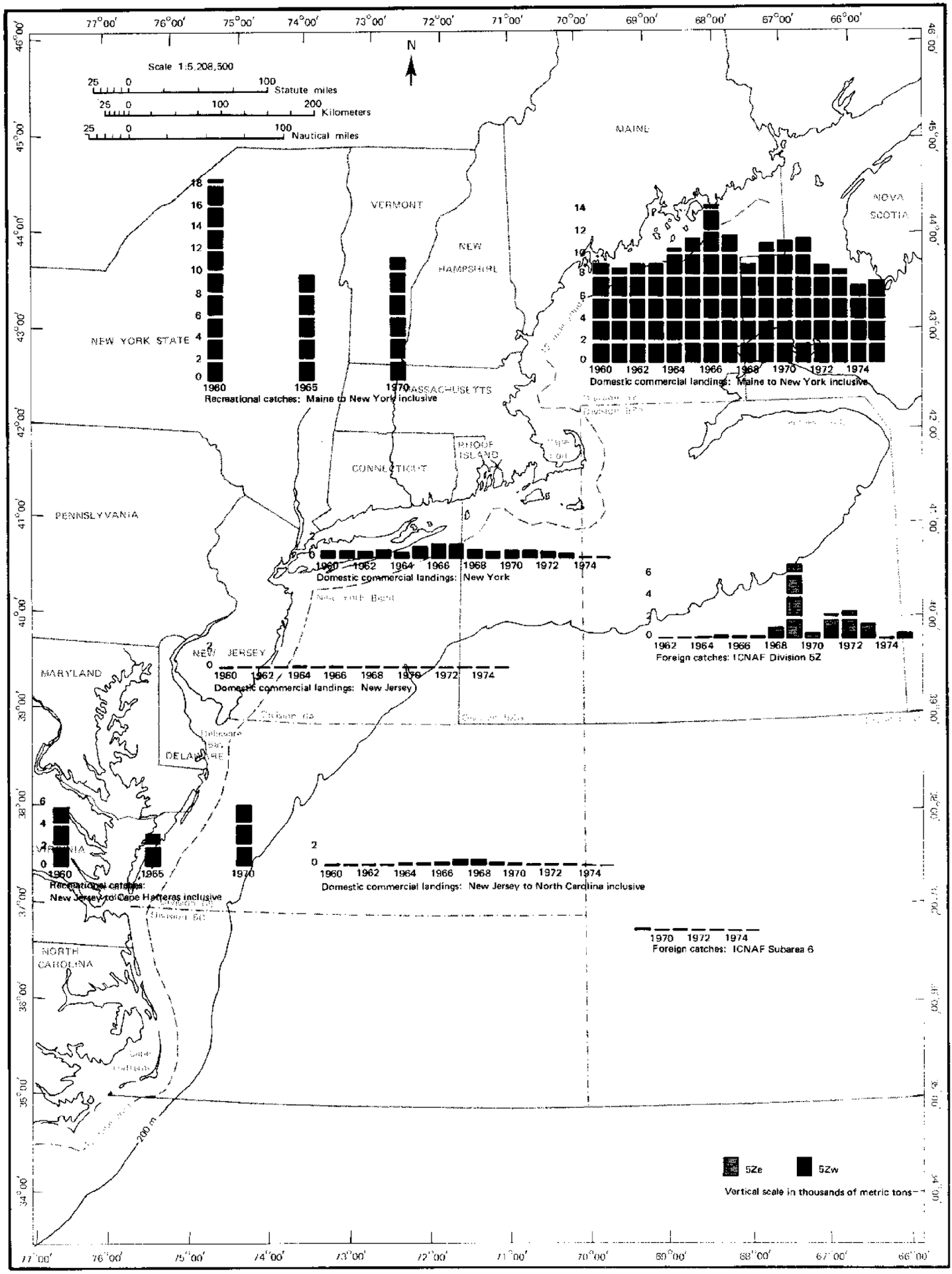
Figure 12. Commercial landings of winter flounder in the New York Bight area, 1937-75

The drop in domestic commercial landings of winter flounder in the Bight area in the mid-1950s may have been caused by a decline in abundance, but it also could have come about because the domestic trawl fleet was concentrating on higher-priced summer flounder, unusually abundant at that time. The decline in domestic commercial landings since 1966 has coincided with increased foreign catches of winter flounder.

Winter flounder is "right-handed." It ranges from the Gulf of St. Lawrence to the coast of Georgia. Spawning is in winter, most intense in February and March. Unlike the eggs of most flounders, developing eggs are not buoyant. They sink to the bottom and stick to each other in clusters. Adults often are found in relatively low salinities, sometimes almost in fresh water.

Much information needed for management of the winter flounder fishery is not available, and ICNAF has not set a specific catch quota, although, like summer flounder, the species is protected by the quota for flounders other than yellowtail, and by the second-tier quota. Commercial overfishing has been at least partially prevented by these measures, but the quotas will not necessarily prevent overfishing of some local stocks. The relatively large and uncontrolled recreational catch also works against management for maximum yields. Immediate prospects for rational management of the winter flounder resource are not bright.

Map 9. Winter flounder



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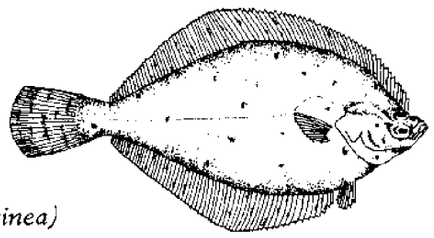
Yellowtail Flounder



(Limanda ferruginea)

Yellowtail Flounder (*Limanda ferruginea*). Yellowtail flounder prefers deeper water than the other two major flounder species, and usually does not enter coastal bays and estuaries. Minor recreational fisheries exist in some areas, off Long Island, for example, but there is no officially reported sport catch. Domestic commercial fishing for yellowtail flounder began in the late 1930s when winter flounder temporarily became scarce. In the 1950s, catches in the Bight area dropped almost to nothing as the yellowtail flounder resource in the area declined sharply. In the 1960s, the resource recovered and commercial catches rose again. The decline and subsequent recovery have been attributed to changing water temperatures, which may have affected spawning success, but which also caused stocks off New York and New Jersey to shift to Georges Bank and farther north. The recent decline in domestic commercial landings of yellowtail flounder has been attributed to the effects of foreign fishing. ICNAF imposed a quota on the yellowtail flounder catch in Subareas 5 and 6 combined of 20,000 metric tons (44 million lb) for 1976. This compares with an estimated maximum sustainable yield of 32,000 metric tons (70 million lb). Average annual landings in the period 1972-74 in this quota area were about 70,000 metric tons (154 million lb). The decline has been caused by a combination of overfishing and recent poor spawning success.

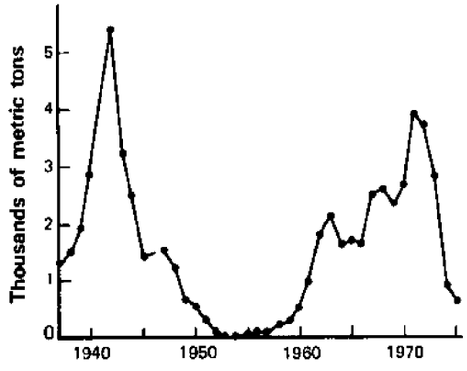
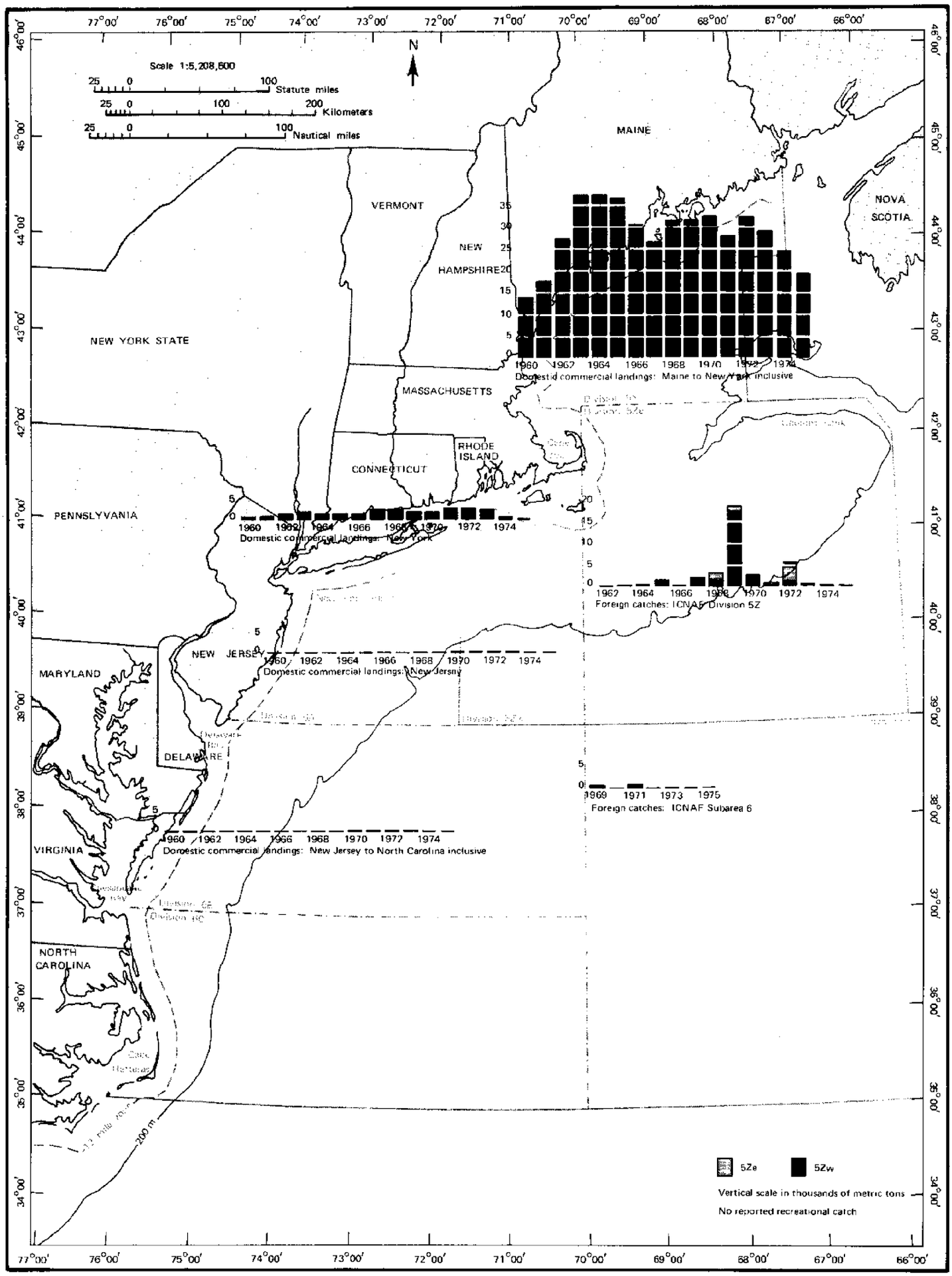


Figure 13. Commercial landings of yellowtail flounder in the New York Bight area, 1937-75

Yellowtail flounder is "right handed." It spawns in spring over a wide area of the continental shelf. Buoyant developing eggs drift with the water currents. Adults range from the Gulf of St. Lawrence to waters off Chesapeake Bay.

Yellowtail flounder is clearly one of the group of commercial fishes of the Bight area that has been severely overfished. The ICNAF quota for 1976, together with the second-tier quota, was designed to increase the total *standing stock* (numbers or weight in existence) of all species. It was hoped that by 1980 or perhaps longer for some species, the abundance of most local fishery resources of the continental shelf would have increased to a level that would allow a sustainable harvest of about 1 million metric tons (2.2 billion lb) a year. This is about 50% above the present second-tier quota. Species like yellowtail flounder probably will be among the last to recover fully, because its numbers have been so severely reduced. This also requires the assumption that transfers of energy from one segment of the resource to others, if they have occurred while a species was overfished, are reversible. Absence of a significant recreational fishery removes one possible complication. The New England and mid-Atlantic regional fishery management councils have recommended that no foreign fishing be allowed for yellowtail flounder. The outcome of domestic management of this fishery will be watched with great interest.

Map 10. Yellowtail flounder



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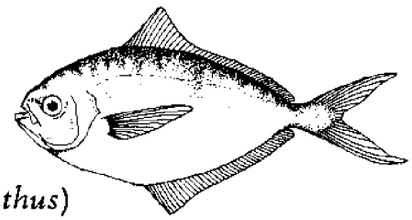
Butterfish



(*Peprilus triacanthus*)

Until recently, butterfish was considered an underutilized resource in the New York Bight area. Thus, the downward trend in commercial catches from the peak year 1939 to the mid-1960s cannot be attributed to overfishing. Some of the variations probably were associated with short-term fluctuations in success of spawning, but market demand and changing fishing strategies probably also played a part. Much of the reason may be attributed to the decline of the New York and New Jersey trawl fisheries and a return to fishing near shore. Large foreign catches of butterfish since the late 1960s have altered the situation, and the butterfish resource may now be overfished. ICNAF did not set an individual quota for butterfish for 1976, but some limits were set by the overall catch quota (second-tier) agreed upon late in 1975.

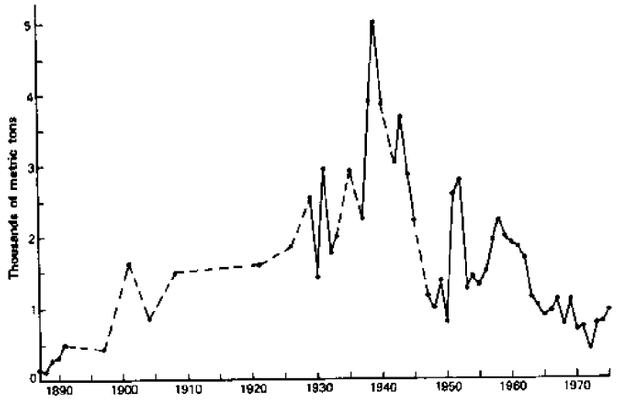


Figure 14. Commercial landings of butterfish in the New York Bight area, 1887-1975

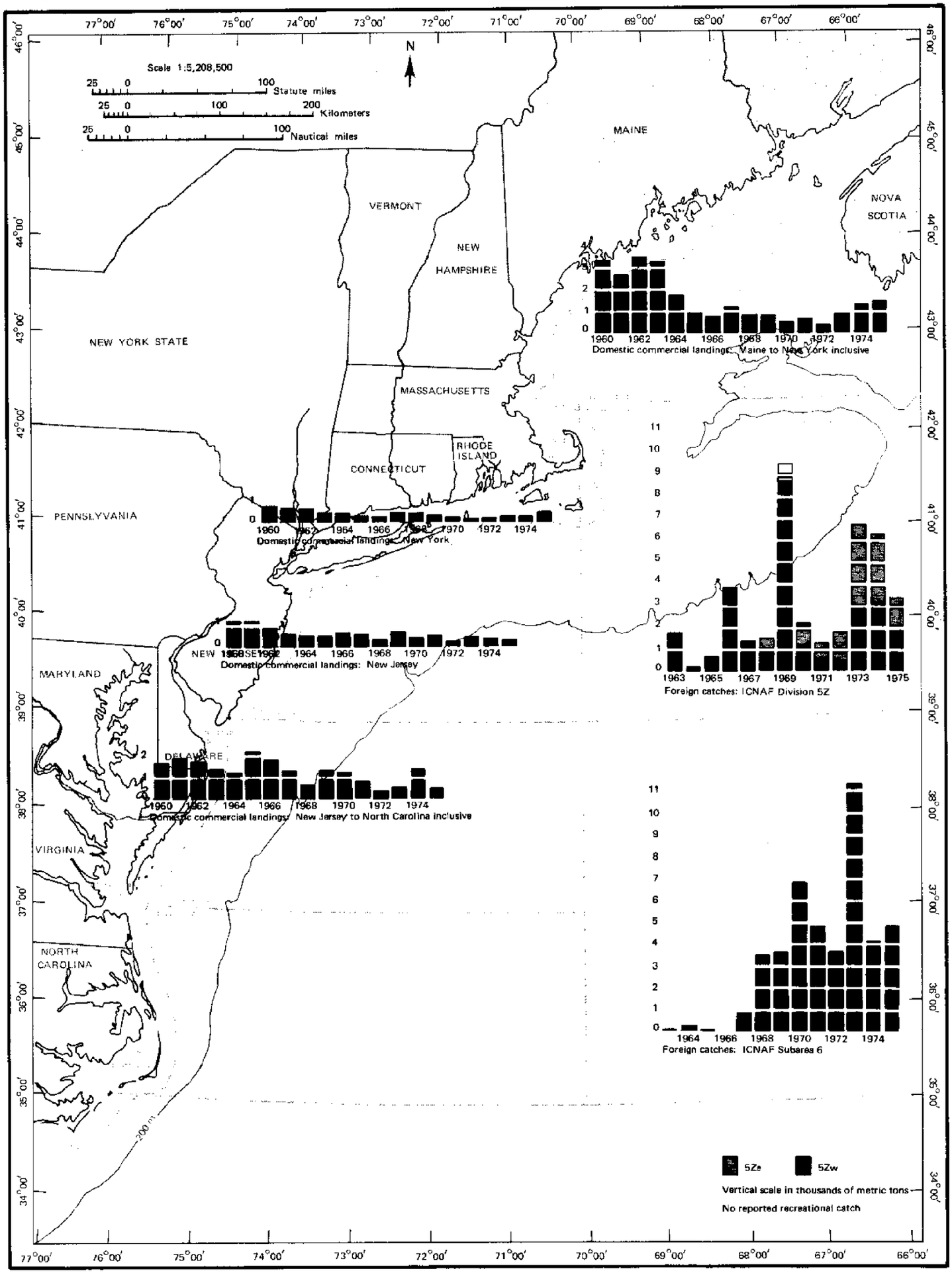
Butterfish school near the surface or at mid-depth and move out to the edge of the continental shelf in winter. Large quantities are taken in foreign trawl fisheries for squid and other species. Most of this catch is made by Japanese vessels, but at least two other countries, Poland and the Soviet Union, have at times made larger catches of butterfish than the United States.

Butterfish school at mid-depths frequently, thus may be vulnerable to increased mid-water and surface fishing, which has been the trend of foreign fisheries recently. The quota for "other finfish" and the second-tier quota have tended to limit foreign catches of species like butterfish, for which no specific quota has been allocated. It is likely that the large domestic catches of butterfish of the late 1930s and early 1940s in the Bight area will not be repeated. In setting quotas for other species, such as squids, the regional fishery management councils have considered the implications of incidental catches of butterfish. The *windows* for foreign fishing (areas within 200 nmi open seasonally for fishing certain species) have been chosen as far as possible to reduce to a minimum the chances of large incidental catches of butterfish and other species.

It has been reported that butterfish will bite on very small hooks. The recreational fishery, if one exists, must be small because no catches have been reported in the national surveys of saltwater angling.

Butterfish ranges from the Gulf of St. Lawrence to off South Carolina. Migration is to the south and offshore in winter, north and inshore in summer. Spawning is widespread over the continental shelf from spring to late summer, earlier in the south than in the north. Developing eggs drift freely with the water currents. Juveniles concentrate inshore in fall in the Bight area.

Map 11. Butterfish



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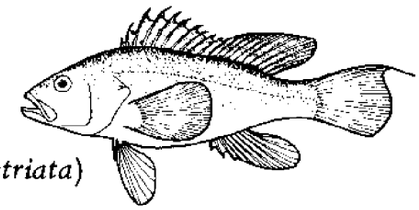
Black Sea Bass



(*Centropristis striata*)

Black sea bass is most abundant south of Cape Cod. This is reflected in recent landings in the New York Bight area, consistently higher in New Jersey than in New York. Like several important migratory food fishes of the area, black sea bass moves offshore and to the south in winter and returns inshore and northward in spring. When it is inshore in summer, black sea bass favors rocky irregular bottoms, wrecks, and artificial fishing reefs.

Except for a reported 1964 foreign catch of 1,494 metric tons (3.3 million lb) in ICNAF Subarea 5Z, no foreign catches of black sea bass have been reported. Although the United States is the only country with a fishery directed at this species, it is believed that incidental catches by foreign fleets

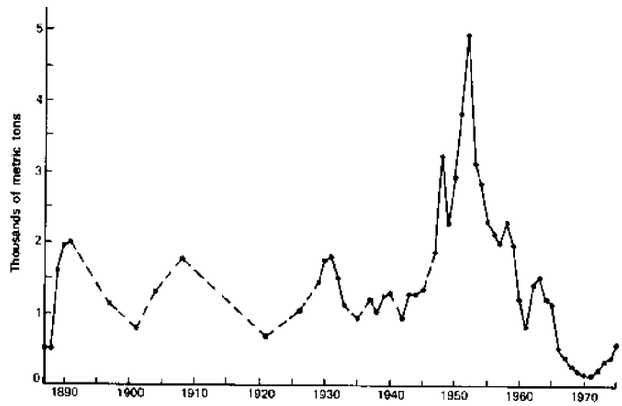


Figure 15. Commercial landings of black sea bass in the New York Bight area, 1887-1975

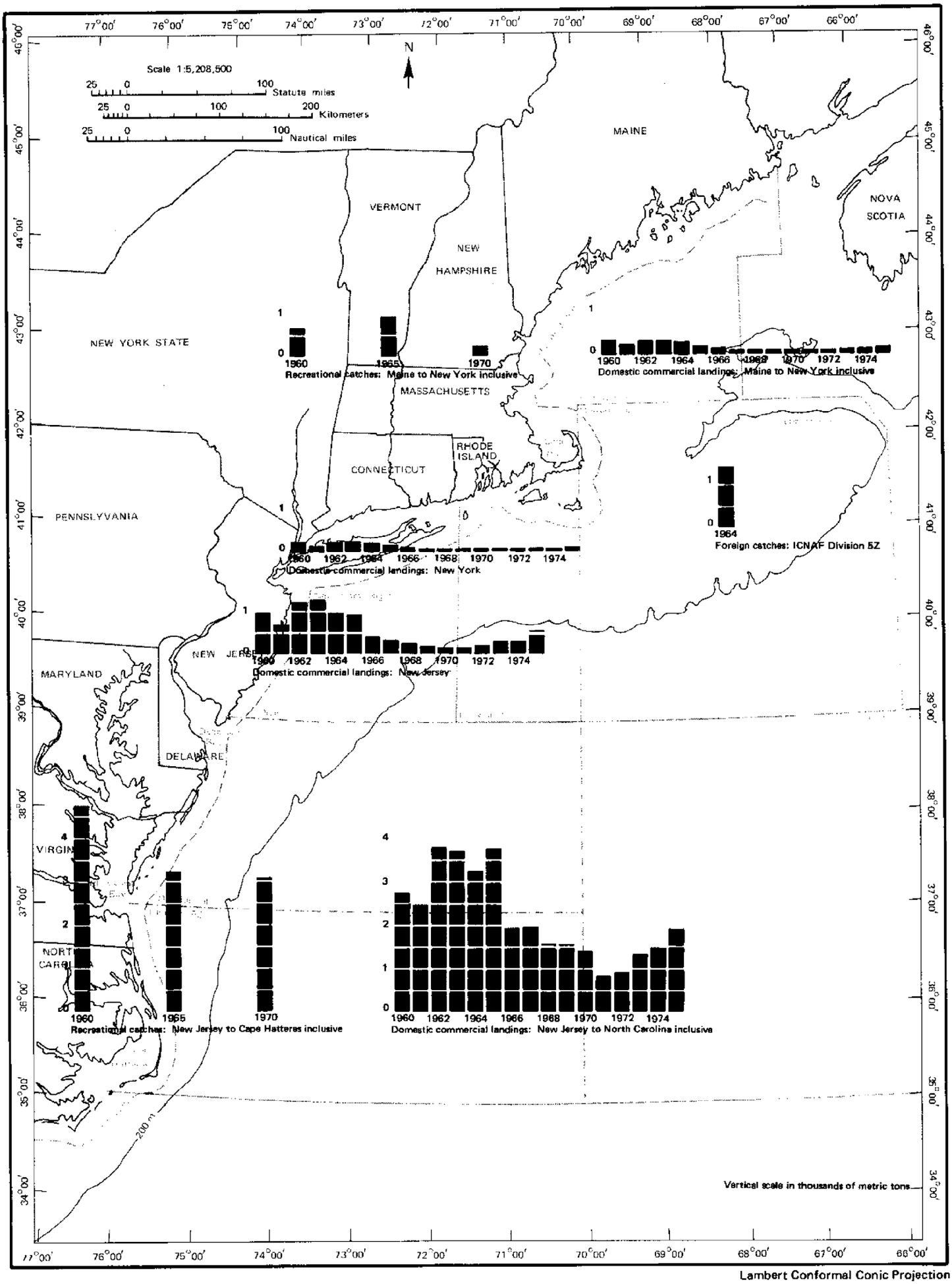
fishing for other species on the outer continental shelf may be fairly large. Black sea bass is known to fluctuate widely in abundance at times, apparently from natural causes. The relatively large domestic landings of the early 1950s in the Bight area apparently came at a time of unusually great abundance. The recent continued decline in abundance, which has been reflected in commercial as well as recreational catches, may have been accelerated by foreign fishing. At a time when the resource is low in abundance for one reason or another, increased fishing pressure can have serious consequences.

According to best available estimates, the recreational catch of black sea bass exceeds the commercial catch. Sport catches of this species declined from 1960 to 1970 despite an increase in numbers of saltwater sport fishermen. By 1975, however, there were encouraging signs that the resource was recovering.

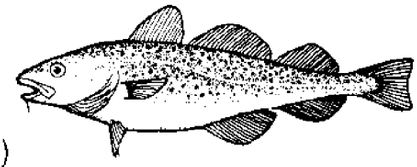
At one time, a substantial part of the commercial catch was made with *pots* (baited traps with a funnel-like opening), especially in New Jersey. The geographic range extends from the Gulf of Maine to the Florida coast and in the eastern Gulf of Mexico. Spawning occurs in late spring and summer at least as far north as Long Island. Developing eggs drift with the currents. Black sea bass is present in the Bight throughout the year, but greatest catches are made in summer.

Like other migratory coastal fishes that are taken in large numbers by recreational fishermen, the black sea bass resource and fishery are difficult to manage. ICNAF set no specific catch quota for the species, but the total quota for all species in 1976 may have afforded some measure of protection against overfishing by commercial fleets. In the absence of controls over sport fishing, the black sea bass resource will be very difficult to manage.

Map 12. Black sea bass



Atlantic Cod



(*Gadus morhua*)

Cod (small fish are called scrod) is a cold water fish, most abundant north of Cape Cod. The greatest concentration in the vicinity of New York Bight is on Georges Bank. A winter migration takes place as far south as North Carolina, supporting winter recreational fisheries at several points in the Middle Atlantic Bight. Adult cod remain near the bottom, where they feed principally on clams and other mollusks, including squid.

Although cod once ranked among the top 10 species by weight in the commercial fisheries of the Bight, it was not quite as important, on the average, as haddock. The downward trend in cod landings since 1938 was principally caused by the decline of the trawl fisheries of the area. Expansion of foreign fishing in the area since the mid-1960s has placed a greater strain on several stocks of fish important to local fishermen, but the cod resource has not declined as alarmingly as haddock. Foreign catches on Georges Bank exceeded domestic commercial catches of cod in the last half of the 1960s, but foreign fleets have now shifted emphasis to other species. The ICNAF cod quota for 1976 in Subareas 5 and 6 combined was 43,000 metric tons (95 million lb). This equaled the estimated maximum sustainable yield. Present estimates of the condition of the cod stocks are less optimistic, and the New England and mid-Atlantic fishery management councils have recommended that no foreign fishing be allowed for the species.

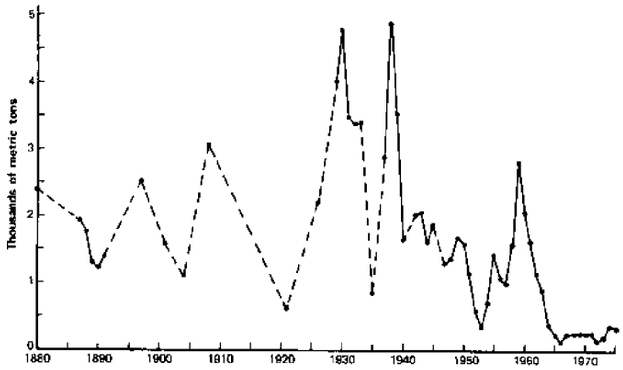


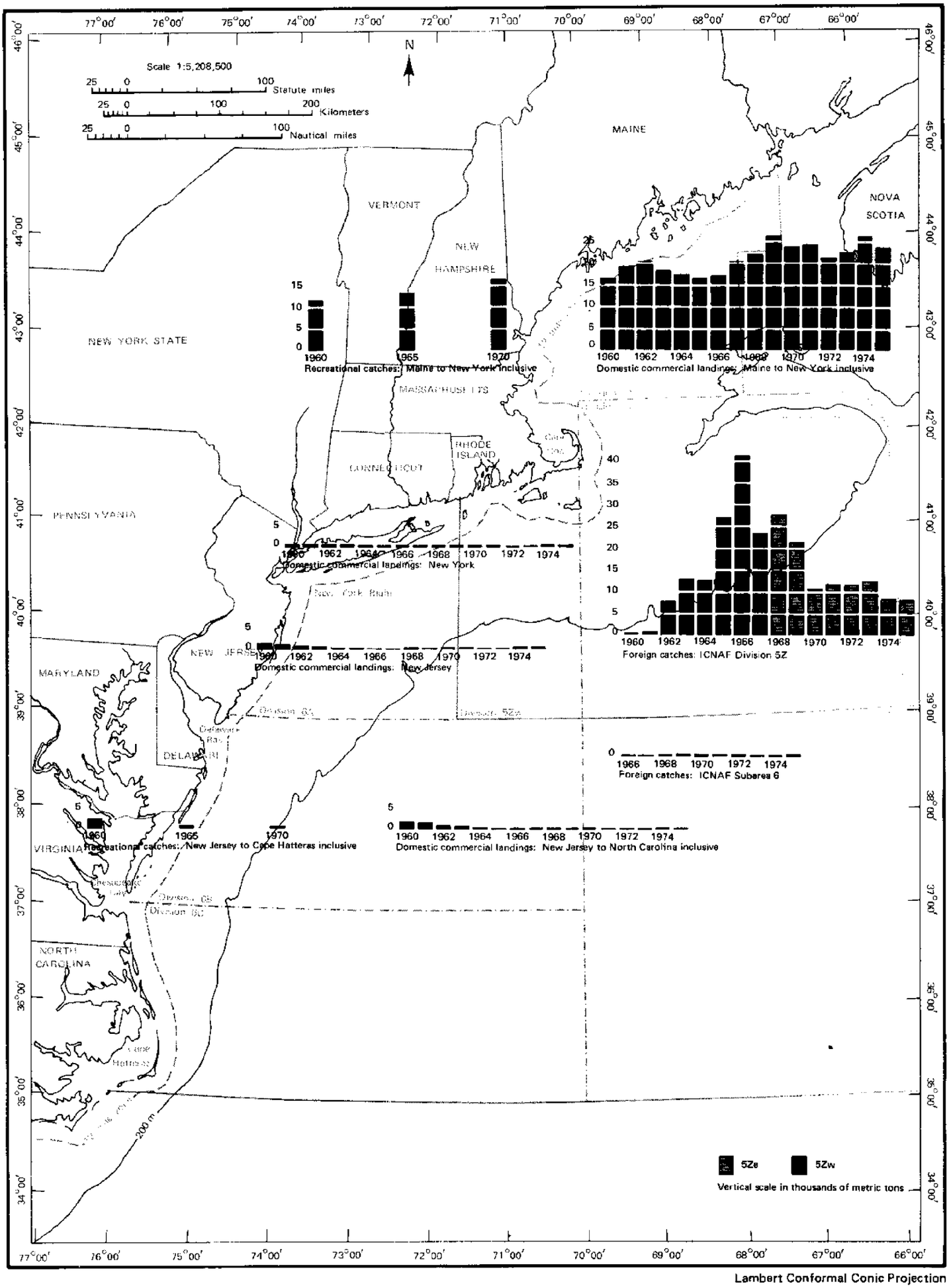
Figure 16. Commercial landings of Atlantic cod in the New York Bight area, 1880-1975

From 1960 to 1970, reported recreational catches of cod have increased, but this was probably more than accounted for by the increased numbers of saltwater anglers and the growing popularity of winter sport fishing. Reported recreational catches in New England have been almost as large as domestic commercial landings in the same area, and from New York south sport fishermen apparently take considerably more than commercial fishermen.

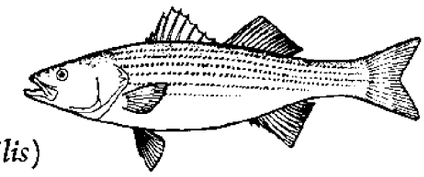
Atlantic cod spawns in winter. Developing eggs drift with the water currents and hatch in two to three weeks. For the first few months, young remain above the bottom. Once they have adopted a bottom living habit, some cod apparently remain in the general area throughout life, while others perform extensive migrations.

As with other species taken by sport fishermen, the substantial recreational fisheries for cod are not under control. This could threaten the success of the new management program under PL 94-265.

Map 13. Atlantic cod



Striped Bass



(*Morone saxatilis*)

Striped bass, rockfish, or rock is one of the most popular recreational fishery resources along the Atlantic coast. It attracts some of the most skillful and determined sport fishermen. Despite the general belief that the resource has declined in abundance, all available evidence points to a decided upward trend in abundance since the resource and the catch reached low points in the 1930s. This increase in abundance is reflected in available commercial and recreational catch statistics, not only in the New York Bight area, but also at all points along the coast. Wide short-term variations, however, mean that at any time the annual catch is about as likely to be dropping as it is to be rising. This has caused some people to lose sight of the long-term trend, which is clearly illustrated in the history of landings. Almost each major high and each major low point was higher than the last since the mid-1930s. From 1967 to 1972 the trend was downward, but 1973 and 1974 have produced the greatest weight of commercial landings for the Bight area. This upward trend in abundance and catches cannot continue forever, and recently abundance has been declining. There is no way of knowing whether this will be a short-term decline or not. Much more attention needs to be given to developing a rational striped bass management program. The need for management has been virtually ignored in endless squabbles about who should get what share of the catch.

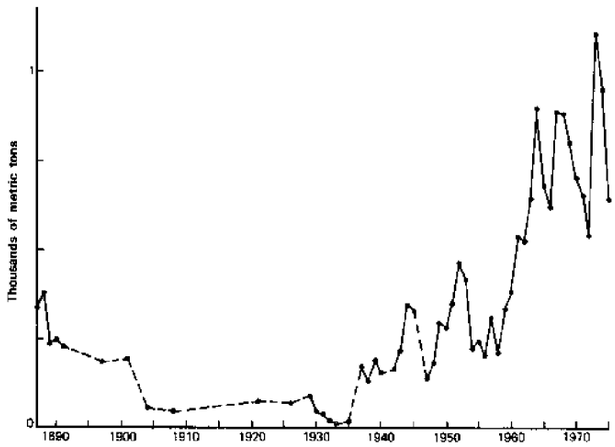


Figure 17. Commercial landings of striped bass in the New York Bight area, 1887-1975

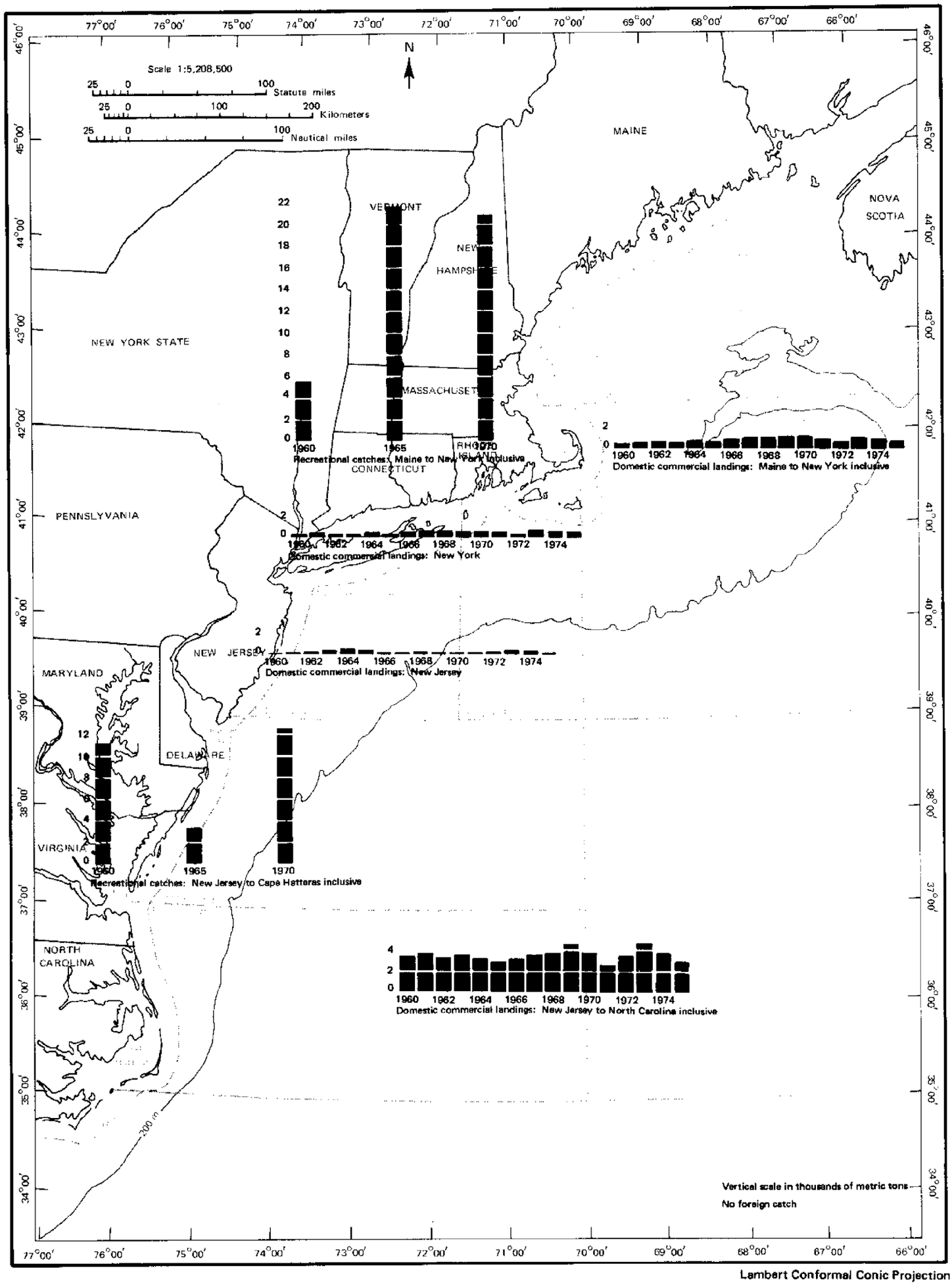
Some scientists have suggested that the upward trend in abundance of striped bass has been caused by increased amounts of nutrients in estuarine nursery grounds, provided mostly by human wastes. Although there is no direct evidence to support this hypothesis, the suggestion is not unreasonable. Striped bass spends its first two years of life in estuaries and coastal bays, where biological productivity is most likely to be enhanced by increasing amounts of domestic wastes.

According to available catch statistics, the total sport catch of striped bass along the Atlantic coast has been nearly seven times the commercial catch. The species ranked first by weight in saltwater sport catches in 1960, second in 1965, 1970, and 1974. Although striped bass may stray occasionally into international waters, the species is typically a resource of estuaries and the coastal zone, and there is no reported foreign catch.

Striped bass is anadromous. Most of the fish caught along the coast from Cape Hatteras to New England are born in tributaries of Chesapeake Bay, especially in Maryland. Young remain within the influence of the estuary for about two years after birth, then many perform an annual migration to the north in spring and summer, returning south in fall and winter. It is believed that there is a strong tendency to return to spawn in the stream of birth, as salmon do. However, the Susquehanna River in Maryland, once a major spawning ground, has largely been abandoned by striped bass, mainly because a dam blocks access to most former spawning grounds, and water flows below the dam have been altered. Recently the Chesapeake-Delaware Canal, a man-made waterway, has become the major spawning area.

The habit of migrating annually up the coast and back again is shared with many other species of the Atlantic coast. The northward migration in spring and summer usually takes the fish farther north each year of life, so that on the average, fish are larger and older with increasing latitude. In 1965 and 1970, for example, striped bass caught in the North Atlantic region had an average weight of over 2.3 kg (5 lb), but those taken in the Middle Atlantic region weighed less than 1.3 kg (3 lb).

Map 14. Striped bass



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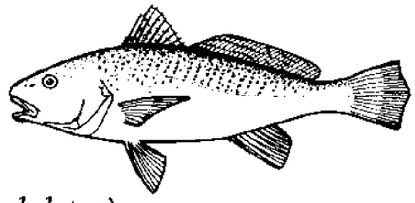
Atlantic Croaker



(*Micropogon undulatus*)

In total weight landed, Atlantic croaker or hardhead once was one of the most important food fishes along the Atlantic coast of the United States. More than 29,000 metric tons (64 million lb) were landed in 1945 at the peak of the fishery. This is a southern species, and most of the catch is made in Chesapeake Bay, but over 3,630 metric tons (8 million lb) were landed in the New York Bight area in 1935, mostly in New Jersey. Because recent landings have been relatively small, no map accompanies this section. The species is included here mainly for its historic importance, and because it was and still is an important recreational resource in areas of abundance. No commercial landings were reported in the Bight area from 1962 to 1969 inclusive, nor in 1971.

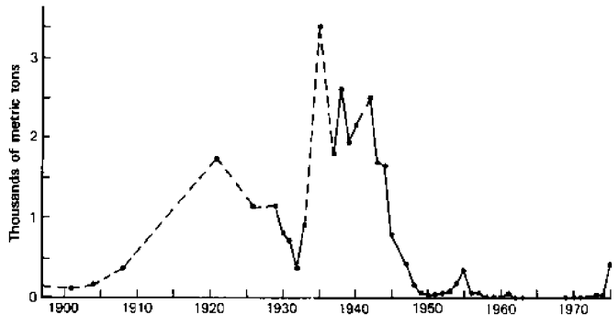


Figure 18. Commercial landings of Atlantic croaker in the New York Bight area, 1897-1975

Recently, small commercial landings have been reported in New Jersey, and in New York a few were landed in 1973 for the first time since 1957. This illustrates how widely estuarine fishery resources can fluctuate in abundance. It is not known what caused the abrupt decline in abundance, but undoubtedly natural environmental factors were partly responsible. Overfishing and water pollution are suspected also. Indications of substantial recovery of the croaker stocks in Chesapeake Bay in the mid-1970s led to optimism that the stocks were increasing. The unusually cold winter of 1976-77, however, apparently caused heavy mortality.

Atlantic croaker has been an important recreational species throughout its range. The sport catch apparently exceeds the commercial catch. There is no reported foreign catch.

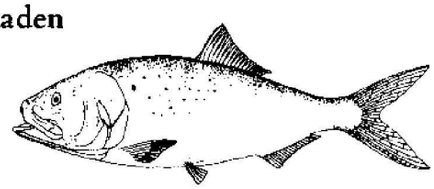
Atlantic croaker is a fish of estuarine waters. Although it moves out of the estuaries in winter, it is not taken in trawl fisheries on the outer continental shelf. The species ranges from Massachusetts to Texas, but it is not common north of New Jersey. Spawning takes place in the ocean from late summer to winter. Buoyant developing eggs drift with the water currents. Young move into coastal bays, sounds, and estuaries soon after hatching, often penetrating into fresh water. They spend the winter in brackish water, then as growth begins in spring, start moving down the rivers and estuaries, going to sea the second winter. Thereafter, like other coastal migratory fishes, they move north in spring and summer, south in fall and winter.

When croaker declined sharply in abundance in the late 1940s, it was suspected that incidental catches of young by shrimp trawlers in the Carolinas and by pound-netters in Chesapeake Bay and elsewhere might have been responsible. Proof of such effects is lacking, but these incidental catches were large. It is possible that the decline of the pound-net fishery along the coast was advantageous to the croaker resource.

Industrial and Semi-Industrial Species

Industrial fish and shellfish species are used for a variety of purposes other than human food. In the New York Bight area, the major such use is to manufacture fish meal and oil, but considerable quantities are used at times for bait, animal food, and other purposes. Semi-industrial species are those for which demand is limited as human food, and excess catches are sold for industrial uses. Catches of semi-industrial species tend to vary widely, and depending on the market and the use to which the catch is put, prices fluctuate widely.

Atlantic Menhaden



(*Brevoortia tyrannus*)

Menhaden has been an important resource in the coastal fisheries of the New York Bight area since the Pacific sardine fishery declined in the 1940s. Peak landings in New York and New Jersey combined were reached in 1956 and 1962, as unusually successful spawnings led to local increases in abundance of the resource. The catch is used entirely for industrial purposes—to manufacture fish meal and oil, for animal food, and as bait.

The major Atlantic coast menhaden fishery is in Virginia. Most spawning has been in waters off Virginia and North Carolina, although the menhaden regularly spawns in New York waters. As it grows older and larger, menhaden migrates farther north each year, so that in the Bight area and off New England most of the catch consists of big fish. Since 1960, the Virginia fishery has been so intense that few menhaden have survived to migrate farther north. This led to virtual collapse of the fishery north of Chesapeake Bay for several years. For some unknown reason, however, phenomenally successful recent spawnings have led to very large catches in Virginia, exceeding previous scientific estimates of maximum yields that the resource can sustain. In the period 1971-75, average annual landings in Virginia were much greater than in any equal period in history. Despite this heavy fishery, abundance was so great

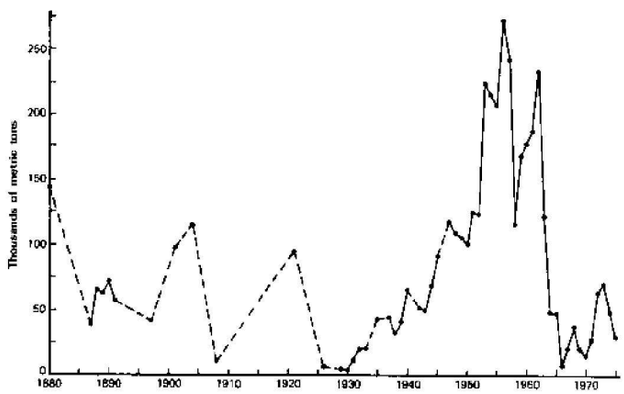


Figure 19. Commercial landings of Atlantic menhaden in the New York Bight area, 1880-1975

that sufficient numbers of fish survived to continue their seasonal northward migrations, and resumption of the fishery in the Bight area was possible. The last remaining menhaden factory in New York was closed, and most factories from Delaware north were no longer operational. Most local catches now are taken to New Jersey and New England for processing.

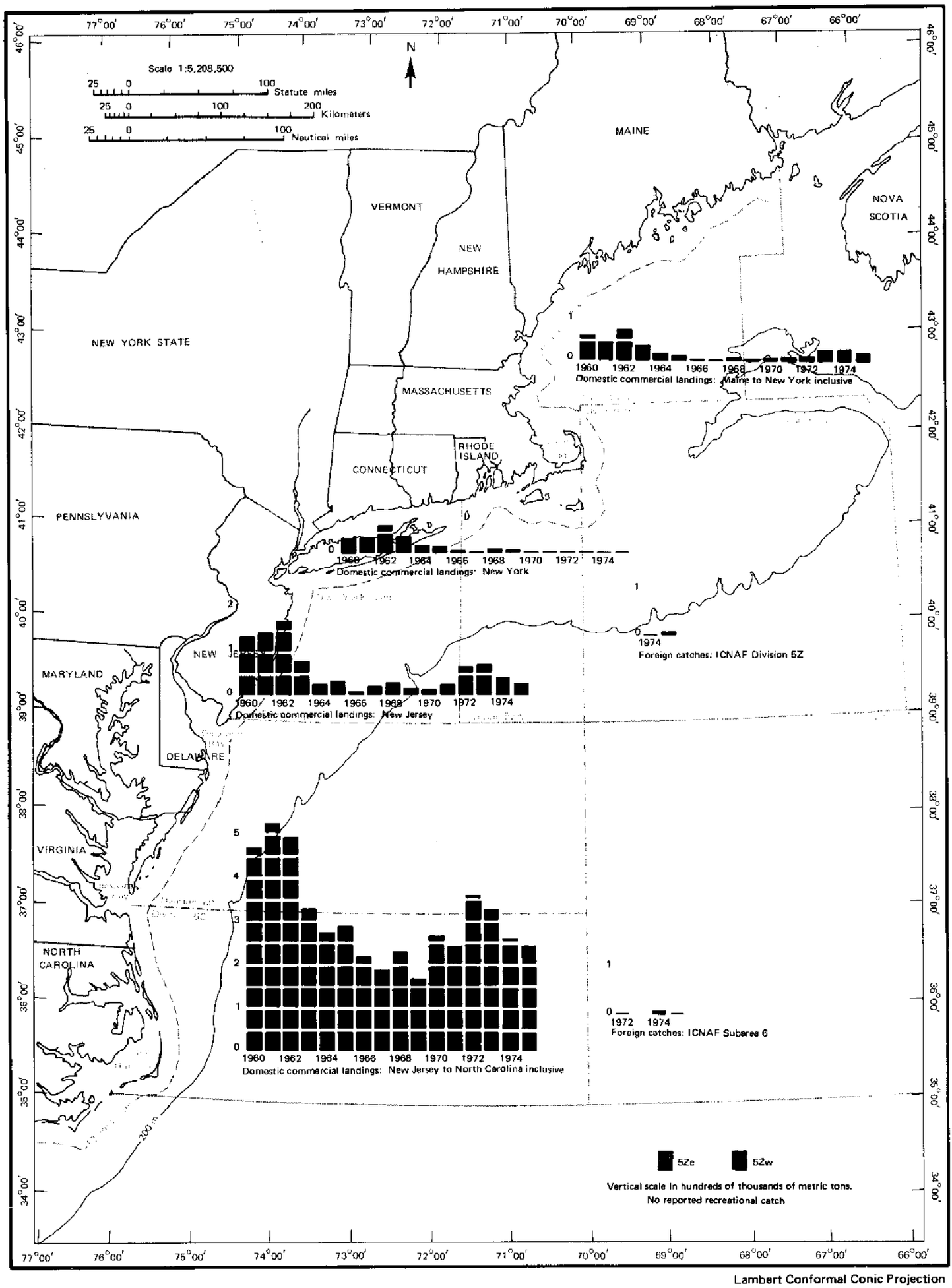
There is no sport fishery for menhaden, although some may be taken with *jigs* (unbaited hooks jerked rapidly through the water) for bait. Because they are usually so abundant, menhaden have been important in the diet of striped bass and other recreational species of the coastal zone.

Menhaden is largely a fish of coastal waters. No large catches have been reported by foreign fleets. The United States has concluded bilateral agreements with some nations that provide, among other things, that those nations will not develop specialized menhaden fisheries. The regional fishery management councils are not likely to permit foreign fishing for menhaden.

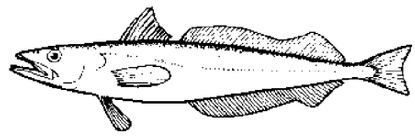
Atlantic menhaden ranges from Nova Scotia to central Florida. Actually there are two species along the Atlantic coast. Yellowfin menhaden (*B. smithi*) has been reported from North Carolina to Louisiana. It may hybridize with the much more abundant *B. tyrannus*. Another two species occur in the Gulf of Mexico, the finescale menhaden (*B. gunteri*) and the very abundant Gulf menhaden (*B. patronus*), which supports a fishery even larger than that on the Atlantic coast. Spawning of Atlantic menhaden occurs in the open ocean throughout most of the year at one place or another, but mostly in winter off North Carolina. Buoyant developing eggs drift with the water currents. Larvae hatch a few days after fertilization, and soon move from the ocean into coastal bays and estuaries, often penetrating almost into fresh water. As they grow, the young move down the estuaries slowly and by the following fall reach the ocean. After the first year, they perform annual migrations.

The future of the menhaden industry in the Bight area is not promising. Management of the fishery locally would not assure continued catches because the supply in the Bight area depends mainly on what happens farther south. It seems unlikely that the present unusual abundance in Chesapeake Bay can continue, although catches there have remained high since 1970. Whether abundance in the south remains high or not, few menhaden are likely to escape the intensive and essentially unregulated Chesapeake fishery and migrate farther north.

Map 15. Atlantic menhaden



Silver Hake



(Merluccius bilinearis)

Silver hake, also known as whiting, became a major species in the commercial domestic fisheries of New York Bight in the mid-1930s with development of the offshore trawl fisheries. Landings remained high until shortly after the end of the second world war, then dropped abruptly, recovered partially, and have fluctuated widely ever since. Until recently, most of the fluctuations in landings were of economic origin, because silver hake is not in great demand locally for human food; prices fluctuate and are generally low compared to prices of other food fishes. The recreational catch is rather small.

Since large-scale foreign fishing began on Georges Bank and southward, the silver hake resource probably has been overfished. ICNAF regulated the catch by quota, and south of Georges Bank the United States negotiated bilateral agreements with some nations under which certain areas were closed to fishing at specified times. The ICNAF silver hake quota for 1976 was 103,000 metric tons (227 million lb) for Subareas 5 and 6 combined. The greatest historic catch by foreign and domestic commercial fishermen in the area was nearly 337,000 metric tons (743 million lb) plus about 2,700 metric tons (6 million lb) by recreational fishermen in 1965.

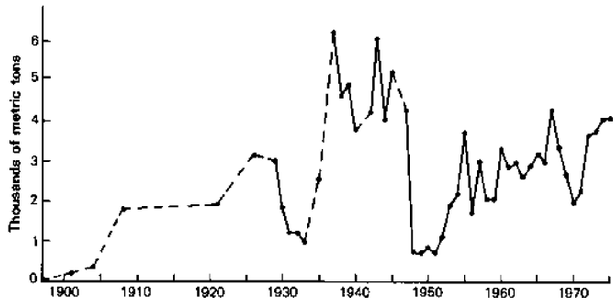
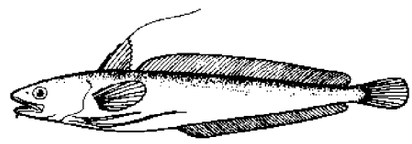


Figure 20. Commercial landings of silver hake in the New York Bight area, 1897-1975

Silver hake ranges from the Newfoundland Banks to the coast of South Carolina. Spawning is widespread over the continental shelf from spring to fall. Buoyant developing eggs drift with the water currents.

Stocks of silver hake in the area appear to be in reasonably good condition despite heavy catches in the mid-1960s. Successful recent spawnings have provided good recruitment. It appears likely that optimum sustainable yield will be maintained, provided that adequate allowance can be made for the unregulated recreational catch.

Red Hake



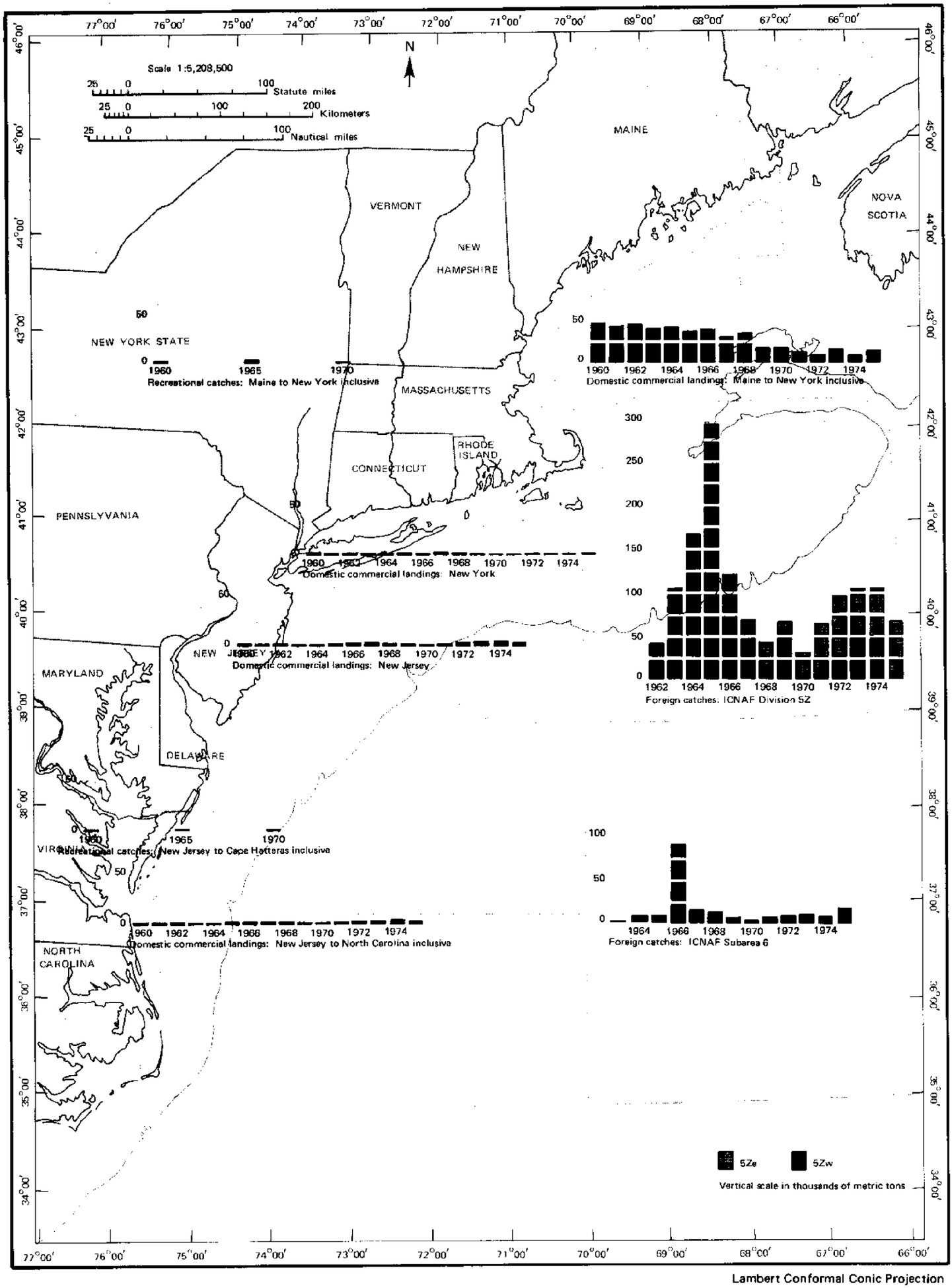
(Urophycis chuss)

Red hake, known also as squirrel hake or ling, is related to cod, haddock, and the other codlike fishes. Prior to 1933, red hake and white hake (*Urophycis tenuis*) landings were reported together, but catches at that time may have been mostly white hake. Since 1944, landings of white hake have been relatively small.

Relatively large landings of red hake were reported in the New York Bight area in 1947, probably from resumption of trawling after the second world war and the strong demand for protein from the sea which developed when meat was in short supply. Since 1947, domestic commercial landings of red hake in New York and New Jersey combined have fluctuated around 454 metric tons (1 million lb) a year. There is also a small seasonal recreational catch in the area.

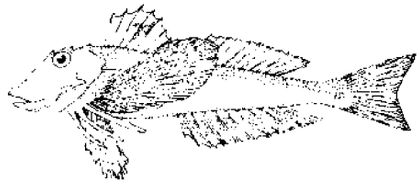
Demand for red hake as human food is limited, and much of the landings is used for industrial purposes—manufacturing fish meal or feeding directly to animals, for example. Most commercial landings of this species in the area are not identified as such, but are included in the category "Unclassified: for bait, reduction and animal food" in published statistics. In

Map 16. Silver hake



the 1950s, red hake made up more than 68% of this category on Nantucket Shoals, and it can be assumed that red hake has been the principal species in New York industrial trawl fishery landings. In New Jersey, on the other hand, most of the industrial fish landings by trawlers have consisted of sea robins (*Prionotus*

Searobin



(Prionotus carolinus)

carolinus and *P. evolans*). At its peak in 1964, the industrial trawl fishery of New York landed about 53,500 metric tons (118 million lb) of mixed industrial fishes, of which about 36,000 metric tons (80 million lb) was probably red hake.

Like several other abundant fishes of the Bight, red hake spends the winter at the edge of the continental shelf and moves inshore in dense schools in spring. Thus, the resource has been available to foreign fleets throughout the year and is caught on the outer continental shelf as well as on traditional

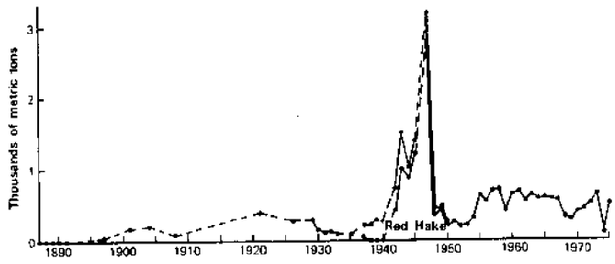


Figure 21. Commercial landings of red and white hake in the New York Bight area, 1887-1975

American fishing grounds like Georges Bank and Nantucket Shoals. Although, as explained above, it is not likely that all domestic landings of red hake appear as such in available statistics, foreign catches have been large compared with domestic landings. This has led to overfishing of red hake and then to strict regulation of the fishery by ICNAF and through bilateral agreements. For 1976, ICNAF set a quota of 42,000 metric tons (93 million lb) for Subareas 5 and 6 combined. The greatest total catch of red hake on record for these subareas, foreign and domestic, was about 110,000 metric tons (242 million lb) in 1966. Recent stock assessments have shown that successful spawnings have replenished the red hake resource. Conservative quotas are expected to maintain the stocks at optimum levels.

In most years of record, domestic landings of unidentified fishes caught by trawlers for industrial uses have been minor, often zero. But in the 1960s, undoubtedly stimulated by scarcity of menhaden, this catch shot up, reaching a peak of about 56,000 metric tons (123 million lb) in 1964. The equally sudden decline of this fishery had different causes in New York and New Jersey. In New York, a group of trawlers from Rhode Island had been making most of the deliveries. These boats returned to their base in Rhode Island when the reduction plant in Point Judith reopened. In New Jersey, the decline probably was associated with the recent increase in menhaden abundance, because menhaden is the preferred species for reduction to oil and meal.

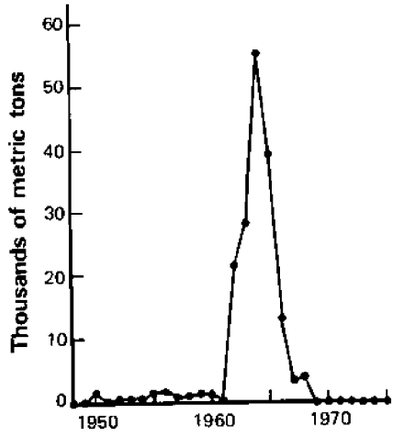
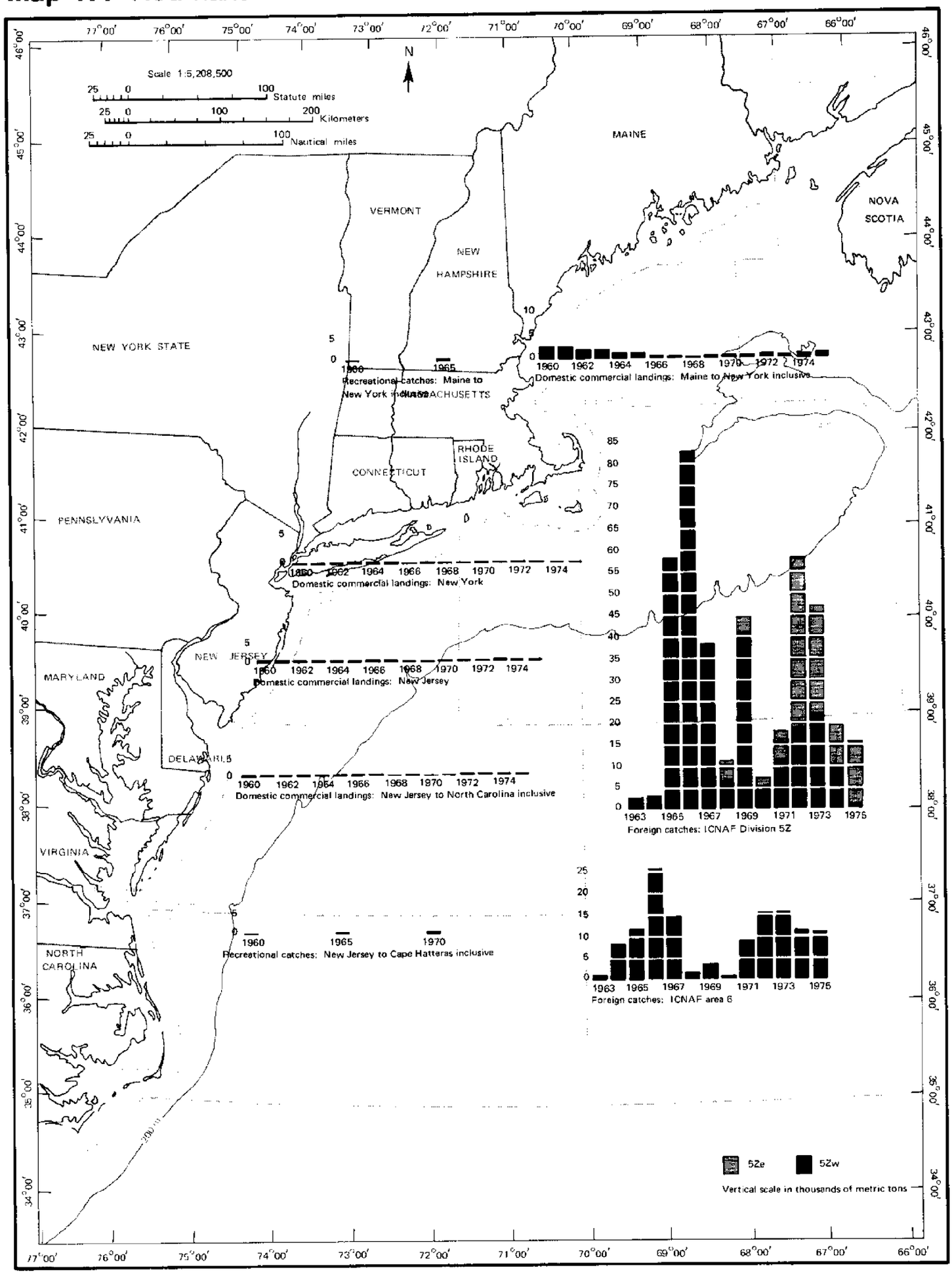


Figure 22. Commercial landings of unidentified trawl-caught industrial fishes in the New York Bight area, 1948-75

Map 17. Red hake



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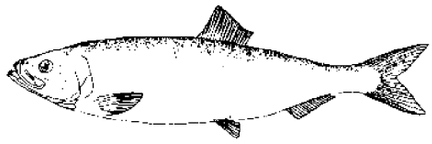
Atlantic Herring



(*Clupea harengus harengus*)

Atlantic herring or sea herring has been little used in the domestic fisheries of New York Bight, although adults are at times abundant on Georges Bank and off the coasts of New York and New Jersey. Fairly large landings were made in the two states on the Bight when fish protein was in great demand after the end of the second world war. Through the late 1940s to the mid-1960s, catches declined through lack of markets. In 1966, the largest landings in history were recorded in the Bight area, when the New York menhaden industry was searching for alternative resources, but this upsurge lasted for one year only. In the last two or three years, domestic catches have been rising.

Foreign catches of Atlantic herring since 1961 have been much larger than domestic catches. The United States has been encouraging foreign fleets to concentrate on species such as this, which have limited market demand in the United States. The offshore stocks of Atlantic herring apparently are distinct from those stocks in the Gulf of Maine which

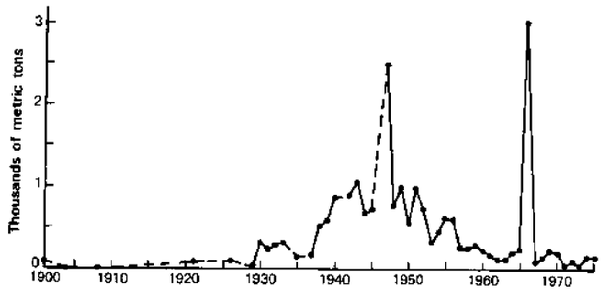


Figure 23. Commercial landings of Atlantic herring in the New York Bight area, 1901-75

are the parents of the young herring that support the Maine sardine industry. The offshore herring resource is overfished, and for 1976 ICNAF set a catch quota of 69,000 metric tons (152 million lb) for Subareas 5 and 6 combined.

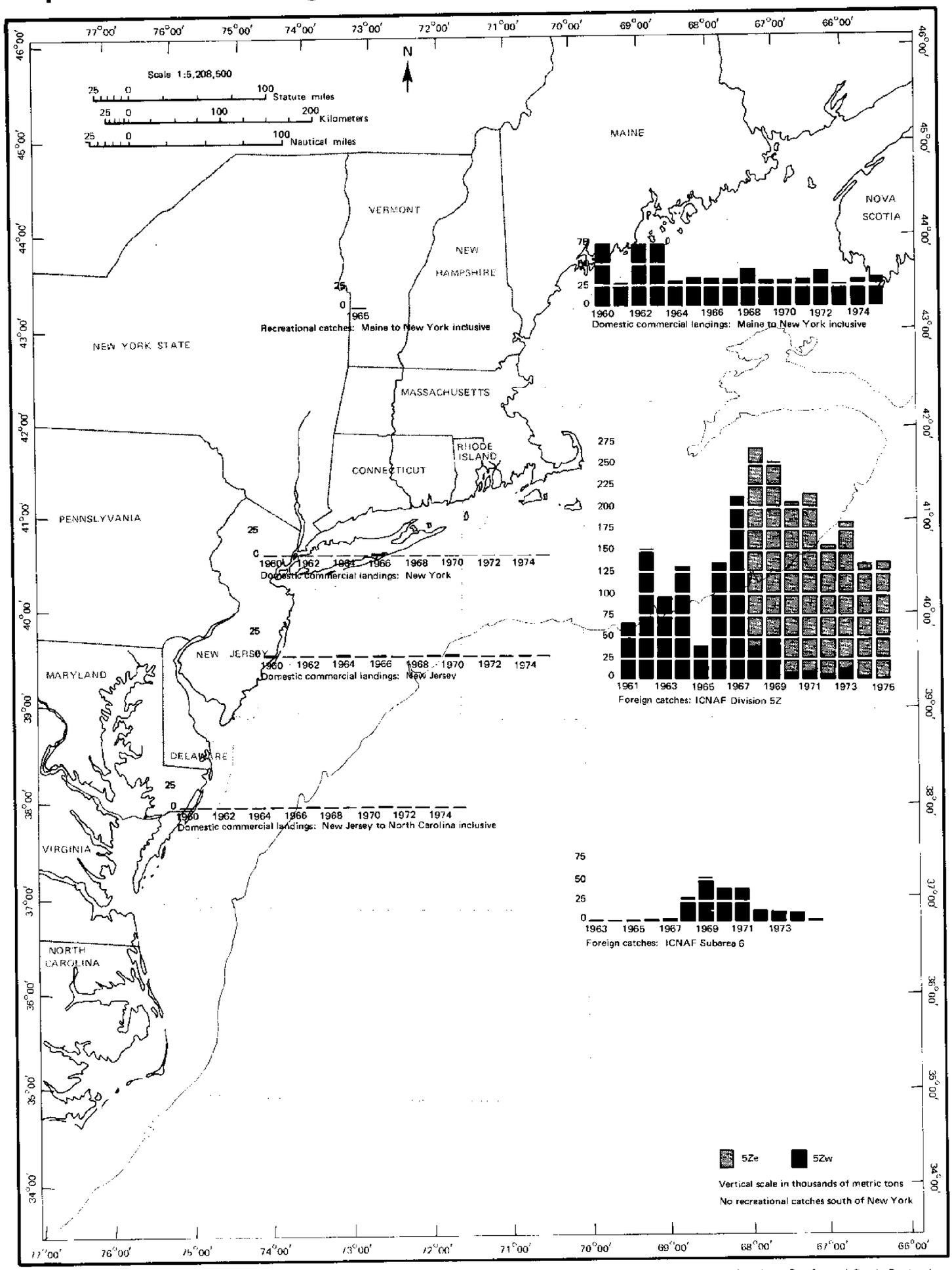
The preliminary management plan for Atlantic herring, developed by the National Marine Fisheries Service under the interim provisions of PL 94-265, further reduced the total allowable catch to 40,000 metric tons (88 million lb) in 1977, some of which were allocated to other nations. Concern has been expressed by American fishermen that the quotas are too high, and that offshore fishing of herring may affect the inshore stocks of juveniles on which the important sardine industry of Maine depends. At the time of writing, Maine has won a court case with a decision that directs the Secretary of Commerce to show cause why relatively large allocations have been made to foreign fleets.

Atlantic herring is widely distributed off the coast on both sides of the Atlantic. On the North American side, commercial concentrations can be found seasonally almost to Cape Hatteras, but the main centers of abundance are farther north. From Georges Bank south, these fish appear to belong to a distinct stock that migrates south and offshore in winter, north and inshore in spring and summer. Spawning may take place from spring to fall on rocky, pebbly, or gravelly bottoms, at depths of 3 to 4 m (10 to 13 ft) or more. The eggs are adhesive and attach to rocks or gravel.

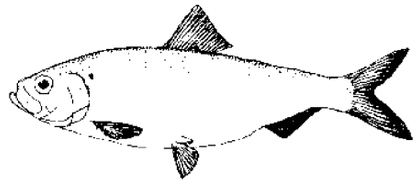
A limited ethnic market exists in the New York area for Atlantic herring, which are pickled or preserved in brine. Processors have had difficulty recently in obtaining necessary supplies of fish.

Minor recreational fisheries for Atlantic herring have developed at some points along the New York and New Jersey coasts. Herring sometimes is caught with jigs.

Map 18. Atlantic herring



Alewife



(*Alosa pseudoharengus*)

Alewife or river herring, like American shad and striped bass, is anadromous. It once was abundant in the New York Bight area; landings were much greater than they are today. Some of the decline has probably been caused by lack of demand, and recent landings probably could have been larger without endangering the resource. The most important domestic fisheries for this species now are in Virginia, North Carolina, and Massachusetts. Included in the alewife catch is blueback herring (*Alosa aestivalis*), a closely-related species.

According to published statistics, alewife landings in the Bight area have been declining since 1889, when peak landings of nearly 2,700 metric tons (6 million lb) were reported. Most of this early catch probably was used as human food. Peak landings in 1966 (the fourth largest annual catch of alewife on record in the Bight) were mostly in New York, where the dying menhaden industry was searching desperately for alternative resources.

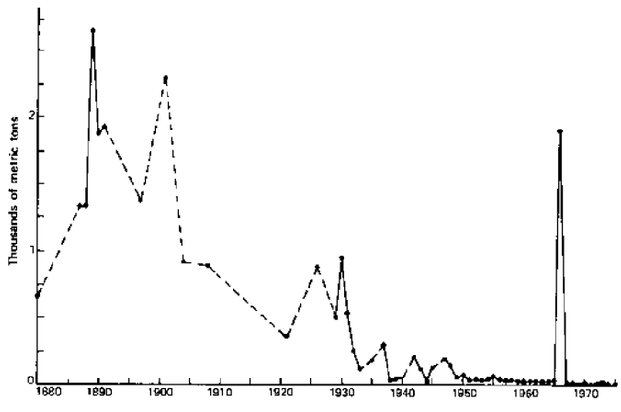


Figure 24. Commercial landings of alewife in the New York Bight area, 1880-1975

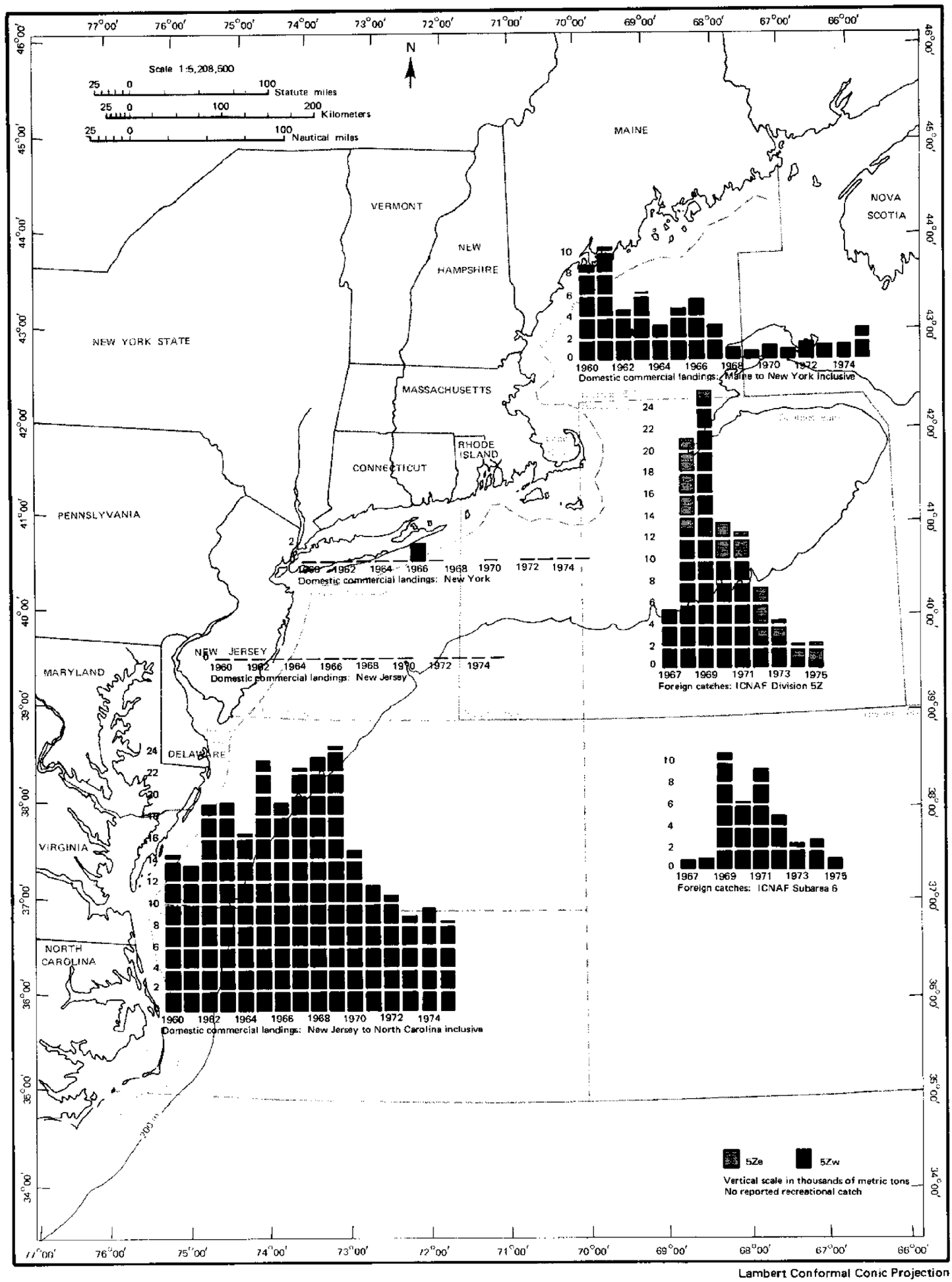
In some coastal streams, recreational fisheries for alewife and other river herrings are carried on during the spring spawning migration. These catches have not been recorded in national surveys of saltwater angling.

In 1967, foreign fleets began to take alewife on Georges Bank and in the Bight. By 1969, foreign catches of this species exceeded domestic catches, and domestic catches declined accordingly. ICNAF has not set an individual quota for alewife in Subareas 5 and 6, but the total quota for all species combined probably afforded some measure of control. Through bilateral negotiations with the nations directly concerned, the United States obtained some limitations on foreign catches of alewife. The Soviet Union, Poland, and Romania, in separate agreements, agreed to refrain from conducting specialized fisheries for the species in waters west and south of Subarea 5. Limits on incidental catches also were obtained.

It is probably too early to forecast the future of the domestic alewife fishery with any degree of certainty. Foreign alewife fisheries in 1969, their peak year, took more alewife than the domestic fisheries from Maine to North Carolina had been taking, more than doubling the total catch. By 1975, the total catch had dropped to about half the peak catch, but despite a sharp reduction in foreign catches, the domestic catch increased only slightly, and was less than half the total domestic catch in 1967, when foreign fishing of alewife began. The important Virginia fishery for alewife has been especially affected. The resource may be slow to recover. It is unlikely that the regional fishery management councils will permit directed foreign fisheries for alewife.

The problems of the alewife fishery are of only minor interest to the Bight states, where the resource is of limited importance.

Map 19. Alewife



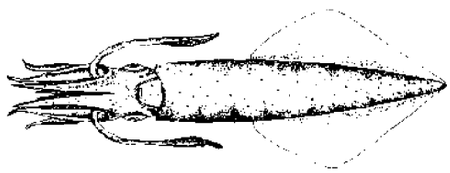
Squids (*Loligo pealei* and *Illex illecebrosus*)

The squid resources of the New York Bight area are relatively large and they have been much underutilized by domestic fishermen. Demand for squid as human food in the United States is small, and most of the catch has been used as bait. In the last decade, a substantial Japanese fishery has developed, especially at the edge of the continental shelf at the mouth of the Hudson Canyon. Several European countries also take substantial quantities. ICNAF found it necessary to place a quota on the total squid catch. The quota for 1976 was 74,000 metric tons (163 million lb) for ICNAF Subareas 5 and 6 combined.

The greatest threats to US domestic fisheries from an intensive foreign squid fishery are that large incidental catches of species important to American fishermen may be taken, or that removal of large quantities of squid will affect the food supply of traditional American fishery resources. On the other hand, squid also preys on young fishes. Thus, the secondary impacts on other fishery resources are not known. Foreign trawl catches of squid often contain more than 50% by weight of butterfish and other fishes.

Some squid are taken by recreational fishermen near shore for use as bait. No estimates of the size of this catch are available.

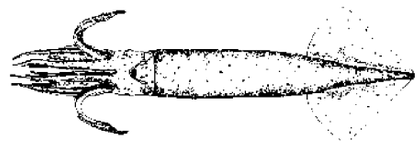
Long-finned Winter Squid



(Loligo pealei)

Long-finned Winter Squid (*Loligo pealei*). The long-finned winter squid, is a shallow water animal. It lives along the inner part of the continental shelf and enters bays, harbors, and other protected waters, but requires relatively high salinities. Breeding takes place near shore. Eggs are laid in clusters attached to the bottom, and may take several months to hatch. Newly born young are free-swimming and similar in appearance to their parents. Maturity is reached in about a year. Most adults die soon after spawning. The life history is not well known. This species ranges from New England to the Caribbean.

Short-finned Winter Squid



(Illex illecebrosus)

Short-finned Winter Squid (*Illex illecebrosus*). The short-finned summer squid, is oceanic, although it comes inshore seasonally in some places along the coast. Its life history and migrations are even less well understood than those of the long-finned squid. On the North American side of the Atlantic it is found from Newfoundland to northern Florida, on the European side south to the British Isles.

It has been generally believed that squids as a group are one of the most important underutilized living marine resources. Although it is believed that the two commercial squids of the Bight area are now fully utilized, data still are rather scanty. If other species could be taken, the sustainable catch might be considerably greater. There is no reason why US fishermen could not take a larger share of the harvest if markets were available. Sentiment is strong in the domestic industry to develop a squid fishery and market most of the catch in other countries. The principal problem has been lack of preservation and processing facilities to provide an acceptable product. To date, American fishermen have not taken the generous share of the total allowable catch allocated to them, and it has been necessary to reallocate a part of the domestic quota to foreign fleets.

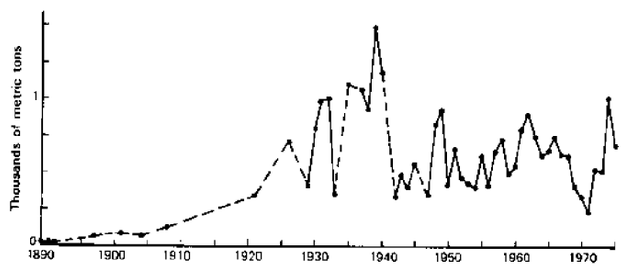
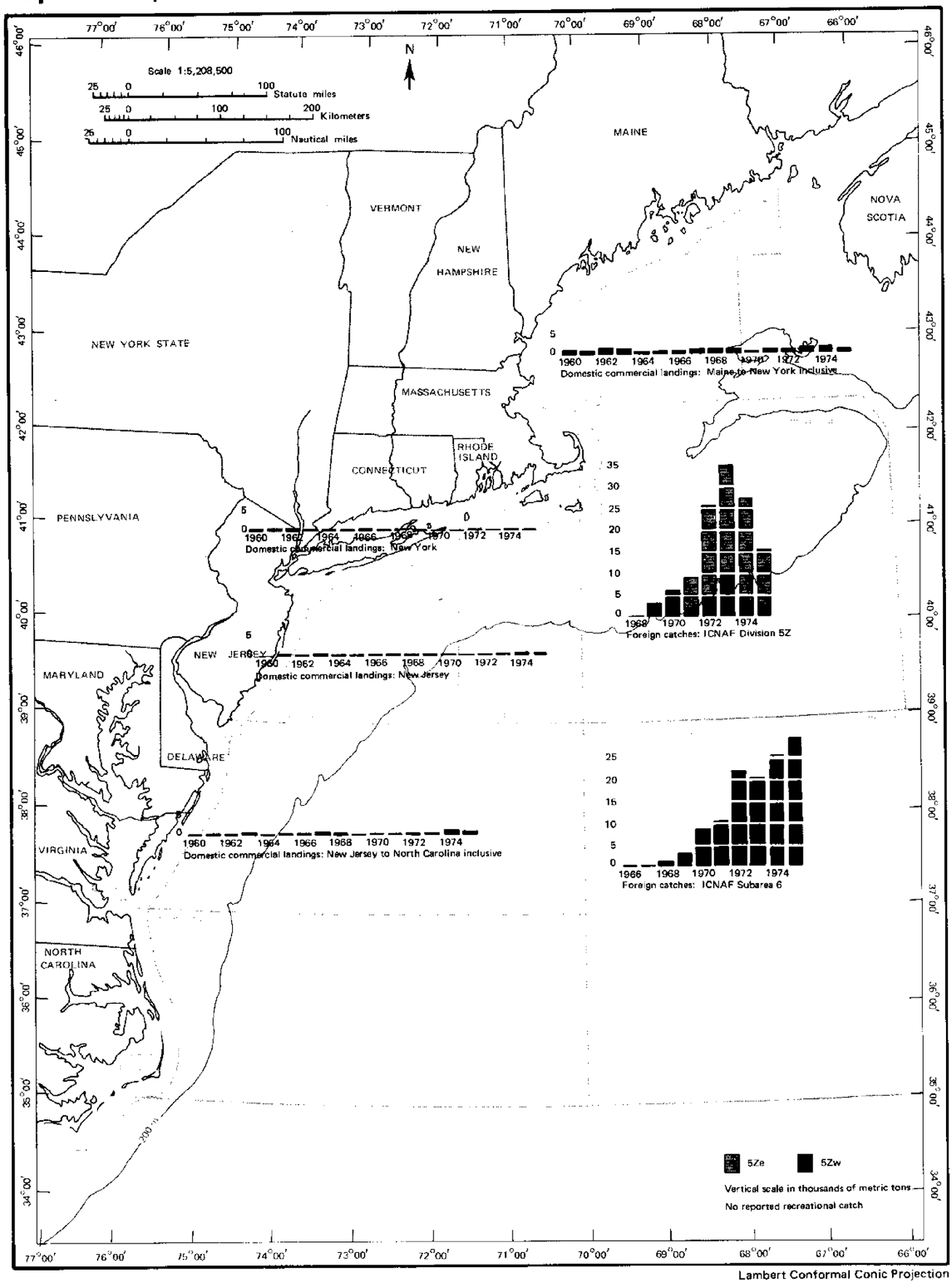


Figure 25. Commercial landings of squids in the New York Bight area, 1889-1975

Map 20. Squids



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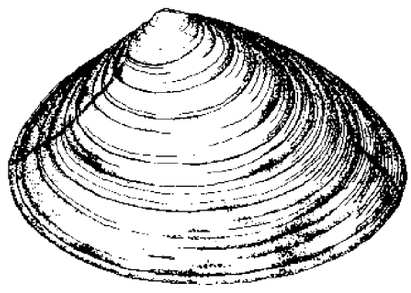
Food Shellfishes

All the major shellfish species caught in the New York Bight area are used primarily as human food, except squid, which is also popular as bait, and horseshoe crab, which once supported a fairly important industrial fishery in New Jersey but now yields negligible catches. Some clams and other mollusks are used for bait, as are crabs, but it is believed that the amounts used in this way are relatively small.

Surf Clam



(*Spisula solidissima*)

Surf clam or skimmer began to develop as a major fishery resource after the end of the second world war. Development of the fishery was made possible when a method was invented in 1943 for removing sand from meats. Growth of the new fishery was also stimulated by increased demand for protein and shortages of red meat during and after the war. The fishery began on the continental shelf off the south shore of Long Island, but soon shifted to beds off the New Jersey coast. In 1966, the peak year of the fishery in the New York Bight area, about 96% of landings came from grounds off New Jersey. The subsequent drop in landings in New York and New Jersey combined probably was caused by overharvesting of surf clam stocks in the Bight. In fact, the decline probably was greater than landings in the two states suggest, for the fleet moved steadily southward. Surf clam, however, does not remain alive for long after it has been removed from the water. It must be processed within a day of catching. Therefore, it cannot be shipped very far in the shell.

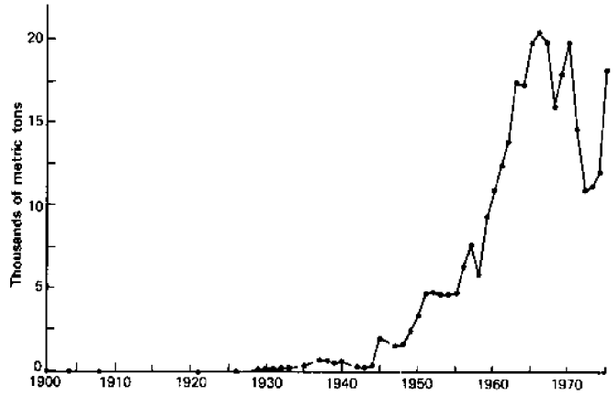


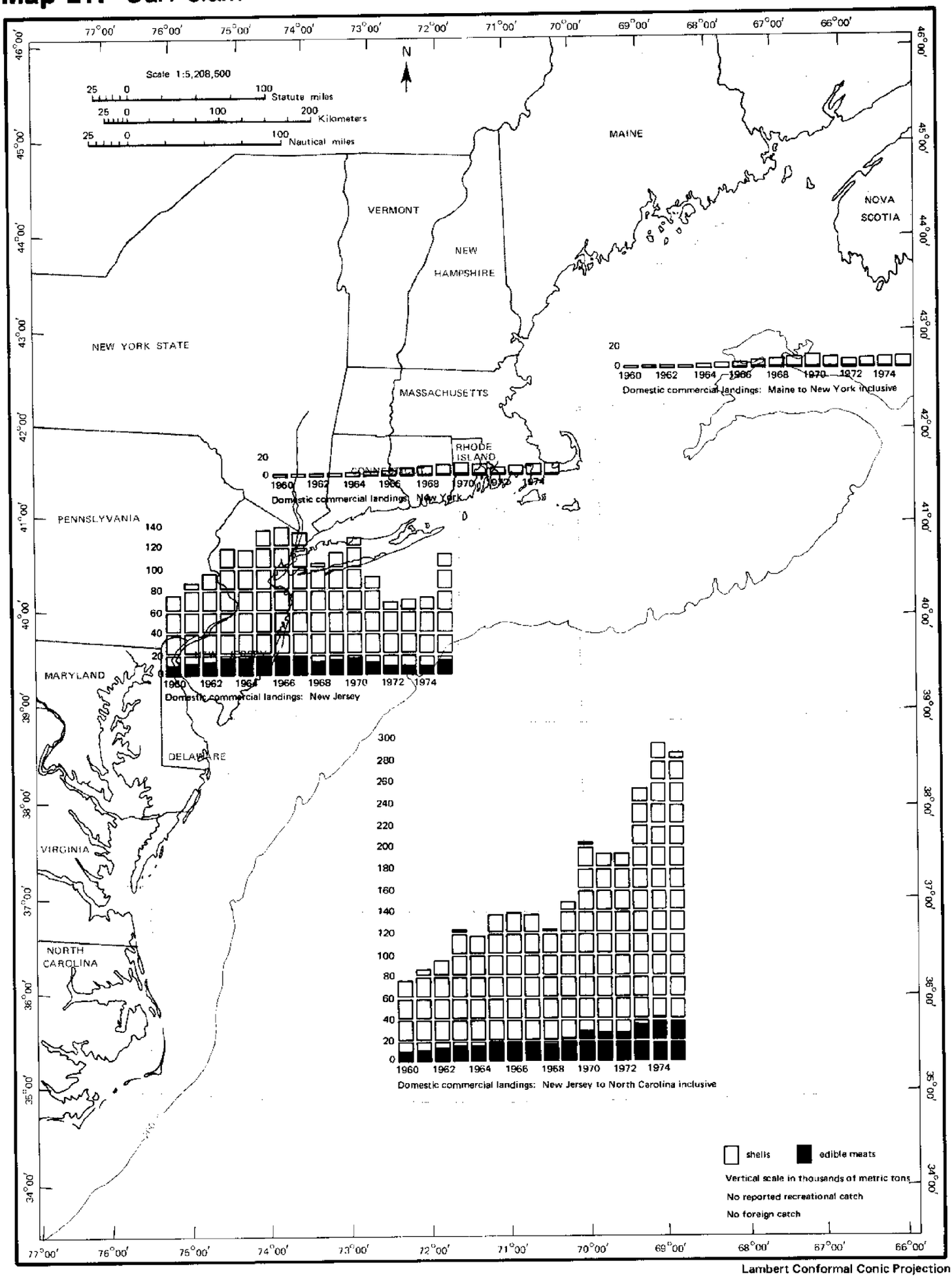
Figure 26. Commercial landings of surf clam meats in the New York Bight area, 1901-75

Landings of surf clam in New York have remained fairly steady at about 1,600 metric tons (between 3 and 4 million lb) of meats since 1968, but landings in New Jersey are down substantially from the peak in 1966. In 1976, the stocks of surf clam off New Jersey were further reduced by massive mortalities caused by depletion of dissolved oxygen in bottom waters on the continental shelf. Recently, most of the Atlantic coast surf clam harvest has come from off Virginia, but landings in that area are down sharply also. Although local landings are down, this is still the second most important living resource in the Bight by weight, exceeded only by menhaden. In fact, if weight of shells were included, surf clam landings in the area have exceeded menhaden landings annually since 1963.

Surf clam is distributed from the Gulf of St. Lawrence to Cape Hatteras, NC, from shallow waters to depths as great as 76 m (250 ft). Some may be found inside the mouths of coastal bays and close to the ocean shoreline. This species is fairly widely distributed in the eastern half of Long Island Sound. Almost all the commercial catch comes from the continental shelf. There is no reported recreational catch, although some are taken in shallow waters for food or bait.

There is no foreign fishery. To protect its interest in the resource, the United States declared surf clam a creature of the continental shelf. Under the terms of the 1958 Geneva Convention and PL 94-265, living resources of the continental shelf cannot be taken by foreign fishermen. To protect this privileged position it seems clear that the United States must develop the necessary scientific information and establish management measures to maintain the resource at maximum levels of biological productivity. The Surf Clam Management Sub-Board of the State-Federal Fisheries Management Board developed such a program and turned it over to the Mid-Atlantic Fishery Management Council in 1977. The council

Map 21. Surf clam



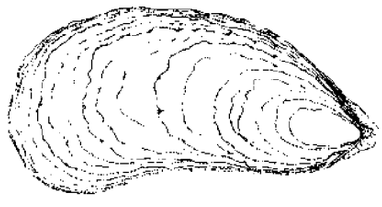
has recommended quotas of about 13,600 metric tons (30 million lb) of meats for 1977.

Like other species of bivalve mollusk, surf clam spawns by ejecting eggs and sperm to be fertilized in the surrounding water. After hatching, larvae go through a series of free-swimming stages before they settle to the bottom and eventually dig in.

Although the total surf clam catch along the Atlantic coast was increasing through 1974, this was possible only by shifting to new grounds. In 1975 and 1976, catches in the Middle Atlantic Bight (Cape Cod to Cape Hatteras) were down. Unless effective management measures can be taken soon, it is likely that this important fishery will repeat the history of many other coastal fisheries and dwindle. Until recently, little concern has been shown for the future of the resource. The strategy has been to search out new beds as production has declined on older clam beds. If the Mid-Atlantic Council fishery management plan for the surf clam fishery succeeds, it can serve as an example for management of other coastal fisheries. Failure to manage this fishery and the resource that supports it, which is nonmigratory and has been harvested exclusively by US fishermen, will be a poor start for the nation as it takes up new responsibilities for fishery management under the provisions of PL 94-265.

A partial alternative to the surf clam resource is the ocean quahog or mahogany clam (*Arctica islandica*). This abundant species occupies the continental shelf over approximately the same geographic range as surf clam, but in deeper water farther offshore. Ocean quahog cannot be shucked economically by hand, as surf clam can. These differences limit the ability of the smaller vessels in the fleet to take ocean quahog, and raise economic problems for some of the smaller processing plants that shuck surf clams by hand and do not have the equipment for mechanical shucking. A provisional quota of about 13,600 metric tons (30 million lb) of ocean quahog meats has been recommended by the Mid-Atlantic Council.

American Oyster



(*Crassostrea virginica*)

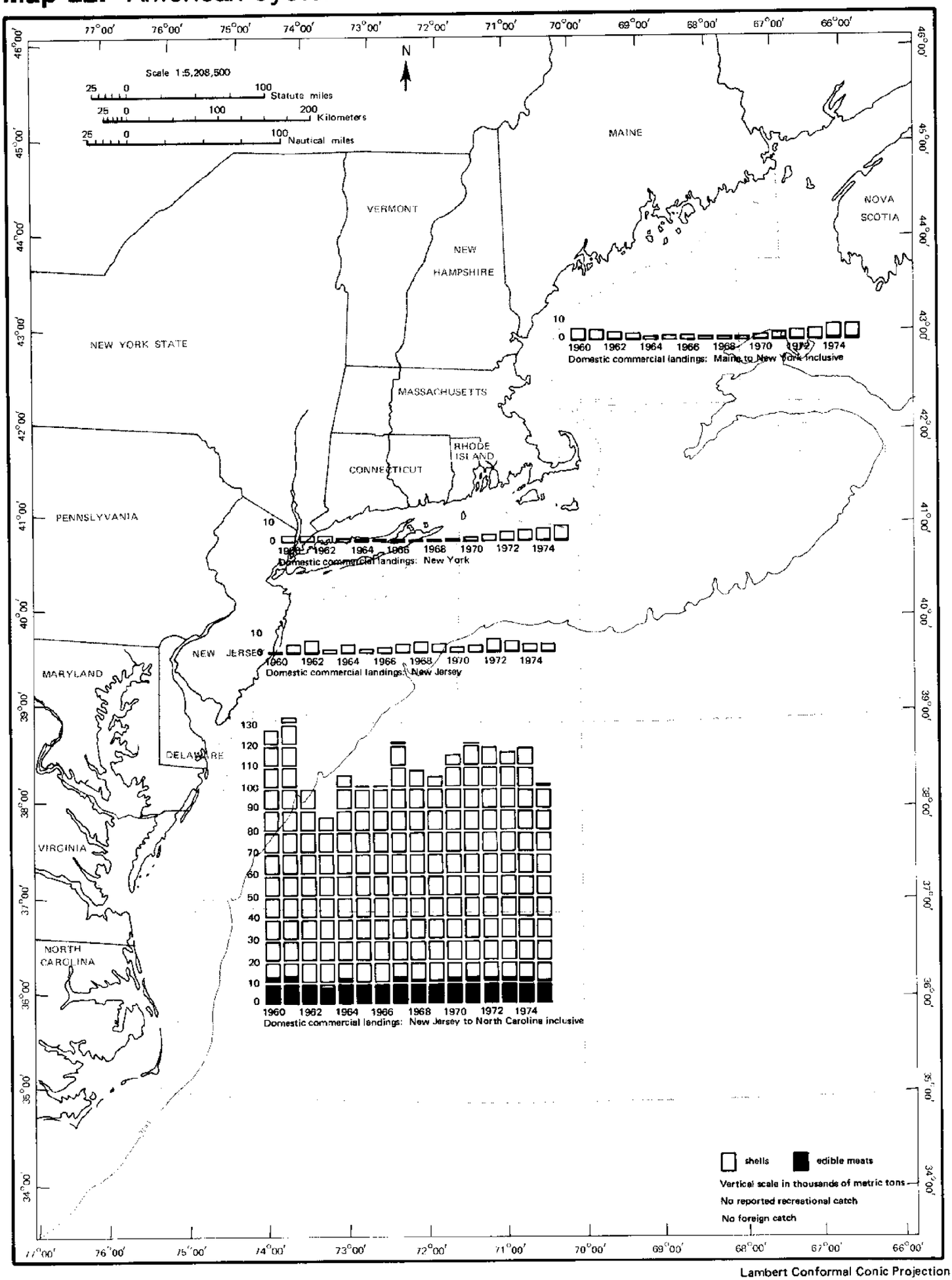
The oyster resources of the US Atlantic coast have supported important but steadily declining fisheries for the past 100 years or more. All the bays and estuaries of the New York Bight area have at one time or another yielded commercial oyster harvests; some still do. Long Island Sound was the location of the most advanced oyster culture industry on the Atlantic Coast, but that industry was virtually wiped out in the early 1950s by a massive invasion of sea stars (starfish). Careless oystering practices by some segments of the industry contributed to the decline in Long Island Sound, as they did in other places along the coast. Raritan Bay once supported a thriving oyster industry, the complete demise of which has been attributed to the effects of water pollution. Many formerly productive areas are closed to shellfishing because water quality does not meet federal standards. Delaware Bay also was an important oystering area. There the decline of the industry was caused primarily by the effects of an oyster killing microscopic organism called *Minchinia nelsoni*.

Since it is a resource of protected coastal waters, American oyster is not available to foreign fishermen. Five planters in New York are raising seed (young oysters) in hatcheries, and by using enlightened oyster growing techniques are improving their yields substantially. The magnitude of this recovery may not be clear from Map 22 or Figure 27, because the level of landings is still so much less than before. In New York, production rose from a low of 46 metric tons (100,000 lb) of meats in 1967 to more than 956 metric tons (2.1 million lb) in 1975. In New Jersey, a low of about 76 metric tons (167,000 lb) of meats was reached in 1960. Production since that time has been erratic, but the trend has been slightly upward.

American oyster spawns in early summer. Eggs are released into the surrounding water, where they are fertilized. Developing eggs soon hatch into free-swimming larvae, which remain in the water above the bottom for 10 days or more. At the end of this period, the larvae settle to the bottom. If they find a

Figure 27. Commercial landings of American oyster meats in the New York Bight area, 1880-1975

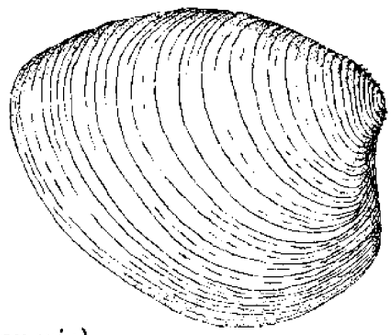
Map 22. American oyster



suitable firm surface they then cement themselves to it, and thereafter do not move voluntarily except to open and close the unattached half of the shell to take in food, obtain oxygen, and release waste products.

The future of the oyster industry, especially in New York waters, appears bright, provided that unexpected disaster does not strike. Improved oystering methods, especially with successful hatchery production of seed, should be able to supply market demand. New York and New Jersey oystermen have an advantage over those in other Atlantic coast states because they can produce in quantity superior oysters that sell at considerably higher prices. Hard bottoms and relatively slow growth produce oysters with cupped, rounded shells that are ideal for the half-shell trade.

Hard Clam



(*Mercenaria mercenaria*)

Hard clam or quahog is a resource of protected coastal waters, not vulnerable to foreign fishing. The New York Bight area produces about two-thirds of the total national harvest of this species, most of which presently comes from Great South Bay on the south shore of Long Island. Landings of hard clam have fluctuated widely, apparently mostly from natural changes in abundance. The most recent peak in reported landings for the area was in 1971, and the catch appears to have stabilized since then at about 10% below the 1971 level. Some people in the industry believe that the resource in Great South Bay is being overharvested, but there is as yet no documented proof that this is so. Nevertheless, the numbers of shellfishing licences issued have increased steadily, and are now almost double what they were in New York in 1970. On the other hand, there is reason to question the accuracy of reported landings. It is commonly believed, not without reason, that published figures on landings are substantially lower than the actual harvest. The diffuse structure of the hard clam industry, and the unknown but certainly large recreational harvest, and catches by residents for their own use, make it very difficult to get accurate figures. However, the decline in reported landings in the 1950s and the recent increase appear to reflect real changes in abundance. Thus, published commercial statistics, at least since the 1940s, appear to be useful indices of change, even if they underestimate the absolute magnitude of the catch.

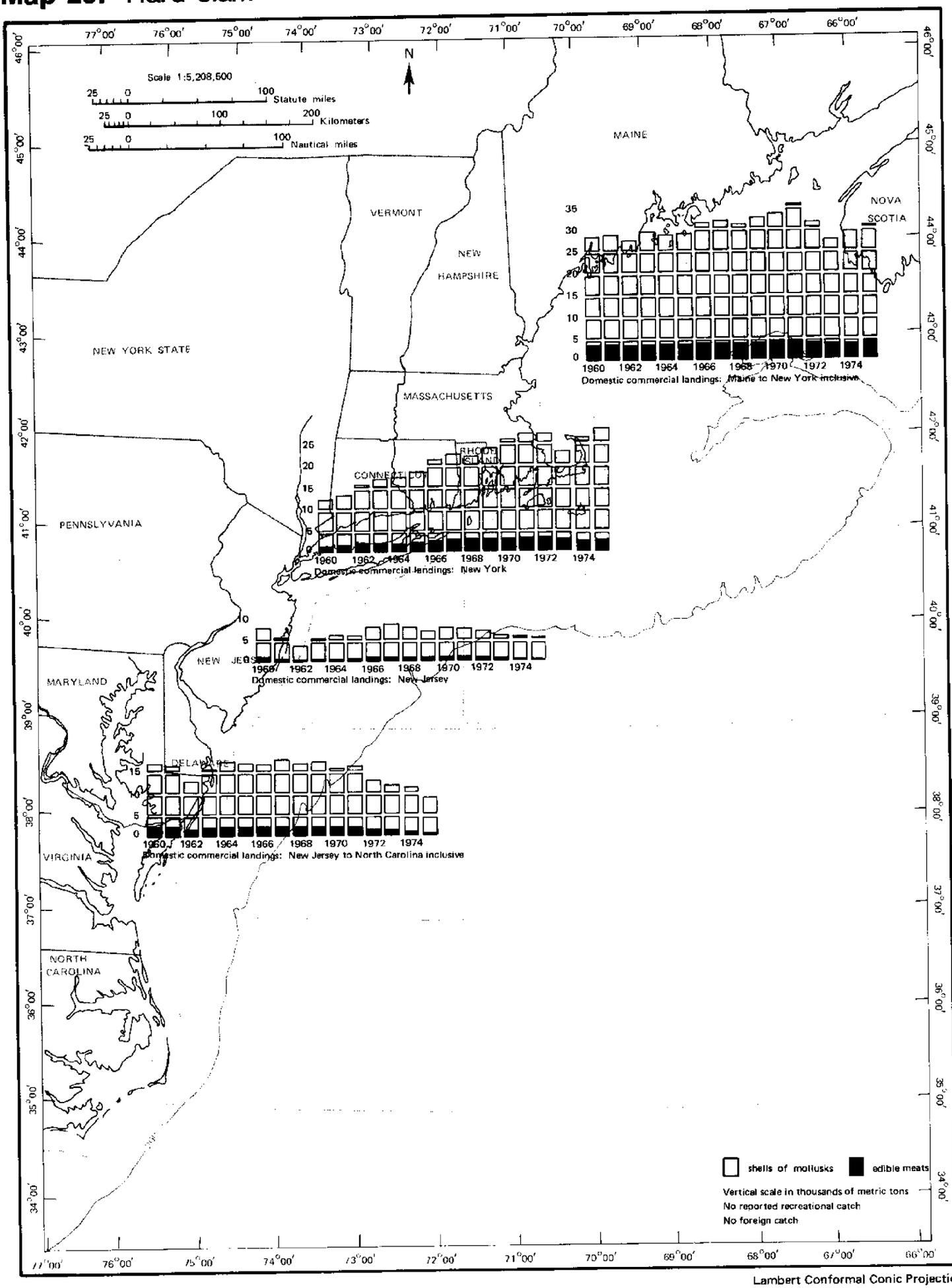
Figure 28. Commercial landings of hard clam meats in the New York Bight area, 1880-1975

Hard clam is the most valuable single fishery resource in the Bight area. Landed value (price paid to clammers for their catch) in 1975 in the two states combined was about $16 million, or about 33% of total landed value for all species. In New York, hard clam accounts for more than 50% of total landed value, and allowing for underestimates, it has been estimated that the gross retail value of the resource is about $100 million per year.

Hard clam goes by a number of trade names based on size. In the Bight, the principal categories are littleneck—the smallest legal size; cherrystone—medium size; and chowder—largest size. Littleneck clams used in cocktails or on the half shell bring by far the highest price. Minimum legal size in New York is 2.5 cm (1 in) thickness (diameter across the two halves of the shell). Minimum size in New Jersey is a shell length of 3.8 cm (1.5 in) (greatest length of the shell), which equals somewhat less than 2.5 cm (1 in) diameter. Such lack of uniformity in state laws creates enforcement problems.

Most hard clams reach maturity in one year. At first almost all are male. At two years of age, about half the clams change to female and there is no further change. Spawning is in summer. Eggs and sperms are released into the surrounding water before

Map 23. Hard clam

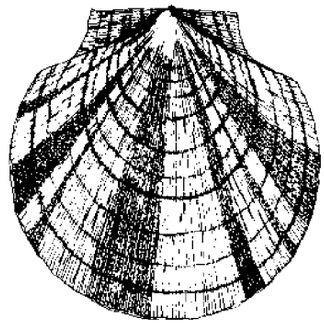


fertilization. The free-swimming larvae go through a series of larval stages, metamorphose in 7 to 14 days, sink to the bottom, then use the muscular foot to crawl around and find a suitable base for attachment. Attachment is by *byssus threads* (fine filaments, like those mussels use), which the young clam may release to crawl to another spot and reattach. Soon the byssus is discarded and the young clam digs into the bottom, leaving only the *siphons* (tubes) exposed to pump water containing food and oxygen and to discard wastes.

Living as it does in shallow waters near shore, hard clam, like other coastal zone mollusks, is subject to many human and natural hazards. The threat of overfishing is great. The industry would probably be better off economically if licenses issued were limited to just that number necessary to take the allowable catch. Water pollution also is a hazard, and extensive clam beds in both states are closed to shellfishing. In both states it is illegal to take clams at night, but poaching and other evasions of the law are a problem. Some efforts are being made to develop management programs, but these may fail if enforcement is inadequate, if the courts continue to impose insignificant penalties, and if public attitudes do not improve.

New York State and the counties on Long Island have certain management responsibilities, but most of the towns have jurisdiction over the living hard clam resource on grounds within their boundaries. For example, the three towns that border Great South Bay—Babylon, Islip, and Brookhaven—have hard clam management programs in various stages of development. Islip has the most advanced program. Some relatively small clam-producing areas in Great South Bay are under state jurisdiction, and a fairly large area of bottom is under private control, under the provisions of a royal charter that dates back to the eighteenth century.

Sea Scallop



(*Placopecten magellanicus*)

The decline of the US sea scallop fishery on Georges Bank has been attributed to a rapid increase in scallop fishing effort in the 1960s as Canadian scallopers moved southward, and to some unsuccessful spawnings in the 1960s. Attempts were made to maintain the catch by moving into the New York Bight area and as far south as waters off Virginia. The scattered and apparently less resilient southern stocks could not make up the difference. Landings in New York and New Jersey combined dropped from a maximum of about 2,720 metric tons (6 million lb) of meats in 1950 to about 213 metric tons (500,000 lb) in 1972. The resource began to recover in 1975, and in late 1976, the total catch was nearly eight times the 1972 low.

Prior to 1937, landings of bay scallop (*Argopecten irradians*) were combined with sea scallop in commercial fishery statistics. From 1887 to 1936 inclusive the greatest Bight landings on record were about 1,225 metric tons (2.7 million lb) of meats in 1935. Therefore, it can be assumed that peak production of sea scallop in this area was in 1950, when 1.3 metric tons (2,783 lb) of meats were landed. The total US-Canadian catch of sea scallop on the Atlantic coast has dropped only moderately. Canada has been taking an increasingly larger share of this total catch, with a consequent decline in the US fishery. Substantial Canadian catches were made in 1965 and 1966 in ICNAF Subarea 6. This coincided with the last and sharpest decline in landings in the Bight area.

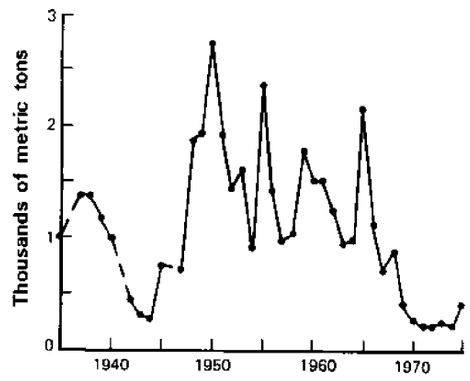
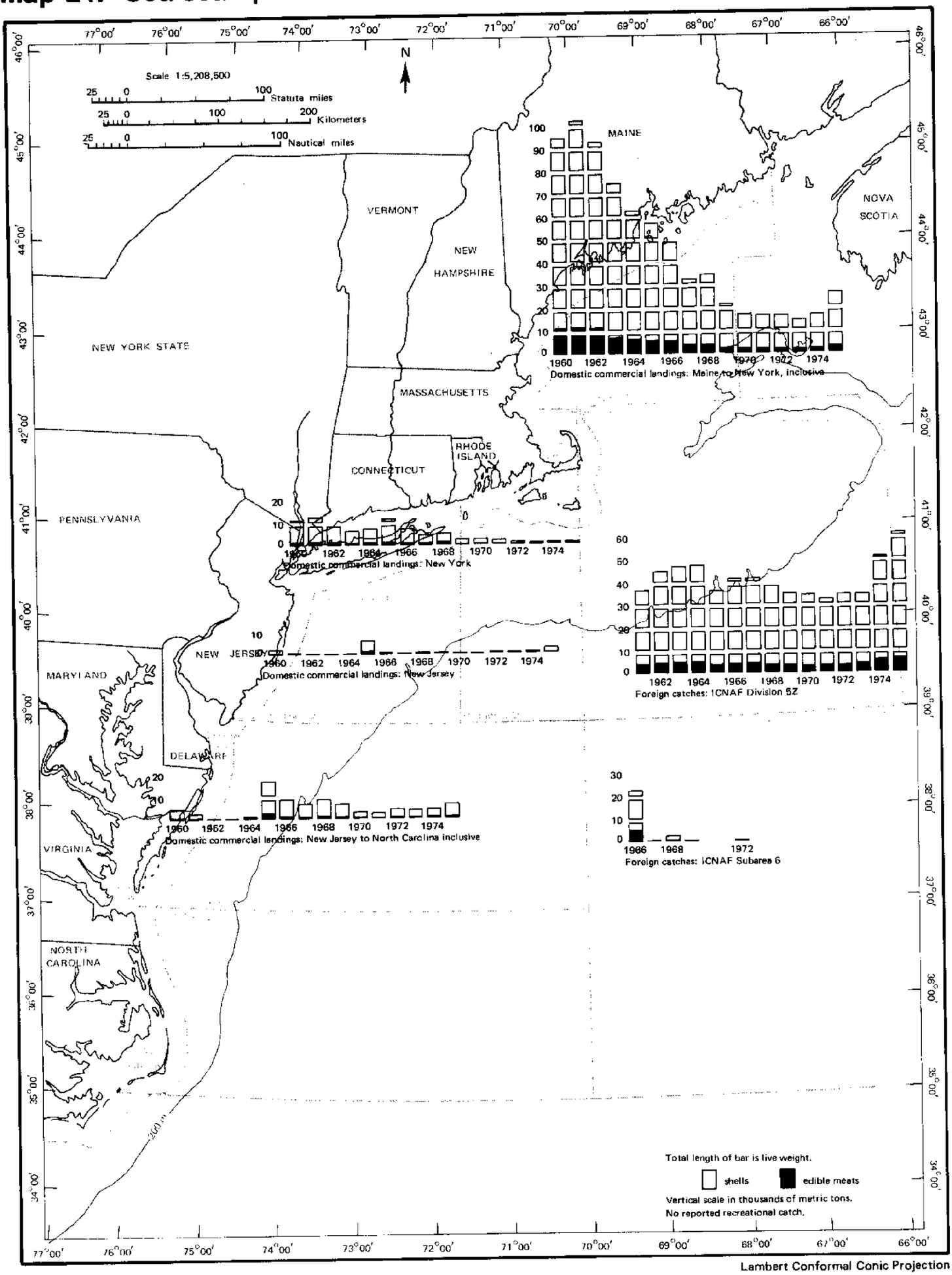


Figure 29. Commercial landings of sea scallop meats in the New York Bight area, 1935-75

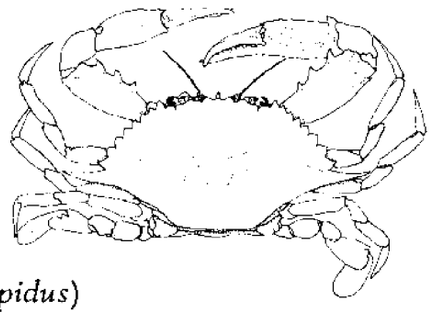
Map 24. Sea scallop



Canada is the only nation besides the United States that takes sea scallop along the North American coast. The fishery was regulated by ICNAF, which established a minimum size limit recently. It has not been determined that a quota is needed in addition.

In the early 1920s, the center of the sea scallop fishery moved from off the New England coast to beds off Long Island, but in the 1930s the large resource on Georges Bank was discovered for the first time. The species ranges from the Gulf of St. Lawrence to Cape Hatteras. Sea scallop does not attach to the bottom, although it spends considerable time there. It has an ability to swim rapidly but erratically by a sort of jet propulsion. Around the edges of the *mantle* (the outer layer of the soft body), where it is readily visible when the two halves of the shell are parted, is a series of 80 to 100 or more bright blue, light-sensitive eyes. Spawning occurs in late summer and fall. The young, after completing the larval stage, attach to solid objects on the bottom by byssus threads, as young hard clams and mussels do. They are able to release themselves and reattach at will, but eventually free themselves from this attached mode of existence for good.

Blue Crab



(*Callinectes sapidus*)

Blue crab, or blue-claw crab as it is known in the New York Bight area, is a major fishery resource in Chesapeake Bay, but its abundance and importance drop off very rapidly toward the north. This is a resource of estuaries and bays that does not migrate far from shore north of Cape Hatteras, hence is not vulnerable to foreign fishing.

As might be expected of a resource that lives in shallow, highly variable coastal waters, blue crab varies widely in abundance from natural causes. As the history of landings in the Bight area shows, abundance has been rather low since the peak year 1939, until a sharp increase began about the end of the 1960s. No commercial landings were reported in New York from 1962 to 1973 inclusive, but in 1974, blue crab reappeared in commercial landings in the state. The species has been noted recently as abundant in most of the bays along the south shore of Long Island. In some years, landings have been about equal in the two states, but usually most of the commercial catch in the Bight area comes from New Jersey waters, most of this catch from Delaware Bay. This is as might be expected in a temperate water and semi-tropical species. Combined landings in the two states, almost all from New Jersey, have been rising since 1968. It has been suggested, although there is no direct evidence to support it, that the increase in abundance has been made possible by the ban on use of DDT for mosquito control.

Recreational catches of blue crab in the Bight area were reported as early as the 1880s. The sport catch undoubtedly is substantial, but estimates of this catch were not included in the surveys of saltwater angling prior to 1974, and details of the most recent survey are not yet available. In the Hempstead estuary on the south shore of Long Island, however, blue crab was found to be one of the most important recreational resources in the 1960s.

In Chesapeake Bay, where its life history is best known because it is a major commercial species, blue crab performs complicated migrations up and down the bay and its tributaries. Females are inseminated in the upper bay in fall, but fertilization of eggs does not take place until later. Females migrate to deeper waters near the mouth of the bay to spend the winter, but males may simply bury in the silt and hibernate until spring. As with American lobster, eggs are extruded in spring, are fertilized by the stored sperm, and become attached in a large mass or "sponge" under the abdomen of the female. After

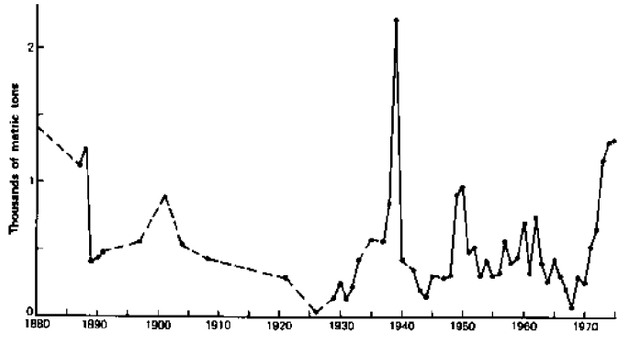
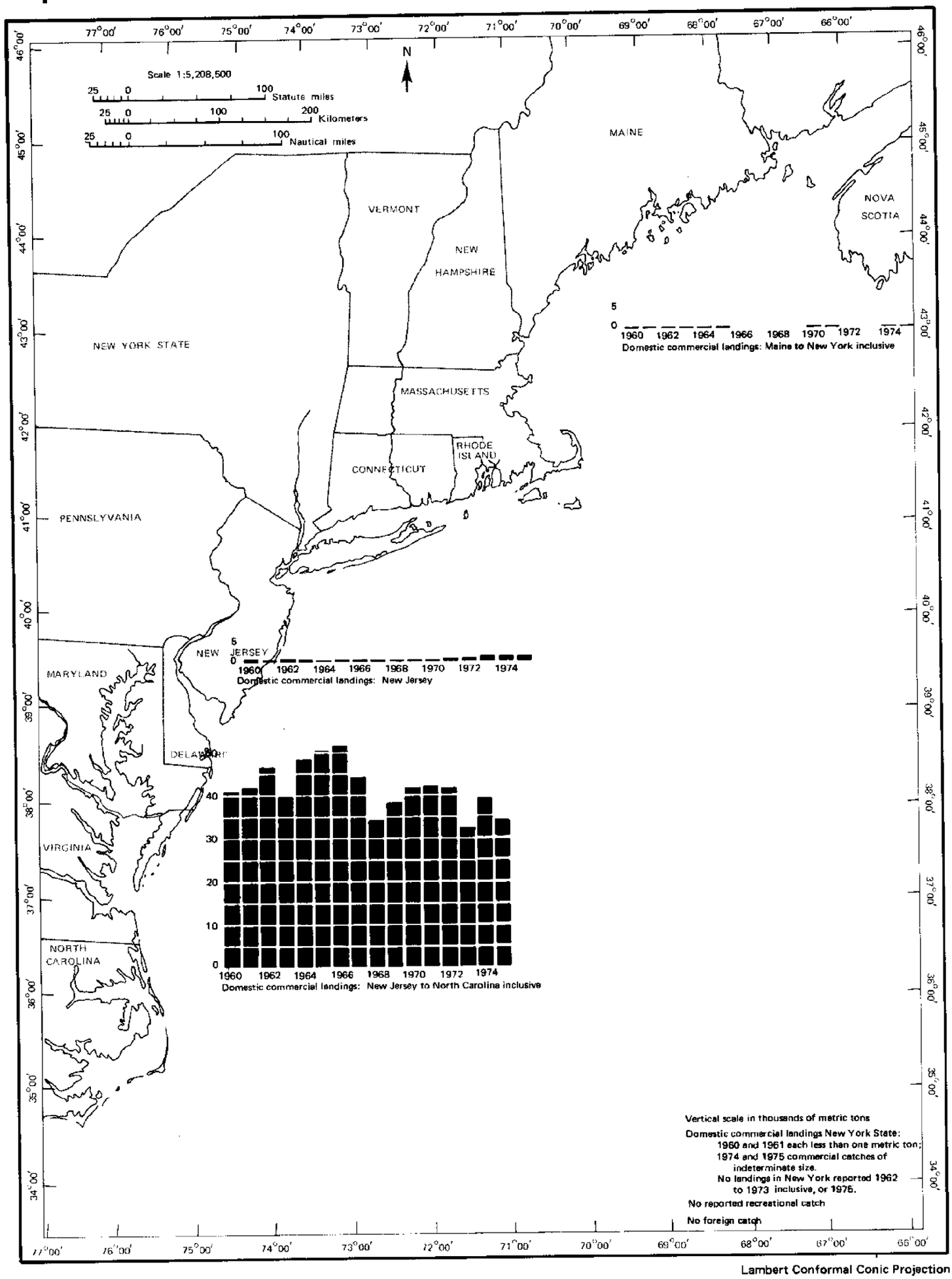


Figure 30. Commercial landings of blue crab in the New York Bight area, 1880-1975

Map 25. Blue crab

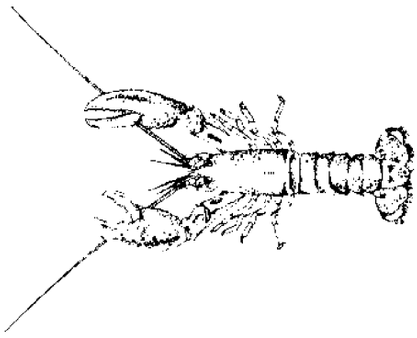


Lambert Conformal Conic Projection

completing a series of larval stages quite unlike the parents, the young begin to migrate up bay and up tributary rivers. Part way in this journey they are halted by low winter temperatures and hibernate in the sediments until spring. The upstream migration is completed in summer, and the cycle then repeats.

The life history of blue crab in the Bight area is not well known, but a somewhat similar migratory pattern must be followed because most crabs disappear in winter. It is likely that they move out into somewhat deeper waters on the continental shelf, as they do in the region of relatively small shallow bays south of Cape Hatteras and in the Gulf of Mexico. Some, however, hibernate in the mud in deeper parts of the coastal bays, where they are taken in some quantities by clammers.

American Lobster



(*Homarus americanus*)

Until recently, lobster landings in the New York Bight area have been following a sharp upward trend. Combined landings in New York and New Jersey reached an all-time high in 1970 of about 1,590 metric tons (3.5 million lb). This increase is believed to have been caused partly by increased abundance of American lobster in the area, as declining water temperatures in the 1960s led to a southward shift in the center of abundance of the species. This conclusion is hypothetical, however. New lobster fisheries on underutilized stocks on the continental shelf also contributed to increased catches. Offshore lobster fishing is carried on to depths of at least 300 m (984 ft). Since 1970, catches have been declining. It is suspected that overfishing has been at least partially responsible.

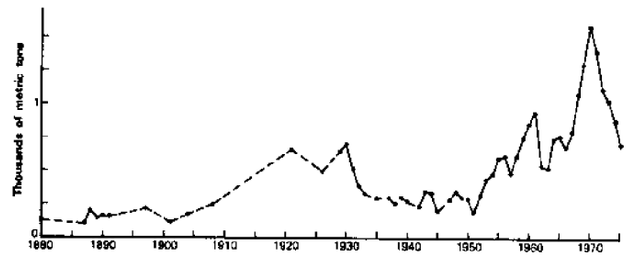


Figure 31. Commercial landings of American lobster in the New York Bight area, 1880-1975

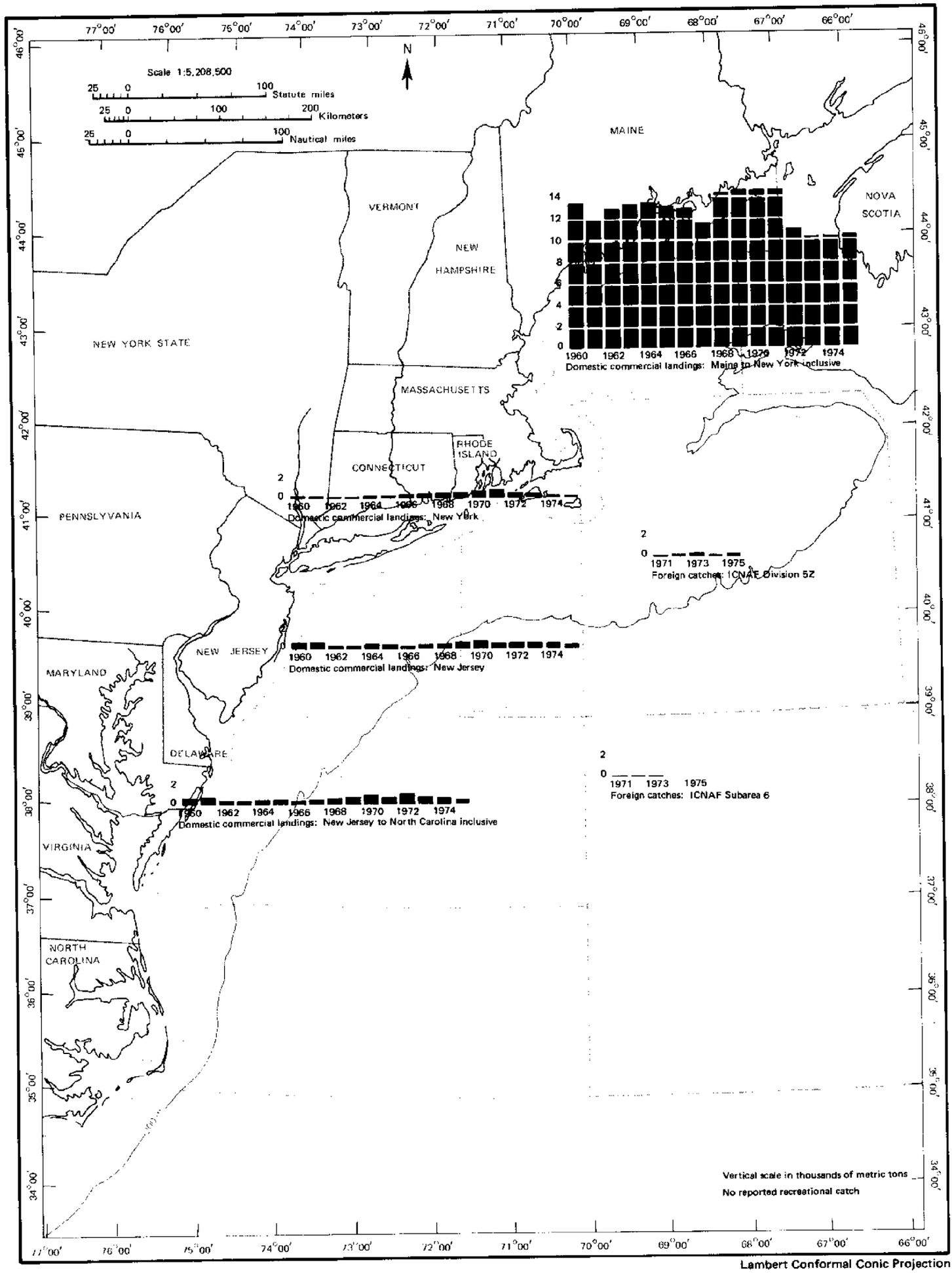
Reported catches of American lobster by foreign fleets have been relatively small, but members of the domestic lobster industry believe that incidental and unreported catches have been substantial. In response to public pressures, Congress recently declared American lobster a creature of the continental shelf, although the species does not meet the criteria set forth in the 1958 Geneva Convention. This was done by adding the provision to another piece of fishery legislation that the President was unlikely to veto, a method sometimes used by Congressmen to enact measures not popular with the Administration. This action asserts that the lobster resource on the continental shelf belongs to the United States and that it is illegal for other nations to retain lobster caught anywhere on the continental shelf off our coast. Under the provisions of this statute, foreign vessels with American lobster aboard have been seized and heavy fines have been levied. Under the provisions of PL 94-265, lobstering by foreign fishermen off the US coast is prohibited.

In some places along the coast, American lobster is a valued recreational species. The national surveys of saltwater angling up to 1970 have made no estimates of this recreational catch.

American lobster occurs from Newfoundland to Cape Hatteras. Most of the fishery is in the southern part of the Gulf of St. Lawrence and off Nova Scotia and the New England states, but catches as far south as North Carolina have been rising until recently. Mating may occur at any time, but the peak is in late spring and summer. Sperm cells are transferred to the female shortly after she has molted, but fertilization of the eggs is delayed until as much as a year later. Developing eggs are carried under the abdomen of the female, attached to the small swimming legs. Two years may elapse from mating to hatching.

Much more information about the lobster resource and the fishery will be needed before a rational management plan can be drawn up for the Bight area. A cooperative state-federal program was established recently by the lobster fishing states.

Map 26. American lobster



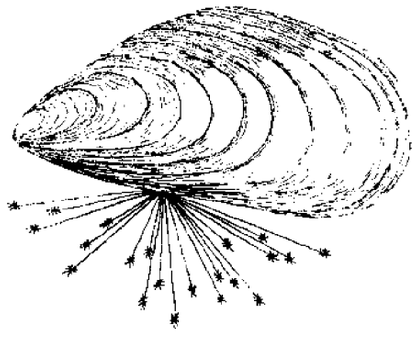
Miscellaneous Fish and Shellfish Resources

In addition to the species or groups of species already discussed, many additional species or groups have been reported as landed in the New York Bight area since 1880. Table 3 lists these fishes and shellfishes by common and scientific names, maximum annual weight landed, the year in which maximum landings were reported, and type of life history—oceanic, coastal, estuarine, or anadromous. Some of these species were important in the early fisheries but are insignificant now, some have been growing in importance recently, but the years in which most peak landings were made were in the period 1929-50. Species are arranged in the table in descending order of importance by maximum weight landed per year. In maximum weight landed, some of these so-called minor species exceed some of those treated as major in the preceding pages. They were not included in that group for various reasons: the period of maximum landings may have been brief, market demand may be limited, or the species may not support important recreational or foreign fisheries. Brief discussions of those living resources that in at least one year produced landings of 454 metric tons (1 million lb) or more follow. A few species of relatively little commercial value, but important to recreational fishermen, are included.

Except for bluefin tuna, tilefish, and swordfish, none of these resources has been important in foreign fisheries, and most have not been taken at all by foreign fleets.

Mussels

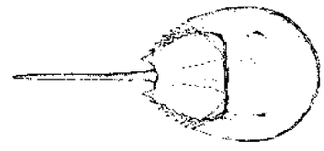
Blue mussel



(Mytilus edulis)

The most important sea mussel in this area is the blue mussel, *Mytilus edulis*. The ribbed mussel (*Modiolus demissus*) is used mostly as bait. In the New York Bight area, landings of mussels have exceeded about 454 metric tons (1 million lb) in only four years. Recorded landings of about 3,855 metric tons (8.5 million lb) of meats in 1908 were more than three times as large as the next largest annual landings. It is not known why this single very large catch was made. Mussels once were used as fertilizer on farmlands, but that use has stopped. For a while they were a source of vitamins, but this use declined when synthetic vitamins were developed. Mussels are an excellent human food, but in the United States they are popular only with certain ethnic groups from Europe. The resource in the area probably is very much underutilized. Catches have been increasing slowly recently, as new markets are found overseas.

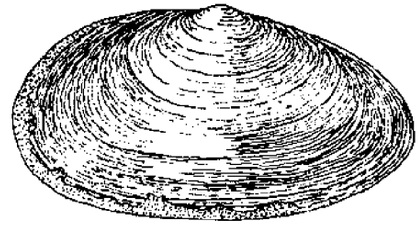
Horseshoe Crab



(*Limulus polyphemus*)

Also known as king crab, the horseshoe crab was once in great demand as fertilizer in New Jersey. New York landings have never been large. The peak of the fishery in New Jersey was in the late 1920s and early 1930s. Landings in that state have been reported in only one year since 1968. No landings have been reported in New York since 1921.

Soft Clam



(*Mya arenaria*)

This is one of the most popular clam species of the New England and Middle Atlantic states. Maine was once the major producer, but landings there began to decline in the 1950s, and now Maryland is the leading

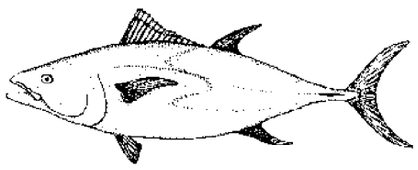
state. In the New York Bight area, annual landings were commonly greater than 454 metric tons (1 million lb) of meats until 1949. A resource of shallow, sheltered waters, soft clam is vulnerable to the effects of water pollution, overfishing, and natural environmental variations. Declining production in Maine in the 1950s has been attributed to rising water temperatures, which led to an increase in abundance of a serious predator, the green crab (*Carcinus maenas*). The trend of landings of soft clam in the Bight has been downward since records began, although the maximum of about 1,860 metric tons (4.1 million lb) of meats in 1880 probably is an exaggerated figure. The recreational catch is not known, but it probably is relatively large.

Atlantic Sturgeon

(*Acipenser oxyrhynchus*)

This sturgeon is anadromous, like striped bass and shad, returning to coastal rivers to spawn and as such is vulnerable to water pollution and overfishing. In the early days, fishermen disliked strugeon, which grows very large and does much damage to nets. Consequently, they deliberately destroyed sturgeon whenever they could. The period of major catches was over by the beginning of the twentieth century, and landings now are only a very small fraction of those in the 1880s and 1890s. For example, from 1965 to 1974 inclusive, average annual landings of sturgeon in the New York Bight area were less than 10 metric tons (21,000 lb) as compared with about 1,678 metric tons (3.7 million lb) in 1888.

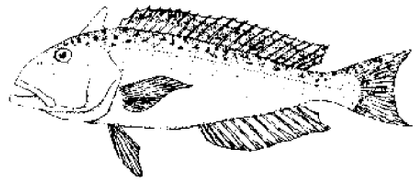
Bluefin Tuna



(*Thunnus thynnus*)

Bluefin tuna was largely a recreational species in the New York Bight area until a short-lived major commercial fishery developed in 1963. Catches were highly variable, but in most years substantial, until 1974 when landings dropped below 454 metric tons (1 million lb) for the first time since the peak of over 1,400 metric tons (3 million lb) in 1970. The mercury scare of the early 1970s may have been partly responsible. Bluefin tuna in the North Atlantic now is recognized as seriously overfished, and drastic steps are being taken to limit catches. This highly migratory species, moving freely from the Caribbean region to New England and across the ocean to the coast of Europe, is vulnerable to commercial and recreational fishing wherever it is found in all seasons. Almost all the commercial catch in the Bight area is landed in New Jersey.

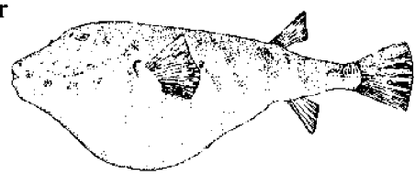
Tilefish



(*Lopholatilus chamaeleonticeps*)

Tilefish lives in a very specialized environment in deep water at the edge of the continental shelf. Distribution is limited in New York Bight to a narrow band of water which has colder boundaries inshore and offshore. The fishery thrived for a short time in the late 1920s and early 1930s as the offshore trawl fisheries developed, but declined sharply, for obvious reasons, during the second world war. Landings increased for a short time in the late 1940s and early 1950s, but dropped to even lower levels at the end of the 1960s. Recent increases in commercial landings in the area have come about from development of a specialized hook and line fishery out of New Jersey. There is also a developing deepwater recreational fishery for tilefish.

Northern Puffer



(*Sphoeroides maculatus*)

Puffer, swellfish, or blowfish was not a popular commercial resource until the late years of the second world war, when shortages of red meat stimulated

development of a fishery. The peak year of landings in the New York Bight area was 1945, when nearly 1,080 metric tons (2.4 million lb) were landed, almost all in New York. By the 1960s, a large fishery had developed in Chesapeake Bay, and the consequent reduction in prices brought about by overproduction in Maryland contributed to the decline of the Bight fishery. Abundance of northern puffer varies widely from natural causes, and the recent decline of local landings to very low levels was caused by a scarcity of fish. When the resource is abundant, large numbers of puffer are taken by sport fishermen. This reduces catches of more desirable species like flounders.

American Eel

(*Anguilla rostrata*)

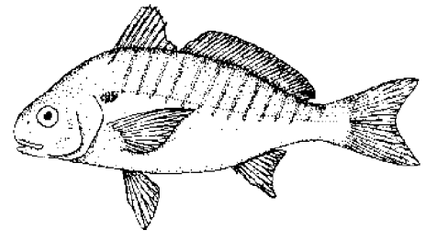
Fishermen in the New York Bight area catch two species of eel. The *catadromous* American eel (spawning in the ocean but spending most of its life in fresh water) is the more important of the two. The oceanic conger eel (*Conger oceanicus*) is taken in small quantities incidental to other fisheries. The two species were not reported separately in landings prior to 1935. The greatest combined landings in the Bight area were about 1,040 metric tons (2.3 million lb) in 1889. It can be assumed that most of this catch was Americal eel, which suggests that the species was much more popular than it is today. Annual landings have varied from an average of about 180 metric tons (200,000 to 600,000 lb) since the mid-1930s, with no pronounced trend. Market demand is limited; the resource probably could sustain a larger catch. Eel is taken, but not prized, by recreational fishermen.

Atlantic Bonito

(*Sarda sarda*)

Atlantic bonito or common bonito, a temperate and semi-tropical tunalike fish, travels in schools and is an erratic summer visitor to the New York Bight area. The commercial catch has been taken mostly in pound nets or haul seines, and the decline in landings since the 1940s probably can be accounted for partially by local declines in use of these gears. Maximum reported landings in the Bight area were 860 metric tons (1.9 million lb) in 1940. Average annual landings in the decade 1965-74 were less than 10 metric tons (22,000 lb). Recreational catches declined from 1960 to 1970 also, which suggests a decrease in abundance, failure to migrate into these areas recently, or both.

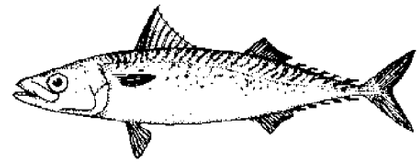
Spot



(*Leiostomus xanthurus*)

This southern fish has always been more abundant in New Jersey than in New York waters. It spends most of its life in bays and estuaries and does not travel far from shore. Abundance varies widely from natural causes, but the sharp decline in commercial landings from the peak of about 770 metric tons (1.7 million lb) in 1943 to an average annual landing of only about 1.4 metric tons (3,000 lb) in the decade 1965-74 suggests a real decline in abundance locally. Recreational catches from New Jersey to Cape Hatteras increased about threefold from 1960 to 1970, and in 1975 and 1976 commercial and recreational catches were larger in New Jersey and New York than in the last 20 years or more. This is a popular and important recreational species. The sport catch is apparently much larger than the commercial catch. No foreign catches have been reported.

Chub Mackerel

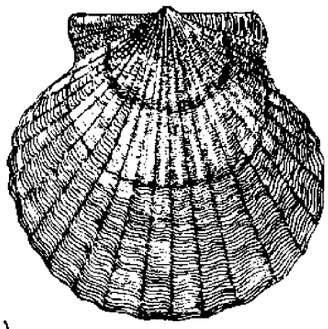


(Scomber japonicus)

A schooling fish of temperate waters, chub mackerel or thimbleeye migrates in much greater numbers to New Jersey than into New York waters. Most of the catch is made in pound nets, and the sharp decline in

landings from the peak year 1942, when about 680 metric tons (1.5 million lb) were caught, probably was caused mostly by the decline of the pound net fishery. Erratic migrations into an area at the northern limit of the species range also are suggested by wide annual variations in landings. No landings of chub mackerel have been reported in the New York Bight area since 1960. The species has not been reported as such in saltwater sport fishing surveys.

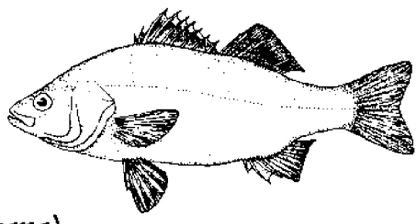
Bay Scallop



(*Argopecten irradians.*)

This mollusk is an inhabitant of shallow, protected bays along the coast. In the New York Bight area, it usually has produced larger catches in New York than in New Jersey, which suggests that the bays of the south shore and eastern end of Long Island provide a more favorable habitat than New Jersey bays. In common with many living resources of shallow bays, bay scallop is highly variable in abundance, but although peak landings of about 635 metric tons (1.4 million lb) of meats were reached in 1962, it is not certain that the subsequent drop is significant for the future of the resource. It is possible that declining commercial landings may have been balanced by increasing recreational catches.

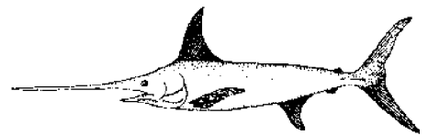
White Perch



(*Morone americana*)

A small relative of striped bass, white perch spawns in fresh water and lives most of its life in estuarine environments. It does not migrate extensively, as striped bass does, and probably remains within the influence of its home stream. Maximum historic landings of white perch in the New York Bight area were about 590 metric tons (1.3 million lb) in 1901. Subsequently, landings dropped sharply, but there has been no evident trend from 1904 to 1974. This is a popular recreational species. It is interesting that while sport catches of white perch in the area from New Jersey to Cape Hatteras about doubled from 1960 to 1970, in the area from New York north they dropped sharply.

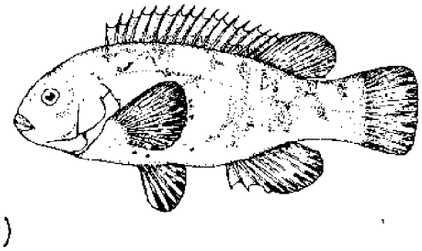
Swordfish



(*Xiphias gladius*)

The swordfish fishery in the New York Bight area was relatively minor until an enterprising fisherman in New Jersey hit on the idea of using longlines instead of spearing fish individually from a pulpit ahead of the bow of his boat. From a catch of only about 30 metric tons (67,000 lb) in 1962, landings shot up to about 500 metric tons (1.1 million lb) in 1965, mostly in New Jersey. The decline that followed apparently represented a scarcity of fish, but recent low levels of landings were a result of the discovery of high mercury residues in swordfish. Now that restrictions have eased, catches may be expected to increase. Swordfish is not listed separately in the national saltwater sport fishing surveys, but billfishes as a group (relatives of swordfish) produced relatively small catches in the years of the surveys. Recreational catches of billfishes were much smaller in 1970 than in 1960 in the mid-Atlantic coastal region.

Tautog



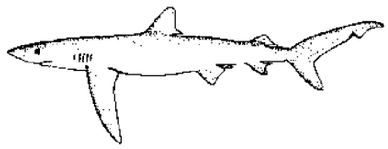
(*Tautoga onitis*)

A relatively unimportant commercial fish, tautog or blackfish is taken in some quantity by recreational fishermen. The largest sport catch on record in the

mid-Atlantic coastal region was about 4,500 metric tons (9.9 million lb) in 1960. A close relative, cunner or bergall (*Tautogolabrus adspersus*) also is taken mostly by recreational fishermen, but is less prized than tautog. Both fishes are relatively nonmigratory and tend to favor rock bottom or reefs.

Sharks

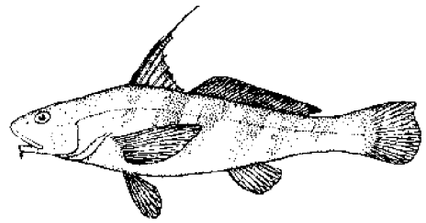
Blue shark



(Prionace glauca)

Several shark species are taken by saltwater sport fishermen in the New York Bight area. Illustrated is the blue shark (*Prionace glauca*). The commercial catch is small, but recreational interest is growing. Several shark-fishing tournaments are held in the area every year. The largest catch on record in the mid-Atlantic coastal region, all species combined, was 1,600 metric tons (3.5 million lb) in 1970. Most sharks produce relatively few young, which are born alive.

Northern Kingfish



(*Menticirrhus saxatilis*)

Kingfish or king whiting is a migratory coastal species that never moves far from shore. Of minor importance commercially, it is caught frequently by recreational fishermen in the surf or from boats along channel edges or over sand bars. Maximum reported sport catch in the mid-Atlantic coastal region was 1,100 metric tons (2.4 million lb) in 1970.

Table 3. Species or groups of species listed in domestic commercial fishery landings in the New York Bight area (New York and New Jersey) 1880-1976, recreational catches in the mid-Atlantic coastal area (New Jersey to Cape Hatteras inclusive) 1960-70, and foreign catches in ICNAF Division 6A (New York Bight) 1968-75

Common Name	Scientific Name	Maximum Domestic Commercial Landings metric tons (year)	Maximum Sport Catch metric tons (year)	Maximum Foreign Catch metric tons (year)	Life History[a]
Atlantic menhaden, mossbunker, pogy	*Brevoortia tyrannus*	272,441 (1956)	–	64 (1974)	C
Unclassified industrial fishes		55,634 (1964)	–	–	CO
Surf clam, skimmer clam	*Spisula solidissima*	20,419 (1966)[b]	–	–	O
American oyster, Virginia oyster	*Crassostrea virginica*	14,624 (1887)[b]	–	–	E
Scup, porgy	*Stenotomus chrysops*	12,083 (1960)	1,925 (1965)	466 (1974)	CO
Weakfish, gray sea trout, squeteague	*Cynoscion regalis*	10,371 (1908)	6,368 (1970)	–	C
Atlantic mackerel, Boston mackerel	*Scomber scombrus*	9,503 (1949)	13,268 (1970)	151,185 (1972)	CO
American shad	*Alosa sapidissima*	7,921 (1901)	1,919 (1970)	–	A
Haddock	*Melanogrammus aeglefinus*	7,721 (1926)	–	107 (1966)	O
Bluefish, snapper	*Pomatomus saltatrix*	7,398 (1897)	22,553 (1970)	17 (1974)	CO
Silver hake, whiting	*Merluccius bilinearis*	6,266 (1937)	980 (1960)	92,924 (1966)	O
Hard clam, quahog	*Mercenaria mercenaria*	6,149 (1947)[b]	–	–	E
Yellowtail flounder	*Limanda ferruginea*	5,446 (1942)	–	930 (1971)	O
Butterfish	*Peprilus triacanthus*	4,993 (1939)	–	8,950 (1973)	CO
Black sea bass	*Centropristis striata*	4,938 (1952)	4,722 (1960)	–	CO
Atlantic cod	*Gadus morhua*	4,895 (1938)	2,590 (1960)	144 (1972)	O
Summer flounder, fluke	*Paralichthys dentatus*	4,816 (1956)	4,756 (1965)	61 (1971)	CO
Mussels, blue and ribbed mussels	*Mytilus edulis, Modiolus demissus*	3,838 (1908)[b]	–	–	EC
Atlantic croaker, hardhead	*Micropogon undulatus*	3,380 (1935)	4,744 (1965)	–	EC
Winter flounder, blackback flounder	*Pseudopleuronectes americanus*	3,161 (1938)	5,843 (1970)	131 (1969)	EO
Red hake, ling, squirrel hake	*Urophycis chuss*	3,069 (1947)	410 (1970)	25,722 (1966)	CO
Atlantic herring, sea herring	*Clupea harengus harengus*	3,042 (1966)	–	21,841 (1971)	CO
Sea scallop	*Placopecten magellanicus*	2,783 (1950)[b]	–	3,475 (1968)	O
Alewife, river herring, blueback herring	*Alosa pseudoharengus, Alosa aestivalis*	2,654 (1889)	–	3,730 (1971)	A
Horseshoe crab, king crab	*Limulus polyphemus*	2,589 (1929)	–	–	E
Blue crab, blue-claw crab	*Callinectes sapidus*	2,221 (1939)	–	–	EO
Ocean quahog, mahagony clam	*Arctica islandica*	1,859 (1976)	–	–	O
Soft clam, soft-shell clam	*Mya arenaria*	1,845 (1880)[b]	–	–	E
Atlantic sturgeon	*Acipenser oxyrhynchus*	1,675 (1888)	–	–	A
American lobster, northern lobster	*Homarus americanus*	1,579 (1970)	–	25 (1971)	CO
Squids	*Loligo pealei, Illex illecebrosus*	1,496 (1939)	–	28,900 (1975)	OC
Bluefin tuna, horse mackerel	*Thunnus thynnus*	1,411 (1970)	8,242 (1960)[c]	515 (1970)	O
Tilefish	*Lopholatilus chamaeleonticeps*	1,199 (1929)	–	1 (1972)	O
Striped bass, rockfish, rock	*Morone saxatilis*	1,107 (1973)	12,366 (1970)	–	A
Northern puffer, swellfish	*Sphoeroides maculatus*	1,068 (1945)	7,515 (1970)	–	E
American eel, common eel	*Anguilla rostrata*	1,051 (1889)[d]	354 (1965)	–	A
Atlantic bonito	*Sarda sarda*	873 (1940)	767 (1960)	–	O
Spot, lafayette, Cape May goody	*Leiostomus xanthurus*	786 (1943)	9,786 (1970)	–	EC
Chub mackerel, thimbleeye mackerel	*Scomber japonicus*	681 (1942)	–	–	O
Bay scallop	*Argopecten irradians*	614 (1962)[b]	–	–	E
White perch	*Morone americana*	600 (1901)	4,652 (1965)	–	A
White hake	*Urophycis tenuis*	511 (1943)	–	296 (1971)	O
Swordfish, broadbill swordfish	*Xiphias gladius*	494 (1965)	3,048 (1960)[e]	98 (1970)	O
Carp, German carp	*Cyprinus carpio*	449 (1897)	–	–	F
Pollock, pollack, Boston bluefish	*Pollachius virens*	352 (1933)	–	886 (1971)	O
Little tunny, false albacore	*Euthynnus alleteratus*	334 (1952)	1,479 (1960)	–	O
Minnows	Family Cyprinidae	260 (1888)	–	–	EF

Common Name	Scientific Name	Maximum Domestic Commercial Landings metric tons (year)	Maximum Sport Catch metric tons (year)	Maximum Foreign Catch metric tons (year)	Life History[a]
Shrimp, grass shrimp, sand shrimp	*Palaemonetes vulgaris, Crangon septemspinosus*	251 (1929)	–	–	E
Conch, whelks, scongilli, channeled whelk, knobbed whelk	*Busycon canaliculatum, Busycon carica*	248 (1963)[b]	–	–	E
Searobins	*Prionotus carolinus, Prionotus evolans*	227 (1888)[f]	3,058 (1970)	503 (1974)	CE
Yellow perch	*Perca flavescens*	227 (1891)	1,982 (1965)	–	F
Catfish and bullheads	Family Ictaluridae	196 (1901)	9,331 (1965)	–	F
Redfish, ocean perch, rosefish	*Sebastes marinus*	184 (1939)	–	6 (1972)	O
Harvestfish, starfish	*Peprilus alepidotus*	161 (1943)	–	–	C
Rock crab	*Cancer irroratus*	157 (1974)	–	–	CE
Tautog, blackfish	*Tautoga onitis*	153 (1897)	4,454 (1960)	–	EC
Conger eel	*Conger oceanicus*	151 (1944)	–	–	O
Suckers	Family Catostomidae	149 (1901)	–	–	F
Atlantic tomcod, frostfish	*Microgadus tomcod*	142 (1890)	–	–	O
Ocean pout, eelpout	*Macrozoarces americanus*	139 (1943)	–	268 (1969)	O
Atlantic silverside, spearing	*Menidia menidia*	136 (1950)	–	–	EC
Striped mullet, jumper	*Mugil cephalus*	125 (1890)	9 (1960)	–	CE
Skates and rays	Family Rajidae	121 (1930)	553 (1960)	215 (1971)	CE
Frigate mackerel	*Auxis thazard*	107 (1943)	–	–	O
King mackerel	*Scomberomorus cavalla*	107 (1890)	112 (1965)	–	O
Spanish mackerel	*Scomberomorus maculatus*	107 (1931)	429 (1970)	–	O
Northern kingfish, king whiting	*Menticirrhus saxatilis*	105 (1939)	1,090 (1970)	–	C
Drums, black drum, red drum	*Pogonias cromis, Sciaenops ocellata*	103 (1904)	6,668 (1960)	–	EC
Grayfish, smooth and spiny dogfishes	*Mustelus canis Squalus acanthias*	101 (1975)	183 (1970)	3,840 (1974)	CE
Tidewater silverside, spearing	*Menidia beryllina*	90 (1908)	–	–	EF
Atlantic wolffish	*Anarhichas lupus*	87 (1948)	–	70 (1966)	O
American plaice, dab, sea dab	*Hippoglossoides platessoides*	83 (1944)	–	34 (1975)	O
Unclassified sharks	Order Squaliformes	80 (1930)	1,551 (1960)	6,645 (1972)	OE
Striped anchovy	*Anchoa hepsetus*	72 (1950)	–	–	EC
Striped killifish, killifish	*Fundulus majalis*	64 (1901)	–	–	E
Cusk, tusk	*Brosme brosme*	61 (1932)	–	–	O
Round herring	*Etrumeus teres*	60 (1904)	–	–	O
Bloodworms, sandworms	*Glycera americana, G. dibranchiata, Nereis virens, N. limbata*	60 (1929)	–	–	CE
Goosefish, angler	*Lophius americanus*	59 (1951)	204 (1960)	328 (1974)	O
Witch flounder, witch, gray sole	*Glyptocephalus cynoglossus*	42 (1937)	–	114 (1971)	O
Turtles	Several species	40 (1955)	–	–	OEF
Sheepshead	*Archosargus probatocephalus*	37 (1889)	–	–	C
Skipjack tuna	*Euthynnus pelamis*	31 (1972)	–	69 (1971)	O
Miscellaneous bait	Invertebrates	29 (1908)	–	–	EC
Gray snapper (red snapper)	*Lutjanus griseus*	24 (1937)[g]	–	–	C
Atlantic halibut	*Hippoglossus hippoglossus*	24 (1933)	–	35 (1966)	O
Hickory shad	*Alosa mediocris*	23 (1921)	–	–	A
Cero	*Scomberomorus regalis*	23 (1937)	–	–	C
American sand lance, launce	*Ammodytes americanus*	17 (1932)	–	565 (1972)	C
Banded rudderfish	*Seriola zonata*	16 (1940)	–	–	O
Pike or pickerel	*Esox* species	15 (1888)	–	–	F
Red crab	*Geryon quinquidens*	12 (1973)	–	–	O
Mummichog	*Fundulus heteroclitus*	12 (1933)	–	–	EF
Gizzard shad	*Dorosoma cepedianum*	10 (1948)	–	–	A
Groupers, jewfish, sea basses	Family Serranidae	10 (1937)	–	–	CO

Common Name	Scientific Name	Maximum Domestic Commercial Landings metric tons (year)	Maximum Sport Catch metric tons (year)	Maximum Foreign Catch metric tons (year)	Life History[a]
Jonah crab	*Cancer borealis*	8 (1975)	–	–	EO
Pilotfish	*Naucrates ductor*	8 (1949)	–	–	O
Pinfish	*Lagodon rhomboides*	7 (1944)	–	–	CE
Razor clam	*Ensis directus*	7 (1967)[b]	–	–	E
Sunfish	Family Centrarchidae	6 (1901)	–	–	F
Black bass	Family Centrarchidae	5 (1892)	–	–	F
Rainbow smelt, smelt	*Osmerus mordax*	4 (1904)	–	–	A
Silver perch	*Bairdiella chrysura*	4 (1945)	–	–	CE
Cunner, bergall	*Tautogolabrus adspersus*	4 (1946)	–	–	CE
Crevalle jack, crevalle	*Caranx hippos*	3 (1939)	5 (1960)[h]	–	C
Atlantic hagfish, hagfish	*Myxine glutinosa*	3 (1930)[i]	–	–	C
Grunts	Family Pomadasyidae	3 (1950)	–	8 (1973)	C
Amberjack	Family Carangidae	3 (1957)	–	–	C
Pigfish	*Orthopristis chrysoptera*	2 (1931)	154 (1960)	–	CE
Florida pompano, pompano	*Trachinotus carolinus*	2 (1935)[j]	–	–	C
Windowpane, sand flounder	*Scophthalmus aquosus*	1 (1973)	–	–	C
Wahoo	*Acanthocybium solanderi*	1 (1929)	1,808 (1970)	–	C
White marlin	*Tetrapturus albidus*	* (1965)[k]	3,048 (1960)[e]	–	O
Atlantic salmon	*Salmo salar*	* (1901)[l]	–	–	A
Periwinkle	*Littorina littorea*	* (1932)	–	–	E
Dolphin, dolphin fish	*Coryphaena hippurus*	* (1930)	431 (1960)	–	O
Angelfish	Family Chaetodontidae	* (1940)	–	–	C
Blue runner	*Caranx crysos*	* (1943)	–	–	C
Cobia, crab eater	*Rachycentron canadum*	* (1942)	–	–	C
Crappie	*Pomoxis* species	* (1956)	–	–	F
Tarpon	*Megalops atlantica*	* (1968)	–	–	CE

[a] O—oceanic
C—coastal (not migrating in substantial numbers more than 12 nmi offshore)
E—estuarine
A—anadromous (spawning in fresh water but spending most of life at sea)
F—strictly freshwater (Sometimes after heavy rains freshwater species are flushed into the estuaries, where they may be caught by marine fishing gear.)

[b] weights of meats only

[c] recorded as tunas (Probably included more than one species, although bluefin is the most popular recreational species.)

[d] American eel and conger eel were not listed separately prior to 1935, but landings of conger eel have nearly always been much smaller than American eel, especially in the 1930s. It is assumed that very few or no conger eel were taken prior to the mid-1930s. American eel spawns in the sea but lives most of its life in brackish or fresh waters.

[e] recorded as spearfishes—could include several species

[f] This figure probably is much smaller than the actual maximum because searobins were an important component of industrial fish landings, especially in New Jersey.

[g] The name used in the statistics was red snapper, but it is assumed that gray snapper was the species most likely to be taken north of Cape Hatteras.

[h] recorded as jacks—probably includes several species

[i] It is possible that this was a misprint, and that hogfish (=pigfish, *Orthopristis chrysoptera*) was meant.

[j] The species was listed as pompano. It is assumed that Florida pompano was the most likely species.

[k] An asterisk signifies maximum landings less than half a metric ton.

[l] Atlantic salmon was virtually gone fom local waters by about 1800. The maximum historic landings probably were much greater than this.

Appendixes

Appendix 1. Common names of finfishes and shellfishes listed in the text

alewife *Alosa aestivalis*
amberjack Family Carangidae
American eel *Anguilla rostrata*
American lobster *Homarus americanus*
American oyster *Crassostrea virginica*
American plaice *Hippoglossoides platessoides*
American sand lance *Ammodytes americanus*
American shad *Alosa sapidissima*
angelfish Family Chaetodontidae
angler (goosefish)
Atlantic bonito *Sarda sarda*
Atlantic cod *Gadus morhua*
Atlantic croaker *Micropogon undulatus*
Atlantic hagfish *Myxine glutinosa*
Atlantic halibut *Hippoglossus hippoglossus*
Atlantic herring *Clupea harengus harengus*
Atlantic mackerel *Scomber scombrus*
Atlantic menhaden *Brevoortia tyrannus*
Atlantic salmon *Salmo salar*
Atlantic silverside *Menidia menidia*
Atlantic sturgeon *Acipenser oxyrhynchus*
Atlantic tomcod *Microgadus tomcod*
Atlantic wolffish *Anarhichas lupus*

bay scallop *Argopecten irradians*
banded rudderfish *Seriola zonata*
bergall (cunner)
blackback flounder (winter flounder)
black bass Family Centrarchidae
black drum (drums)
blackfish (tautog)
black sea bass *Centropristis striata*
bloodworms *Glycera americana, G. dibranchiata*
blowfish (northern puffer)
blueback herring (alewife)
blue-claw crab (blue crab)
blue crab *Callinectes sapidus*
bluefin tuna *Thunnus thynnus*
bluefish *Pomatomus saltatrix*
blue mussel *Mytilus edulis*
blue runner *Caranx crysos*
blue shark *Prionace glauca*
Boston bluefish (pollock)
Boston mackerel (Atlantic mackerel)
broadbill swordfish (swordfish)
bullheads (catfish)
butterfish *Peprilus triacanthus*

cabio (cobia)
Cape May goody (spot)
carp *Cyprinus carpio*
catfish Family Ictaluridae
cero *Scomberomorus regalis*
channeled whelk *Busycon canaliculatum*
chub mackerel *Scomber japonicus*
cobia *Rachycentron canadum*
common eel (American eel)
conchs, channeled whelk, knobbed whelk
conger eel *Conger oceanicus*
crab eater (cobia)
crappies *Promoxis* species
crevalle (crevalle jack)
crevalle jack *Caranx hippos*
cunner *Tautogolabrus adspersus*
cusk *Brosme brosme*

dab (American plaice)
dogfishes (grayfish)
dolphin *Coryphaena hippurus*
drums *Pogonias cromis, Sciaenops ocellata*

eelpout (ocean pout)

false albacore (little tunny)
finescale menhaden *Brevoortia gunteri*
Florida pompano *Trachinotus carolinus*
flounders *Glyptocephalus cynoglossus, Limanda ferruginea, Paralichthys dentatus, Pseudopleuronectes americanus*
fluke (summer flounder)
frigate mackerel *Auxis thazard*
frostfish (Atlantic tomcod)

German carp (carp)
gizzard shad *Dorosoma cepedianum*
goosefish *Lophius americanus*
grass shrimp (shrimp)
grayfish *Mustelus canis, Squalus acanthias*
gray sea trout (weakfish)
gray snapper *Lutjanus griseus*
gray sole (witch flounder)
groupers Family Serranidae
grunt Family Pomadasyidae
Gulf menhaden *Brevoortia patronus*

haddock *Melanogrammus aeglefinus*
hagfish (Atlantic hagfish)
hardhead (Atlantic croaker)
hard clam *Mercenaria mercenaria*
harvestfish *Peprilus alepidotus*
hickory shad *Alosa mediocris*
hogfish (pigfish)
horse mackerel (bluefin tuna)
horseshoe crab *Limulus polyphemus*

jewfish (groupers)
Jonah crab *Cancer borealis*
jumper (striped mullet)

killifish (striped killifish)
king crab (horseshoe crab)
king mackerel *Scomberomorus cavalla*
king whiting (northern kingfish)
knobbed whelk *Busycon carica*

lafayette (spot)
lemon sole (winter flounder)
launce (American sand lance)
ling (red hake)
little tunny *Euthynnus alleteratus*

mahagony clam (ocean quahog)
menhaden *Brevoortia tyrannus*
minnows Family Cyprinidae
mossbunker (menhaden)
mummichog *Fundulus heteroclitus*
mussels *Mediolus demissus, Mytilus edulis*

northern kingfish *Menticirrhus saxatilis*
northern lobster (American lobster)
northern puffer *Sphoeroides maculatus*

ocean perch (redfish)
ocean pout *Macrozoarces americanus*
ocean quahog *Arctica islandica*

periwinkle *Littorina littorea*
pickerel *Esox* species
pigfish *Orthopristis chrysoptera*
pike *Esox* species
pilotfish *Naucrates ductor*
pinfish *Lagodon rhomboides*
pogy (menhaden)
pollack (pollock)
pollock *Pollachius virens*
pompano (Florida pompano)
porgy (scup)

quahog (hard clam)

rainbow smelt *Osmerus mordax*
rays Family Rajidae
razor clam *Ensis directus*
red crab *Geryon quinquidens*
red drum (drums)
red hake *Urophycis chuss*
red snapper (gray snapper)
redfish *Sebastes marinus*
ribbed mussels *Modiolus demissus*
river herring (alewife)
rock (striped bass)
rock crab *Cancer irroratus*
rockfish (striped bass)
rosefish (redfish)
round herring *Etrumeus teres*

sand flounder (windowpane)
sand shrimp (shrimp)
sandworms *Nereis virens, N. limbata*
scongilli (conch)
scup *Stenotomus chrysops*
sea basses (groupers)
sea dab (American plaice)
sea herring (Atlantic herring)
searobins *Prionotus carolinus, P. evolans*
sea scallop *Placopecten magellanicus*
sharks Order Squaliformes
sheepshead *Archosargus probatocephalus*
shrimp *Palaemonetes vulgaris, Crangon septemspinosus*
silver hake *Merluccius bilinearis*
silver perch *Bairdiella chrysura*
skates Family Rajidae
skimmer clam (surf clam)
skipjack tuna *Euthynnus pelamis*
smelt (rainbow smelt)
smooth dogfish *Mustelus canis*
snapper (bluefish)
soft clam *Mya arenaria*
soft-shell clam (soft clam)
Spanish mackerel *Scomberomorus maculatus*
spearing (silversides)
spiny dogfish *Squalus acanthias*
spot *Leiostomus xanthurus*
squeteague (weakfish)
squids *Loligo pealei, Illex illecebrosus*
squirrel hake (red hake)
starfish (harvestfish)
striped anchovy *Anchoa hepsetus*
striped bass *Morone saxatilis*
striped killifish *Fundulus majalis*
striped mullet *Mugil cephalus*

suckers Family Catostomidae
summer flounder *Paralichthys dentatus*
sunfish Family Centrarchidae
surf clam *Spisula solidissima*
swellfish (northern puffer)
swordfish *Xiphias gladius*

tarpon *Megalops atlantica*
tautog *Tautoga onitis*
thimbleeye mackerel (chub mackerel)
tidewater silverside *Menidia beryllina*
tilefish *Lopholatilus chamaeleonticeps*
turtles several species
tusk (cusk)

Virginia oyster (American oyster)

wahoo *Acanthocybium solanderi*
weakfish *Cynoscion regalis*
whelks (conch)
white hake *Urophycis tenuis*
white marlin *Tetrapturus albidus*
white perch *Morone americana*
whiting (silver hake)
windowpane *Scophthalmus aquosus*
winter flounder *Pseudopleuronectes americanus*
witch (witch flounder)
witch flounder *Glyptocephalus cynoglossus*

yellow perch *Perca flavescens*
yellowfin menhaden *Brevoortia smithi*
yellowtail flounder *Limanda ferruginea*

Appendix 2. Scientific names of finfishes and shellfishes listed in the text

Acanthocybium solanderi wahoo
Acipenser oxyrhynchus Atlantic sturgeon
Alosa aestivalis alewife
A. mediocris hickory shad
A. pseudoharengus river herring
A. sapidissima American shad
Ammodytes americanus American sand lance
Anarhichas lupus Atlantic wolffish
Anchoa hepsetus striped anchovy
Anguilla rostrata American eel
Archosargus probatocephalus sheepshead
Arctica islandica ocean quahog
Argopecten irradians bay scallop
Auxis thazard frigate mackerel

Bairdiella chrysura silver perch
Brevoortia gunteri finescale menhaden
B. patronus Gulf menhaden
B. smithi Yellowfin menhaden
B. tyrannus Atlantic menhaden
Brosme brosme cusk
Busycon canaliculatum channeled whelk
B. carica knobbed whelk

Callinectes sapidus blue crab
Cancer borealis Jonah crab
C. irroratus rock crab
Family Carangidae amberjack
Caranx crysos blue runner
C. hippos crevalle jack
Family Catostomidae suckers
Family Centrarchidae black bass/sunfish

Centropristis striata black sea bass
Family Chaetodontidae angelfishes
Clupea harengus harengus Atlantic herring
Conger oceanicus conger eel
Coryphaena hippurus dolphin
Crangon septemspinosus shrimp
Crassostrea virginica American oyster
Cynoscion regalis weakfish
Family Cyprinidae minnows
Cyprinus carpio carp

Dorosoma cepedianum gizzard shad

Ensis directus razor clam
Esox species pike, pickerel
Etrumeus teres round herring
Euthynnus alleteratus little tunny
E. pelamis skipjack tuna

Fundulus heteroclitus mummichog
F. majalis striped killifish

Gadus morhua Atlantic cod
Geryon quinquidens red crab
Glycera americana bloodworm
G. dibranchiata bloodworm
Glyptocephalus cynoglossus witch flounder

Hippoglossoides platessoides American plaice
Hippoglossus hippoglossus Atlantic halibut
Homarus americanus American lobster

Family Ictaluridae catfish
Illex illecebrosus short-finned squid

Lagodon rhomboides pinfish
Leiostomus xanthurus spot
Limanda ferruginea yellowtail flounder
Limulus polyphemus horseshoe crab
Littorina littorea periwinkle
Loligo pealei long-finned squid
Lophius americanus goosefish
Lopholatilus chamaeleonticeps tilefish
Lutjanus griseus gray snapper

Macrozoarces americanus ocean pout
Megalops atlantica tarpon
Melanogrammus aeglefinus haddock
Menidia beryllina tidewater silverside
M. menidia Atlantic silverside
Menticirrhus saxatilis northern kingfish
Mercenaria mercenaria hard clam
Merluccius bilinearis silver hake
Microgadus tomcod Atlantic tomcod
Micropogon undulatus Atlantic croaker
Modiolus demissus ribbed mussel
Morone americana white perch
M. saxatilis striped bass
Mugil cephalus striped mullet
Mustelus canis smooth dogfish
Mya arenaria soft clam
Mytilus edulis blue mussel
Myxine glutinosa Atlantic hagfish

Naucrates ductor pilotfish
Nereis limbata bloodworm
N. virens bloodworm

Osmerus mordax rainbow smelt
Orthopristis chrysoptera pigfish

Palaemonetes vulgaris shrimp
Paralichthys dentatus summer flounder
Peprilus alepidotus harvestfish
P. triacanthus butterfish
Perca flavescens yellow perch
Placopecten magellanicus sea scallop
Pogonias cromis black drum
Pollachius virens pollock
Family Pomadasyidae grunts
Pomatomus saltatrix bluefish
Pomoxis species crappies
Prionace glauca blue shark
Prionotus carolinus northern searobin
P. evolans striped searobin
Pseudopleuronectes americanus winter flounder

Rachycentron canadum cobia
Family Rajidae rays/skates

Salmo salar Atlantic salmon
Sarda sarda Atlantic bonito
Sciaenops ocellata red drum
Scomber japonicus chub mackerel
S. scombrus Atlantic mackerel
Scomberomorus cavalla king mackerel
S. maculatus Spanish mackerel
S. regalis cero
Scophthalmus aquosus windowpane
Sebastes marinus redfish
Seriola zonata banded rudderfish
Family Serranidae groupers
Sphoeroides maculatus northern puffer
Spisula solidissima surf clam
Order Squaliformes sharks
Squalus acanthais spiny dogfish
Stenotomus chrysops scup
Tautoga onitis tautog
Tautogolabrus adspersus cunner
Tetrapturus albidus white marlin
Thunnus thynnus bluefin tuna
Trachinotus carolinus Florida pompano

Urophycis chuss red hake
U. tenuis white hake

Xiphias gladius swordfish

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Foreign Fisheries

Maps

Tables

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Abstract

Modern foreign fisheries operating in the New York Bight and Middle Atlantic areas originated from traditional European fishing areas off Canada. The Soviet fishery was the first to have significant impact on New York Bight domestic fisheries in the early 1960s. Foreign fisheries harvesting Bight resources range along the continental shelf from Georges Bank to Cape Hatteras. National Marine Fisheries Service surveillance data for August 1969 through January 1977 were analyzed for trends in seasonal movements, numbers of vessels, and national representation in the foreign fishing fleet. The seasonal pattern was basically northward in summer and autumn and southward in winter and spring, reflecting migrations of certain fish species. The number of foreign vessels has steadily decreased since 1972, notably within the Soviet Union fleet. Nations, such as Japan, Cuba, and South Korea, with no prior fishing history in this region, have more recently entered the offshore fisheries. Regulation of foreign and domestic fisheries outside territorial limits has substantially increased in the last 30 years. Between 1950 and 1977, fisheries were governed by international agreements, but beginning 1 March 1977, the United States assumed exclusive jurisdiction over all living marine resources in an area extending 200 nmi from shore.

Introduction

The large, multinational fishing industry ranging along the coast from Cape Hatteras, NC, to Nova Scotia, Canada, harvests an important marine food resource for Americans and Europeans. The fisheries along Canada's coast have been especially well known to European fishermen for centuries. In fact, the large European fishery that developed off the US northeast coast in the early 1960s was spawned from traditional foreign, distant-water fisheries* off Canada. Although fishing was the first industry of colonial America, the twentieth century industry in northeastern states has not kept pace with recent international fisheries developments. To comprehend present-day difficulties of allocating "our fish" to all who wish to harvest them, it is essential to understand the size, location, and past performance of the foreign, distant-water fisheries.

*Foreign, distant-water fisheries refer to the collective efforts of industries, other than the United States and Canada, to catch fish in waters far from home ports. Domestic fisheries refer to United States and Canadian efforts.

History of Foreign Fishing in the New York Bight area

Europeans have probably known about the great Northwestern Atlantic fishery resources for nearly 1,000 years. Leif Ericsson is presumed to have landed on the Labrador coast and on the northern tip of Newfoundland in summer 1001 AD. Ericsson found a plentiful supply of virgin forests, Atlantic salmon, pasture land, and berries. Whether the Norsemen harvested and shipped home quantities of fish as they did timber is not recorded, nor do we know why these first European exploiters soon abandoned their Vinland settlement. Samuel Eliot Morison (1971), the late sailor-historian, wrote extensively on early European exploration of North American fishing grounds. His account is the basis for much of the following summary.

Not until John Cabot's first voyage in 1497 were the fish resources of Newfoundland's Grand Bank rediscovered. Codfish were reported to be so plentiful that Cabot and crew took all they wanted "simply by letting down and drawing weighted baskets." Despite

these legendary catches of an important food fish, England did not participate in the early cod fishery. The first significant distant-water fishing expeditions to the New World were Portuguese in 1502; the French joined the fishery two years later and prospered. By 1506, enough Newfoundland cod were being landed in Portugal that the king charged a 10% import duty to protect the home fishery market. The continental fish market was reexporting to England by 1529, and in 1542 no fewer than 60 vessels departed the French port of Rouen for Newfoundland's Grand Bank in a single day.

Bristol businessmen supported Cabot's voyages and others partly to find new fishing grounds, but there is little evidence of much British involvement in Newfoundland cod fisheries until 1542 when an Act of Parliament forbade importing fish caught by foreigners. Another law 20 years later declared two days a week mandatory fish-eating days, making England a major distant-water fishing nation. During this time, the Spanish also developed a significant fishery for Newfoundland cod. Thus, by the mid-sixteenth century hundreds of fishermen from four major European nations were exploiting the continental shelf and inshore fish resources of the Northwest Atlantic off Newfoundland.

Two methods of cod fishing were generally used in the Northwest Atlantic: wet and dry. Spaniards, Portuguese, and Frenchmen pursued mostly wet fishing. Wet fishermen stood in barrels lashed to the outboard sides of their ship and used a simple hook and line. Hooked fish were thrown inboard where they were gutted and packed in barrels with a liberal salting between layers. Ships returned to home ports after about three months or when full. Two or three wet fishing trips could be made in a year. The fish were cured at home while the ship sailed back to the banks for more. Wet fishing required no shore facility and capitalized on quick turn-around time.

Dry fishing boats, on the other hand, sailed home with fish fully prepared for market. This took one trip a year and required two crews. One crew fished from the mother ship and small boats with handlines while the other crew worked on land. The shore crew cut trees and built fish wharves and flakes (drying platforms). Cod landed at the wharf were washed, split, lightly salted, and spread on the flakes to dry in the sun. After several weeks, the cod were cured and stacked like cordwood to await the trip home. Today, European fishermen have factory ships to preserve their catch by modern refrigeration because the distance between home ports and American fishing grounds is too great to do otherwise.

Politics and wars decreased the French and Iberian-based distant-water fisheries, but the British expanded operations in the Northwest Atlantic. Having developed new markets in European countries, the British needed more fish to meet demand. Jensen (1972) reported that by the end of the sixteenth century British fishermen were probing south and west for unexploited fishing banks. Bountiful cod stocks were discovered over the rough, gravelly bottom on Browns Bank off the southern tip of Nova Scotia and on St. George's Bank, now Georges Bank, south of Browns Bank. One of the best cod finds came in 1603 when British merchants sent two ships to explore fish resources near Cape Cod. Cod fishing there was good or better than off Newfoundland and much closer to land in shallower water—7 fm (42 ft) compared to 40 or 50 fm (240 to 300 ft) farther north.

The British cod fishery grew in the early seventeenth century but did not extend farther south than Georges Bank—the southern range of large cod in summer (Jensen 1972). The British had little success in establishing permanent fishing communities in the Americas. The fishermen were satisfied with a seasonal industry, leaving the resources in winter to bad weather. Although one year-round fishing base was started in 1618 on Newfoundland, in 1620 a group of religious malcontents from England established a permanent colony at Plymouth, MA, that had greater impact on American fishing. Within one generation of the establishment of the Plymouth colony, the Pilgrims were shipping significant quantities of dried cod to European markets (Jensen 1972). Thus, the mid-seventeenth century marked the beginning of competition between an American, land-based, domestic fishery and the traditional European, distant-water fishery.

At first, competition with Europeans was more for markets than for fish. The fish supply seemed limitless and was close to shore for the first 100 years. Short trips could be made to local fishing grounds in small vessels because the catch was cured or sold fresh on return to port. In the mid-1700s the nearshore cod stocks began to be depleted. Massachusetts fishermen went farther out on Georges Bank and northeast to the Grand Bank off Newfoundland. Here

they joined European fishermen from England, France, Spain, and Portugal. Because the outer banks were farther from port, New England fishermen began to process their catch before sailing for home. Preliminary salting on board or partial drying at shore bases on Newfoundland was common. Notwithstanding the entry of the New England fishery, cod remained abundant on the offshore banks and the principal focus of European distant-water fishing fleets for over a century.

The early American offshore fishery for cod, and later halibut, continued through the nineteenth century, but few serious conflicts developed over the resource. International disputes that occurred had to do with jurisdictional rights over landing fish for salting and curing. The cod and other offshore stocks remained relatively abundant in spite of the numbers of fishermen and countries involved in the fisheries off New England and Canada. One reason was that domestic inshore fisheries were distinct from the multinational offshore fisheries, depending on the species and market sought. For most of the nineteenth century, cod was the only significant species fished offshore on the banks, whereas inshore finfish and shellfish were sold only in the fresh fish market or for bait and fertilizer. Other *demersal* (bottom-living) and *pelagic* (living above the bottom) species were not sought because, unlike cod, they could not be preserved by salting and drying.

Traditionally, European distant-water fisheries concentrated on cod stocks on northern banks off the Canadian maritime provinces. American domestic offshore fisheries also pursued cod there until advances in fishing and preserving technology made harvesting haddock and other species more feasible. This relieved some fishing pressure from the cod populations and brought the US domestic fleet closer to home. Thus, in the second quarter of the twentieth century, the Grand Bank gradually declined in importance to American fishermen and more domestic attention was given to the Georges Bank region.

During the second world war the codfish was given a respite; this ended with the end of the war. French and Portuguese cod fisheries, among others, grew significantly after the war. These fisheries did not provide major competition for US fishermen whose efforts centered on areas offshore from the Gulf of Maine and south.

Had it not been for the entry of a new European fishery in the mid-1950s, the foreign fleet in the Northwest Atlantic probably would have remained out of sight and out of mind. The new fishing force came from the Soviet Union. Williams (1975) reported that the first Soviet vessels joined the distant-water fleet on the Grand Bank when cod and haddock in the area were already heavily exploited. Unlike other countries, the Soviets concentrated on ocean perch or redfish, a relatively underutilized species in the mid-1950s. By 1960, the Soviets were catching more fish (by weight) than any other foreign nation fishing in the Northwest Atlantic, and over 80% of their catch was ocean perch. This intensive effort affected the comparatively small US and Canadian fisheries for ocean perch, but the Soviets then shifted their attention to other demersal species north and south of the traditional European fishing grounds.

In 1961, Soviet fleets began moving south into major US fishing areas for the first time, attracted by the abundant Atlantic herring on Georges Bank. As herring catches peaked for the Soviets in areas off New England, they shifted to silver hake and moved farther south. Their silver hake catches in the 1960s were the first directly to affect a fishery commercially important to New York. From 1963 to 1967, the Soviets developed their fishery from Long Island to Cape Hatteras, taking mostly silver hake and later red hake. When these catches declined in the late 1960s, they extended their fishery to pelagic species—Atlantic mackerel and herring. By the end of the 1960s, these two species accounted for about 78% of the Soviet catch in the Middle Atlantic Bight. The main body of the Soviet fleet followed major concentrations of pelagic fishes into New York Bight in 1970 and 1971.

The Soviet fishery introduced an entirely new approach to harvesting fish in the Northwest Atlantic. The Soviets gradually increased their distant-water fleet by concentrating on unexploited or highly abundant species, at first avoiding competition with other nations for popular stocks. The Soviets developed a considerable capital investment in their distant-water fleets (Kravanja 1976), and to keep them working, they intensively fish the most abundant stocks wherever and whenever they occur. New England fishermen call this *pulse fishing* and partly blame their failing industry on this method, but the same kind of shifts in effort from one species or stock to another over longer periods of time has been described as common in domestic fisheries (McHugh 1972, 1976).

Marketing the catch at home is less of a problem for the Soviets and other eastern European countries since the government controls the market. Efficient at-sea processing has become the hallmark of Soviet and other modern distant-water fleets and the bane of domestic fishermen restricted by traditional preferences.

After the Soviet success on Georges Bank, other nations began fishing there and farther south. For the fisheries of France and Spain, for example, the move south was an extension of their northern fisheries. Newcomers to the fisheries off New England and in New York Bight included the communist bloc countries of Bulgaria, Poland, Romania, the German Democratic Republic (GDR), and Cuba. Other than the Soviet Union, Canada, and the United States, 11 nations were fishing on Georges Bank by 1973; 9 of these also fished in New York Bight and farther south. The cumulative impact on the fish resources of these foreign, distant-water fishing fleets was profound (Williams 1975). Foreign fisheries working from Georges Bank to Cape Hatteras focused on the same pelagic species first exploited offshore by the Soviet Union. Their success is due largely to mobility, efficiency, and diversification. Unlike past European distant-water fisheries of the Northwest Atlantic, the present-day foreign fleet catches a variety of highly migratory species and fully processes the catch at sea.

Foreign Fishing Fleets

Location, Size, National Composition

Maps 1-30 and Tables 1-3 present the general size, composition, and location of foreign fleets that harvested Northwest Atlantic fishery resources from August 1969 through January 1977. Unless otherwise identified, the maps and tables were derived from monthly surveillance data reported by National Marine Fisheries Service (NMFS) agents based in Gloucester, MA. These data are used for scientific and enforcement purposes and consist of observations of vessels, their nationality, size or class, location, and apparent method of fishing made during 20 to 30 flights per month over the major fishing areas. Sometimes NMFS agents are able to identify species of fish being caught by foreign vessels if the catch is on deck as the surveillance plane passes overhead and by noting the kind of fishing gear in use and the vessel's location. This information is supplemented by occasional inspection by NMFS agents of individual vessels in the fishing areas. The US Coast Guard is jointly responsible with NMFS for enforcement of fishery regulations and provides the airplanes, ships, and other personnel needed to carry out surveillance activities.

Foreign fishery data have inherent limitations for analysis and interpretation. First, Coast Guard and NMFS agents cannot be everywhere at once. Their observations are therefore concentrated where experience suggests foreign vessels would most likely be found. Surveillance flight patterns are flexible, however, incorporating radar scanning over a wide margin on both sides of the flight path. Agents do investigate domestic fishermen's reports of foreign fishing vessels in areas where they have not been previously seen or in areas where their home nations have agreed not to fish. Second, numbers of vessels alone is an imperfect estimation of fishing effort. To fishery biologists and managers, fishing effort usually is a fairly specific, quantitative term describing the harvesting ability or efficiency of a single vessel or an entire fleet. Data used in this monograph do not take into consideration such factors as kind of fishing gear used, horsepower or displacement of the fishing vessels, length of time nets are in the water, or expertise of the fishermen. Fishery biologists at the NMFS laboratory in Woods Hole, MA, have good estimates on the effect fishing has had on the resource north of Cape Hatteras (Brown et al 1976). Third, maps and tables here do not differentiate between vessels actually observed fishing or processing a catch and support or supply ships. Nonfishing support vessels (for example, tankers, freighters, factory ships) are not as numerous as fishing vessels, but they add to the total effect by increasing the efficiency of the fishing fleet. Support vessels, used mostly by Soviet, Polish, and German fishermen, usually amount to about 9% of the total foreign fleet; Soviet support vessels have averaged about 12% of

their total fishing fleet. Finally, the data do not include observations of Canadian and US fishing vessels that catch a significant portion of the resource in the Georges Bank to Cape Hatteras region.

Despite limitations, these data are valuable to US fishery management authorities in developing international fishing agreements and allocations. Moreover, except for what nations may report themselves, these data have been the only measure of foreign fishing effort that can be compared with stock abundance or domestic landings data. Now, US observers on board many foreign fishing vessels can provide more accurate information.

Maps 1-30 show major trends in foreign fishing from Georges Bank to Cape Hatteras. Foreign fleets mainly fish migratory species ecologically associated with the continental shelf and adjacent land mass. Vessels are rarely spotted fishing in the very deep waters seaward of the slope and shelf edge indicated by the 200 m isobath. In fact, large numbers of vessels fish along the shelf edge. Biological productivity is usually greater over the continental shelves and along their edges compared to the deep ocean (Raymont 1963; Ryther 1969; Weyl 1970; and Banse 1973). This is best illustrated in the Georges Bank region where the particular bottom characteristics and dynamics of ocean circulation provide especially fertile waters for all species (Rounsefell 1975). Although Cape Cod and Georges Bank do not act as barriers to northward distribution of some fish stocks, a southern limit is well defined at Cape Hatteras where the continental shelf is very narrow and oceanic conditions, primarily water temperatures, change abruptly. Although some migration of fishes past the Cape occurs—notably menhaden, Atlantic mackerel, and pollock—the fauna south of the Cape do not add significantly to the fish stocks of New York Bight (Hennemuth 1976). The same may be said for species migrating north of Georges Bank. From a fisheries point of view, the entire continental shelf from Georges Bank to Cape Hatteras may be considered one large, geoecological, fish-producing unit.

New York Bight's fishery resources are influenced directly or indirectly by fisheries operating anywhere from Georges Bank to Cape Hatteras. The dynamic nature of the resources, their seasonal movement, and population size are implied in the plots of foreign fleets. Changes in fleet size and location are related to seasonal changes in the living resources and changes in fishing effort from one stock to another.

Seasonal patterns in location and size of the foreign fleet show a general concentration of vessels in the Georges Bank region east and south of Massachusetts in late summer and early autumn (August-October). During early spring (February-April), the fleet moves to waters south of Rhode Island, extending to Cape Hatteras. Following a significant increase in numbers of vessels during early spring, the fleet gradually decreases in summer (May-July) as it moves north once again. Fewest vessels are seen in early winter (November-January) as the fleet moves southward.

Migration of Atlantic herring, Atlantic mackerel, and red and silver hake is the primary reason for this general pattern in fleet movement. Herring and mackerel migrate south, staying near the continental shelf edge in early winter, and north and inshore in early spring (Grosslein 1976, in press). Spring migration is more important to the fisheries because fish spawn then and tend to be more aggregated. The hakes populate areas farther offshore and spawn later (in June and July). Since the hakes have a major population density in New York Bight (Grosslein 1976), a major foreign fishing effort has been in this area. Distribution of the fleet fishing these species would be more pronounced in later maps were it not for the advent of several other fisheries. Since 1970, Japanese and Spanish fisheries have tended to concentrate on butterfish and squid along the continental shelf edge from Georges Bank to Cape Hatteras. This accounts for most of the vessels observed fishing along the 200 m isobath, especially from New York Bight southward. Vessels from these fisheries remained in the south in summer from 1973 through 1976. In addition to seasonal north-south migrations, there are seasonal migrations inshore and offshore, usually associated with spawning and feeding habits. An important aspect of seasonal fish stock distribution is that the species are thoroughly intermixed throughout the entire Georges Bank to Cape Hatteras region (Hennemuth 1976). When the principal foreign effort was on one or two species, fishery distribution was dictated by the particular distribution of those species. Gradually, more nations have become involved, and the search for underutilized species has led the foreign fleet to other stocks, lessening the earlier pronounced geographic shifts in fleet activity.

Over the period and area indicated in Maps 1-30, vessels from some 20 nations were observed as part of the foreign fishery. Table 1 summarizes NMFS monthly surveillance reports for total numbers of foreign fishing vessels operating off the northeastern

US coast. The total international fleet ranged from a maximum of 336 vessels in September 1969 to a minimum of 21 vessels in July 1976. The overall monthly average for the period August 1969 to January 1977 was 200 vessels.

The highest annual average of foreign fishing vessels was in 1972 and the lowest in 1976. This decline in fleet strength since 1972 may indicate a failing resource base as biologists and fishermen have warned. In fact, NMFS trawl survey data for 1970 through 1974 show a maximum abundance of major species groups in 1972, followed by a steady decline over the next two years (Grosslein 1976). The peak year, 1972, may not be the year of greatest foreign fishing activity since the early 1960s, however.

Over the period of record, the foreign fleet was usually largest in early spring, averaging 268 vessels and smallest in early winter, averaging only 156 vessels. The reason for this cyclical pattern in fishing effort no doubt relates to the abundance and movements of certain species. A second but smaller peak of fishing vessels occurred in autumn, which likely relates to species spawning behavior.

The highest average number of vessels was reported in March, the lowest number of vessels in July. Although there is a secondary minimum in summer, the principal reason for the low July average was the extremely small fleet in July 1976. No Soviet vessels were recorded in this month.

The proportion of foreign fishing vessels from each nation was calculated for each month of the study period (Table 2). The foreign fleet was clearly dominated by vessels from the Soviet Union. Moreover, of the 22 nations represented at one time or another, only 5 accounted for over 90% of the total fleet. On the other end of the scale, only one vessel each from Israel, Venezuela, and Mexico was recorded over the period of record. Six vessels from the United Kingdom were recorded in September 1974, but none from that time through January 1977.

Nation-by-Nation Summary

The Soviet Union began fishing in the Northwest Atlantic off Canada in 1956 but rapidly expanded southward and first appeared on the western edge of Georges Bank in March 1961. By 1964, NMFS estimated 500 Soviet fishing vessels operating from west of Greenland to south of Rhode Island (Skerry 1965). Although the Soviet Union maintained an average of over 50% of the foreign fleet, the data show a gradual decline in participation relative to other countries. This decline, most obvious from 1974 through 1976, is a combination of fewer Soviet vessels and more vessels from other countries. For example, the Soviet proportion of the total fleet

Table 1. Foreign fishing vessels observed, Georges Bank to Cape Hatteras

	1969	1970	1971	1972	1973	1974	1975	1976	1977	Monthly Average
January		88	123	258	198	269	234	266	136	196
February		163	257	292	220	309	334	291		267
March		249	258	306	312	323	266	208		275
April		231	288	329	280	302	252	154		262
May		185	310	267	244	181	183	104		211
June		157	185	236	168	159	204	59		167
July		129	126	187	210	126	137	21		134
August	322	188	241	241	135	172	142	43		186
September	336	249	283	294	213	176	133	121		226
October	258	236	271	272	217	162	146	125		211
November	105	136	218	145	216	115	112	55		138
December	80	100	247	173	162	116	125	79		135
Yearly Average		176	234	250	215	201	189	127		

Source: National Marine Fisheries Service

decreased from 69% to 14% in all Decembers, 1969 through 1976, and from 85% to 57% in all Aprils, 1970 through 1976. The average number of Soviet vessels per month peaked in 1972, with 156 vessels, and decreased to 57 vessels in 1976.

The Soviets demonstrated a preference for fishing in the late winter and spring (Table 3). For the six-month period February through July, the Soviets averaged 145 vessels and 65% of the total fleet. Their presence in the foreign fleet was usually lowest in autumn, increasing in January, and reaching highest levels March through May.

Vessels from Poland and the German Democratic Republic (GDR) combined accounted for nearly 25% of the total fleet over the period of record. Poland averaged a fairly consistent 30 vessels per month over the period of record, or about 15% of the total fleet (Table 3). The maximum number of Polish vessels for the period was 74, recorded in September 1971; the minimum was 3, recorded in July and August 1976. Like the Soviet Union, the Polish fleet gradually decreased between 1971 and 1976. After a peak average of 48 vessels per month in 1971, the number of Polish vessels dropped steadily to an average of 11 vessels per month in 1976. No strong seasonal preference is apparent in the Polish fishery except that its weakest season was summer and its strongest was early spring and early autumn.

GDR vessels had a noticeable seasonal pattern of abundance. Largest numbers of GDR fishing vessels tended to occur in early autumn just following a summer minimum (Table 3). During this season, GDR and Polish vessels averaged 18% and 16% of the total fleet respectively. The GDR fleet also decreased in recent years. In 1969 there was an average of 45 vessels per month from August to October. In 1976 an average of only 20 vessels per month was observed in the same season. The GDR fleet crested in 1972 with an average of 25 vessels per month, then decreased to a 1976 average of less than 10 vessels per month.

Spanish representation in the foreign fleet was intermittent with few clear trends over the period of record. Until 1973, the Spanish averaged only seven vessels per month each year (1970 through 1972). Since December 1972, Spanish vessels were observed every month, except in December 1974. Spanish activity in the foreign fleet grew rapidly in 1973 to an average of 19 vessels per month but climaxed the following year with an average of 23 vessels per month. The Spanish fleet then stabilized and slightly decreased. The Spanish preferred the first three months of the year and then early autumn (Table 3). Their vessel increases in June began in 1974 and were noted again in 1975 and 1976. Prior to 1974, usually only two or four vessels were seen in June. This uneven, early summer pattern is typified by the 1975 surveillance reports--in May, 2 Spanish vessels seen; in June, 24 vessels; in July, 9 vessels. The only season of relatively consistent Spanish fishing effort was winter. Even with the usually large number of Soviet vessels reported in February, the Spanish averaged about 10% of the total foreign fleet that month over the study period.

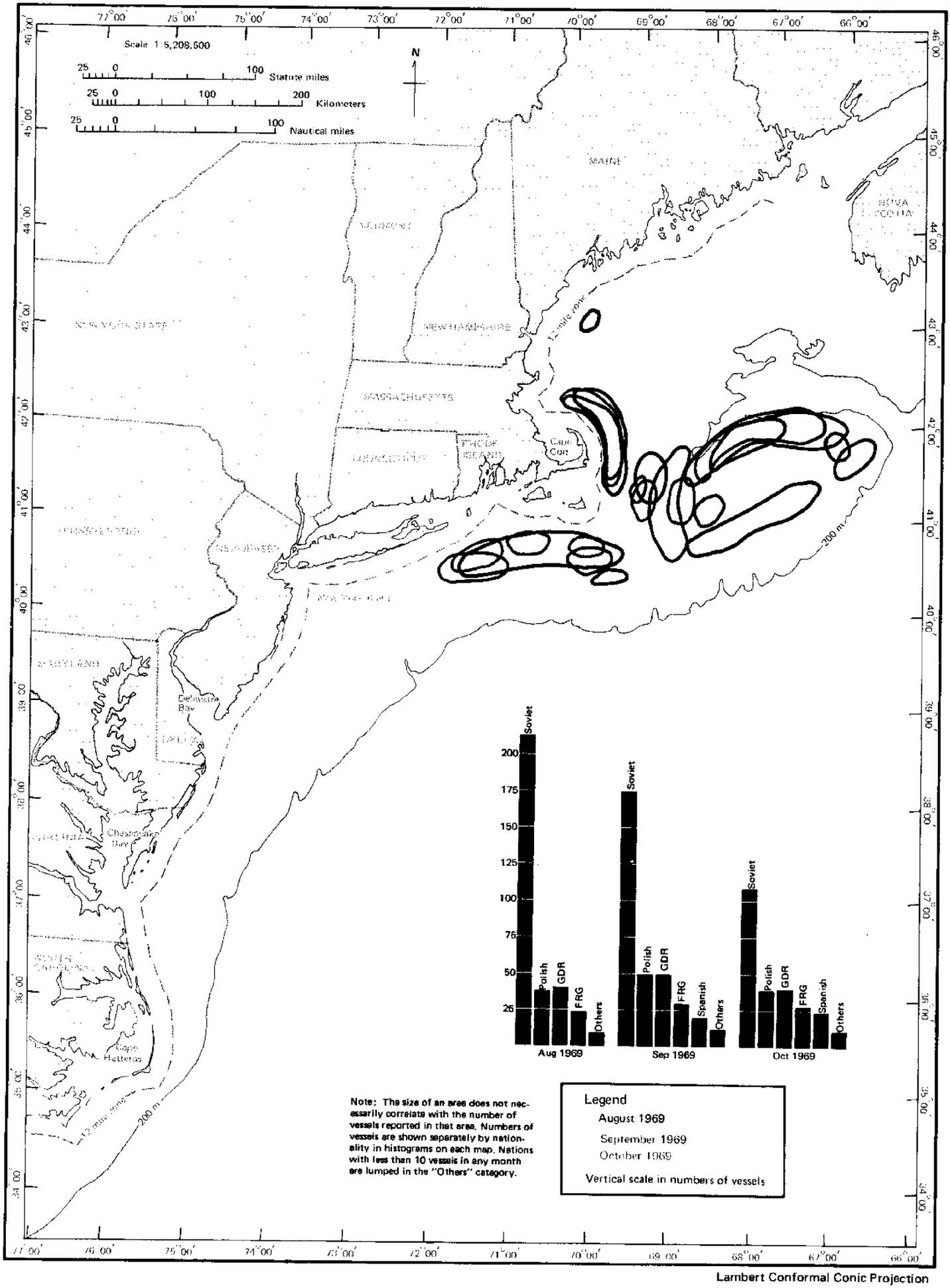
Japan's primary fishing months on the US northeastern continental shelf were January through March, and September and October (Table 3). The Japanese were usually absent from the fleet at other times. Since December 1972, however, Japanese

Table 2. Percent of total fishing fleet operated by each nation; August 1969 through January 1977

	Mean	Range of Monthly Average Percents Maximum	Minimum
Soviet Union	54.62	71.59	36.41
Poland	15.06	20.58	10.05
German Democratic Republic	9.12	19.86	3.88
Spain	7.29	10.64	2.83
Japan	5.28	8.08	2.17
Federal Republic of Germany	3.02	10.13	0
Italy	1.83	4.30	0.07
Bulgaria	1.63	3.44	0.43
Romania	0.59	1.29	0
Cuba	0.47	1.24	0.06
South Korea	0.40	1.36	0
Ireland	0.15	0.31	0
France	0.13	0.61	0
Greece	0.11	0.50	0
Iceland	0.06	0.29	0
Norway	0.05	0.20	0
Faeroe Islands (Denmark)	0.05	0.51	0
United Kingdom	0.04	0.43	0
Nigeria	0.02	0.16	0
Mexico	0.01	0.10	0
Venezuela	0.01	0.10	0
Israel	<0.01	0.04	0

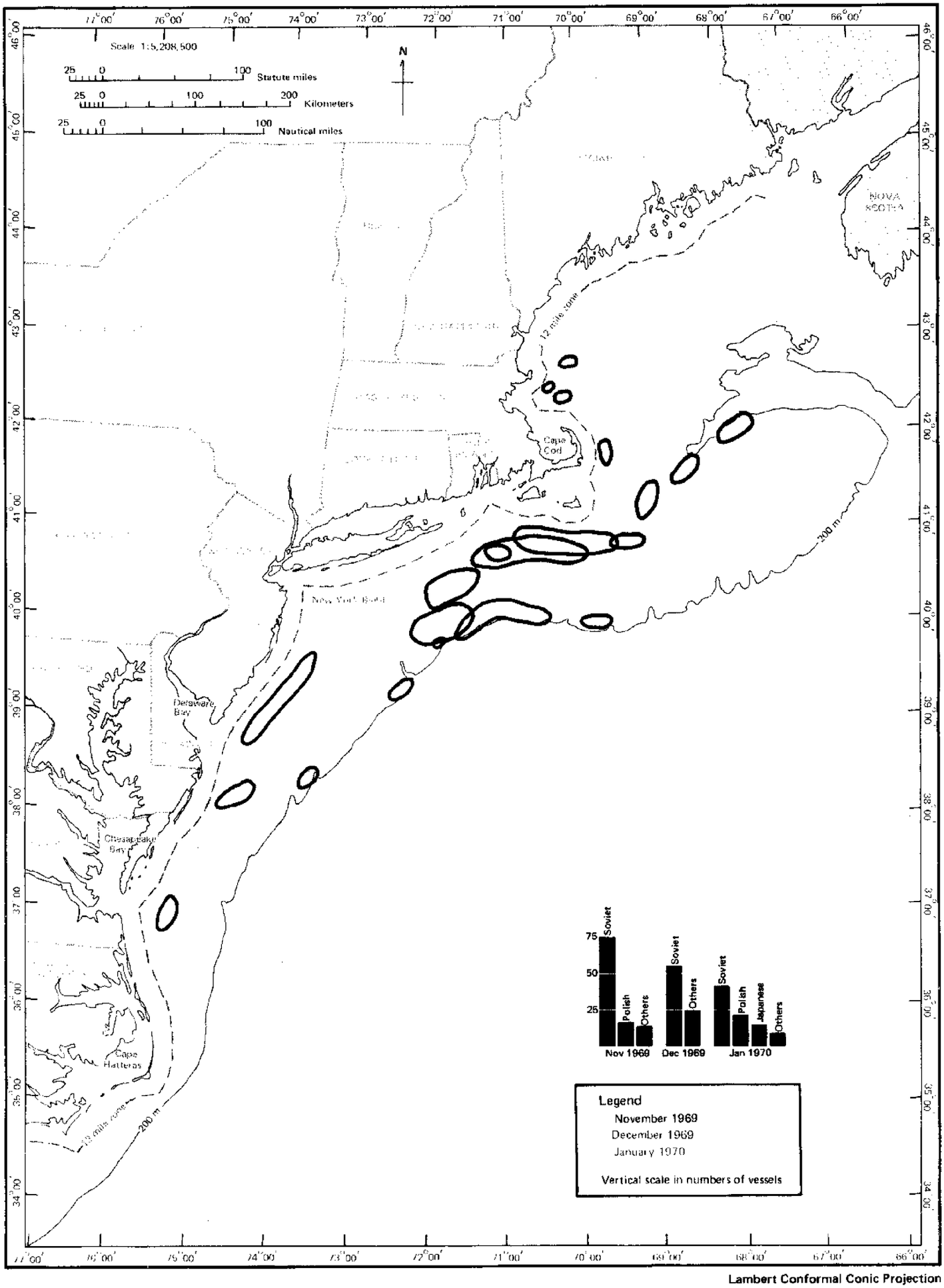
Source: National Marine Fisheries Service

Map 1. Foreign fleets, Northwest Atlantic, Aug 1969 to Oct 1969



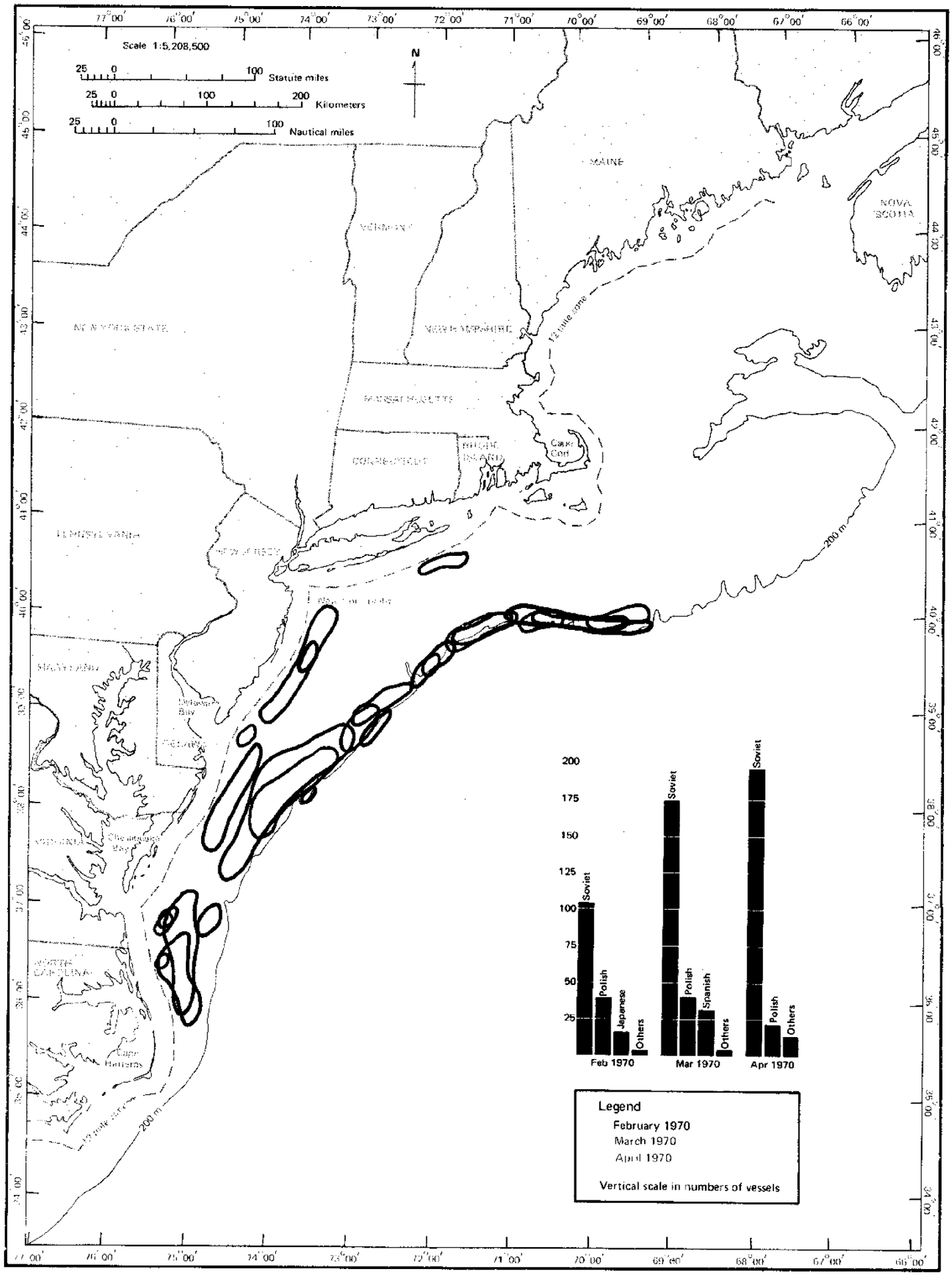
Lambert Conformal Conic Projection

Map 2. Foreign fleets, Northwest Atlantic, Nov 1969 to Jan 1970



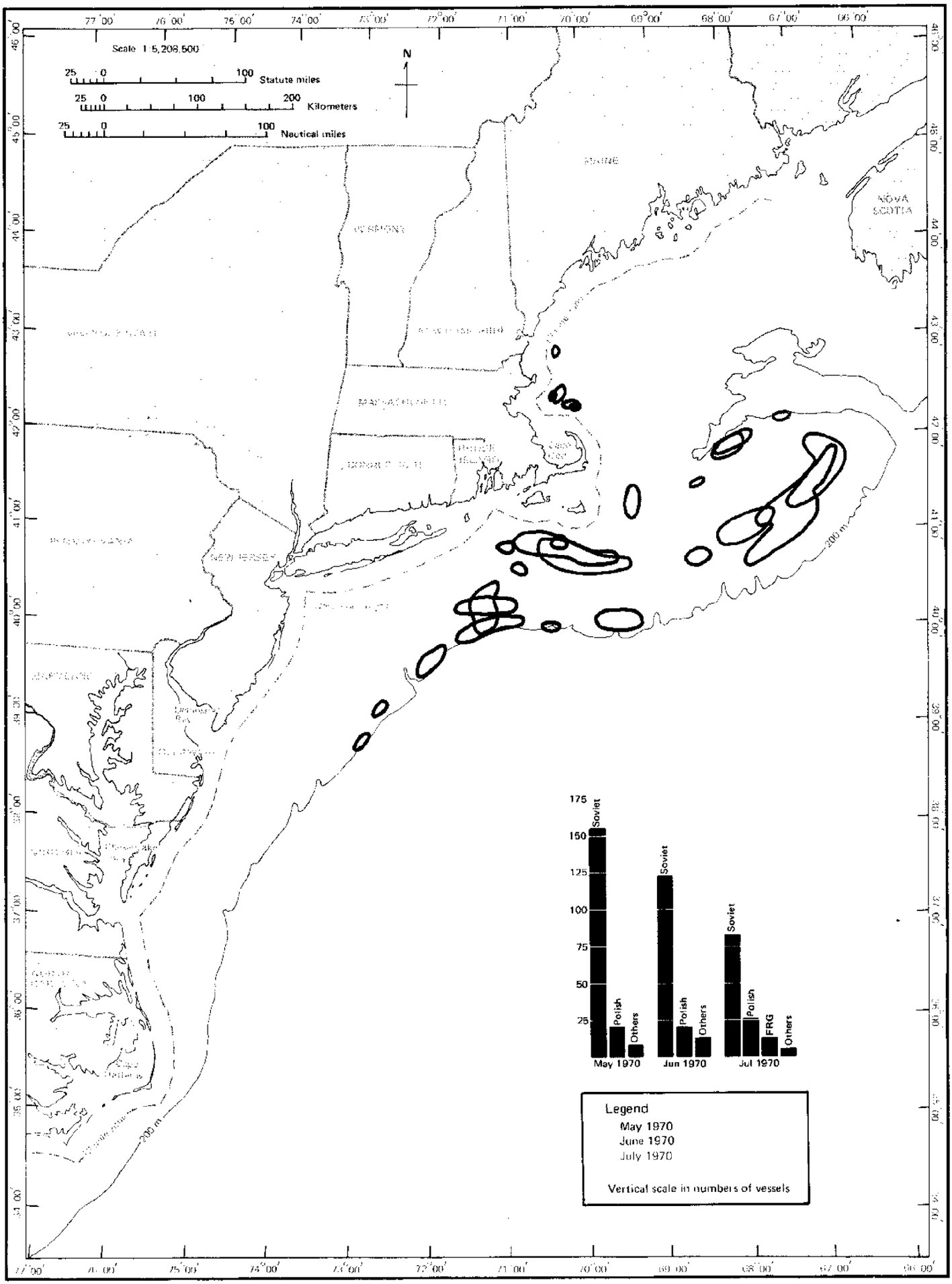
Lambert Conformal Conic Projection

Map 3. Foreign fleets, Northwest Atlantic, Feb 1970 to Apr 1970



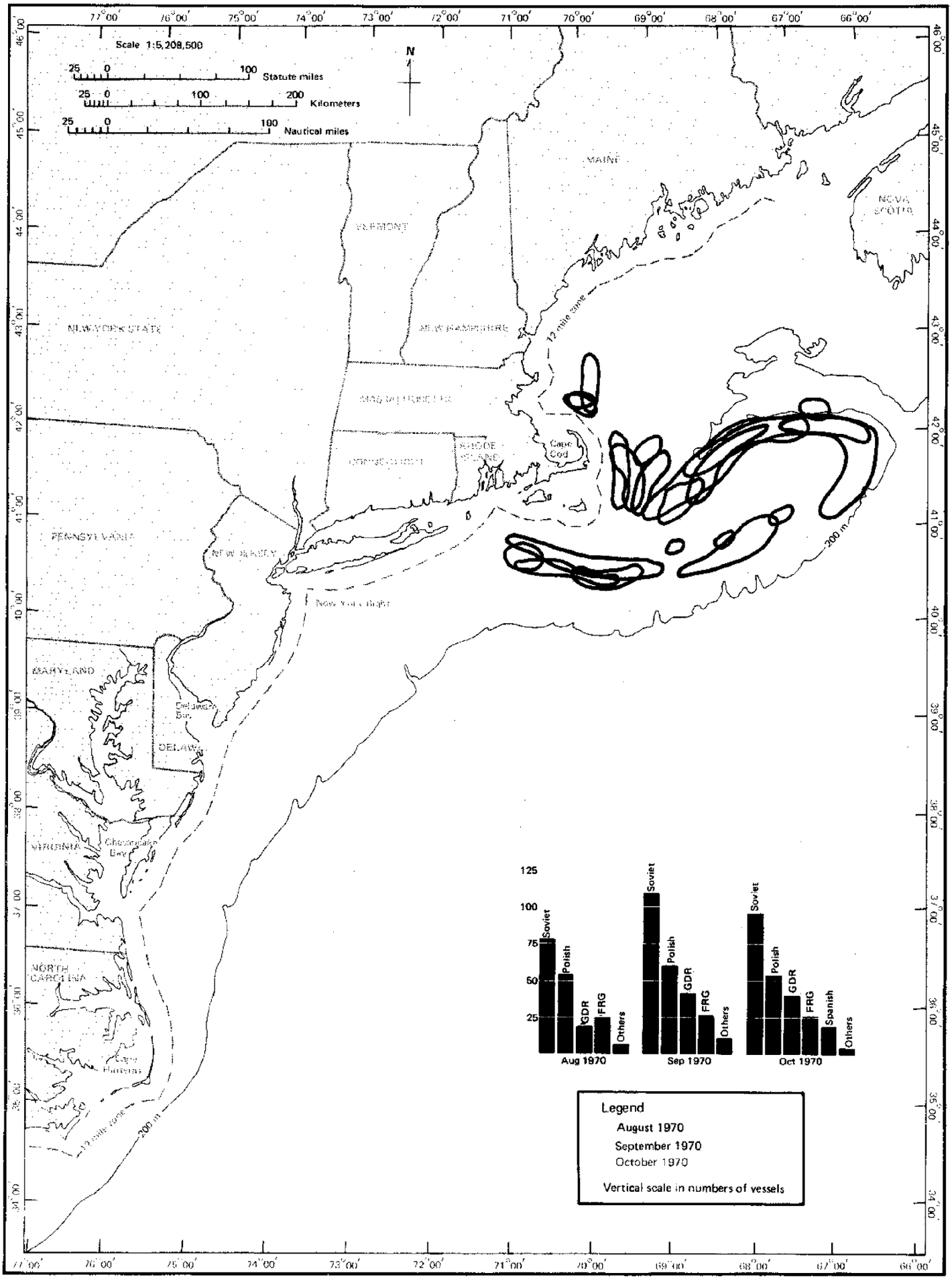
Lambert Conformal Conic Projection

Map 4. Foreign fleets, Northwest Atlantic, May 1970 to Jul 1970



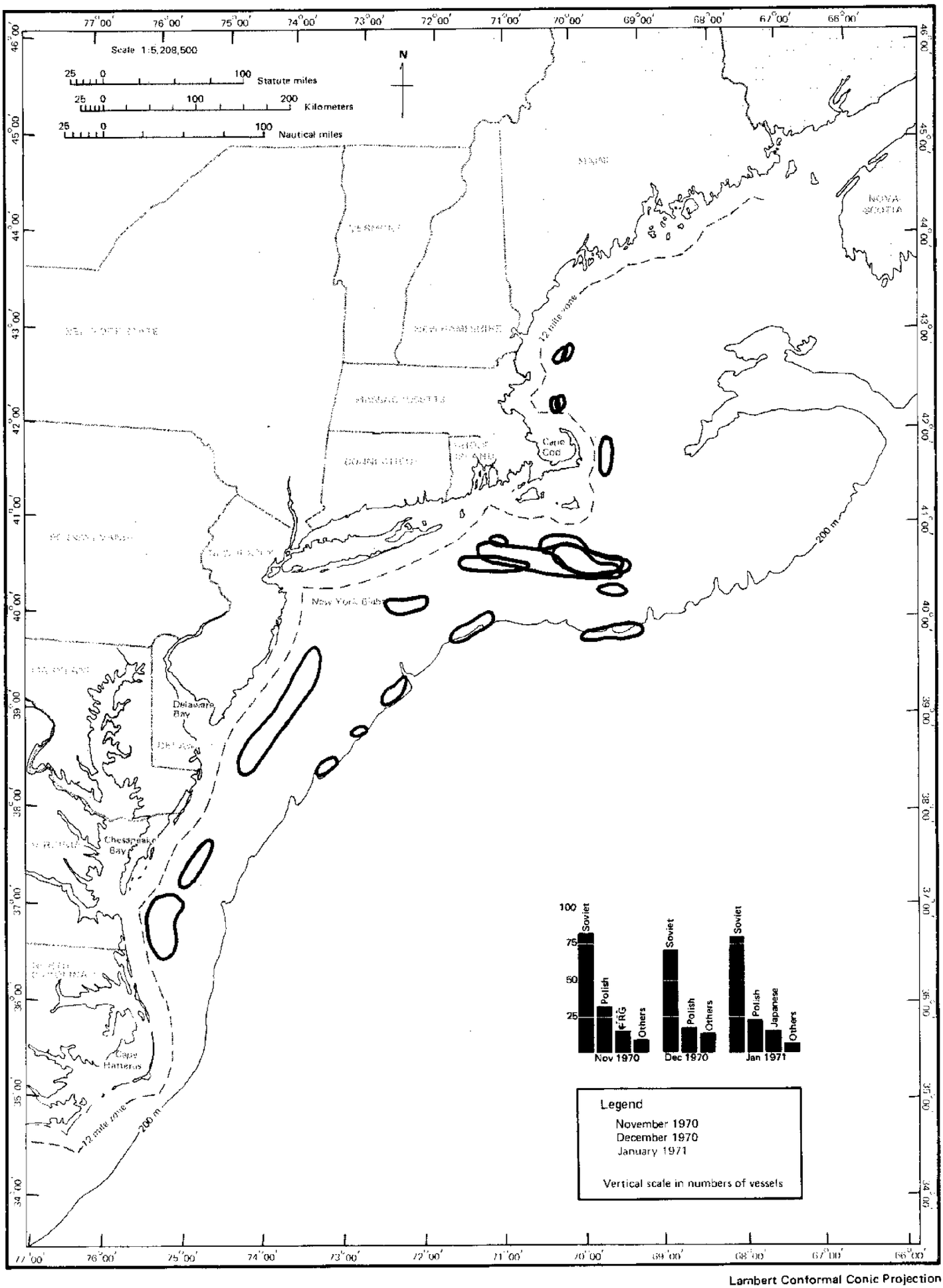
Lambert Conformal Conic Projection

Map 5. Foreign fleets, Northwest Atlantic, Aug 1970 to Oct 1970



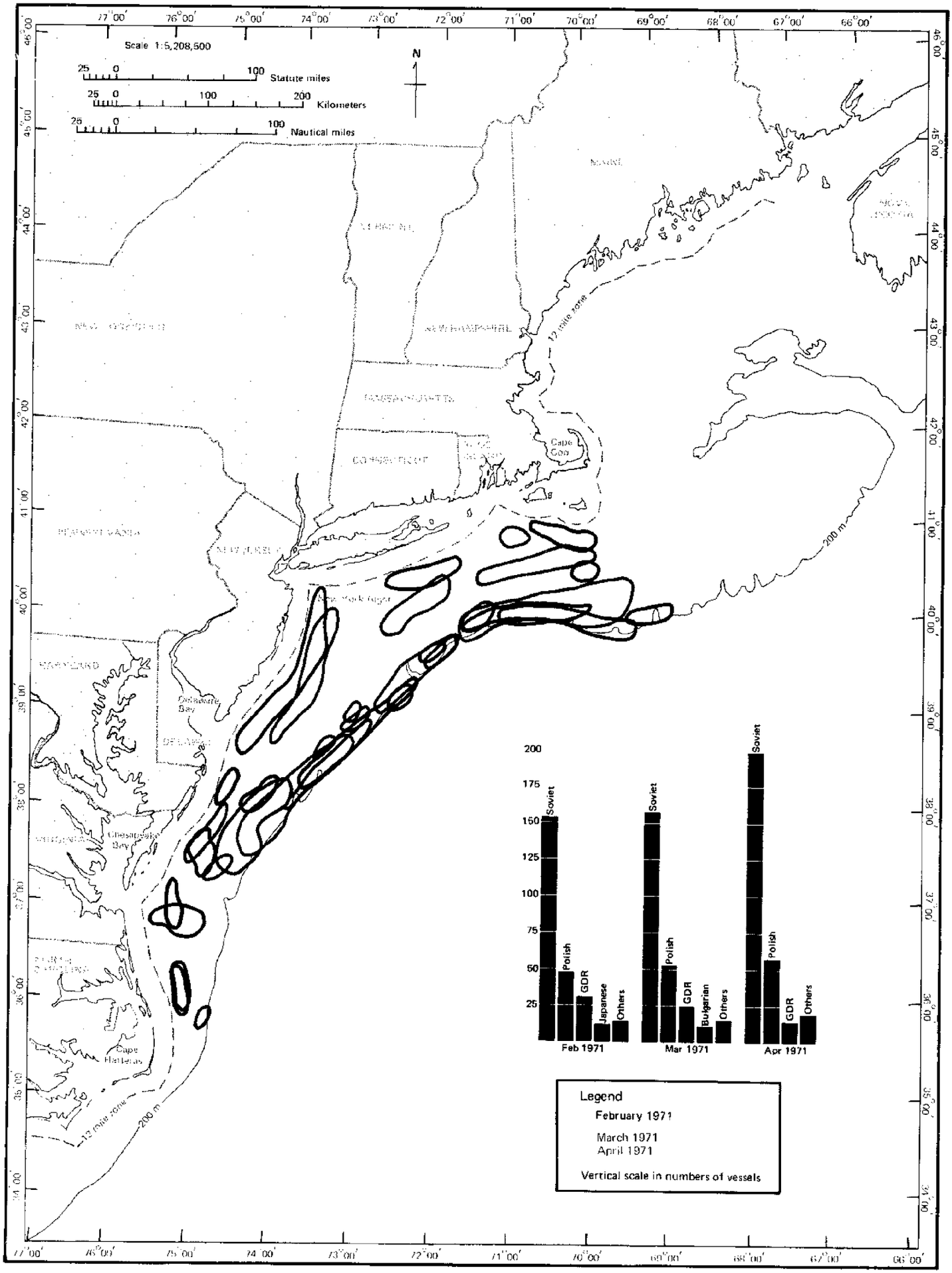
Lambert Conformal Conic Projection

Map 6. Foreign fleets, Northwest Atlantic, Nov 1970 to Jan 1971



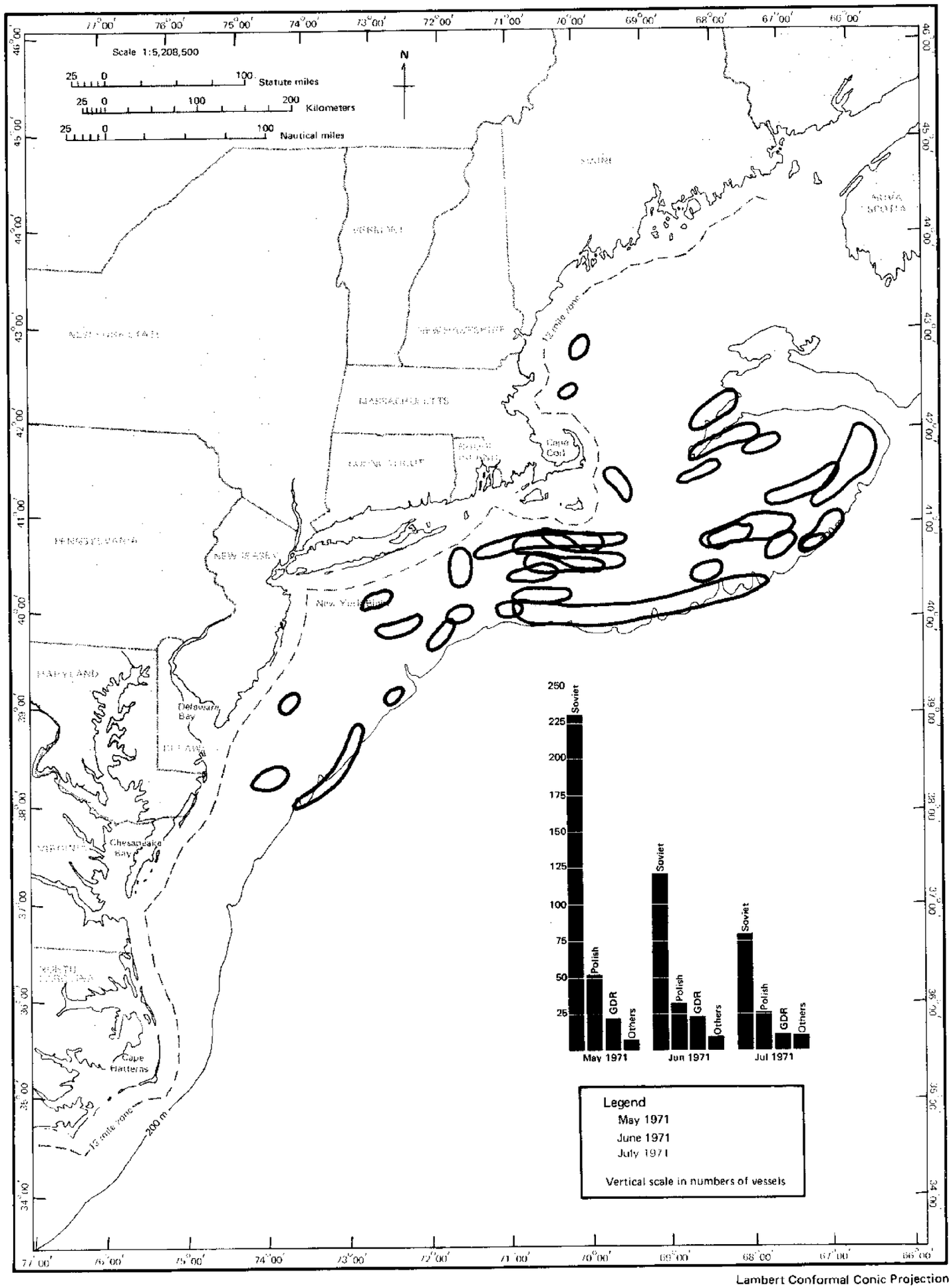
Lambert Conformal Conic Projection

Map 7. Foreign fleets, Northwest Atlantic, Feb 1971 to Apr 1971



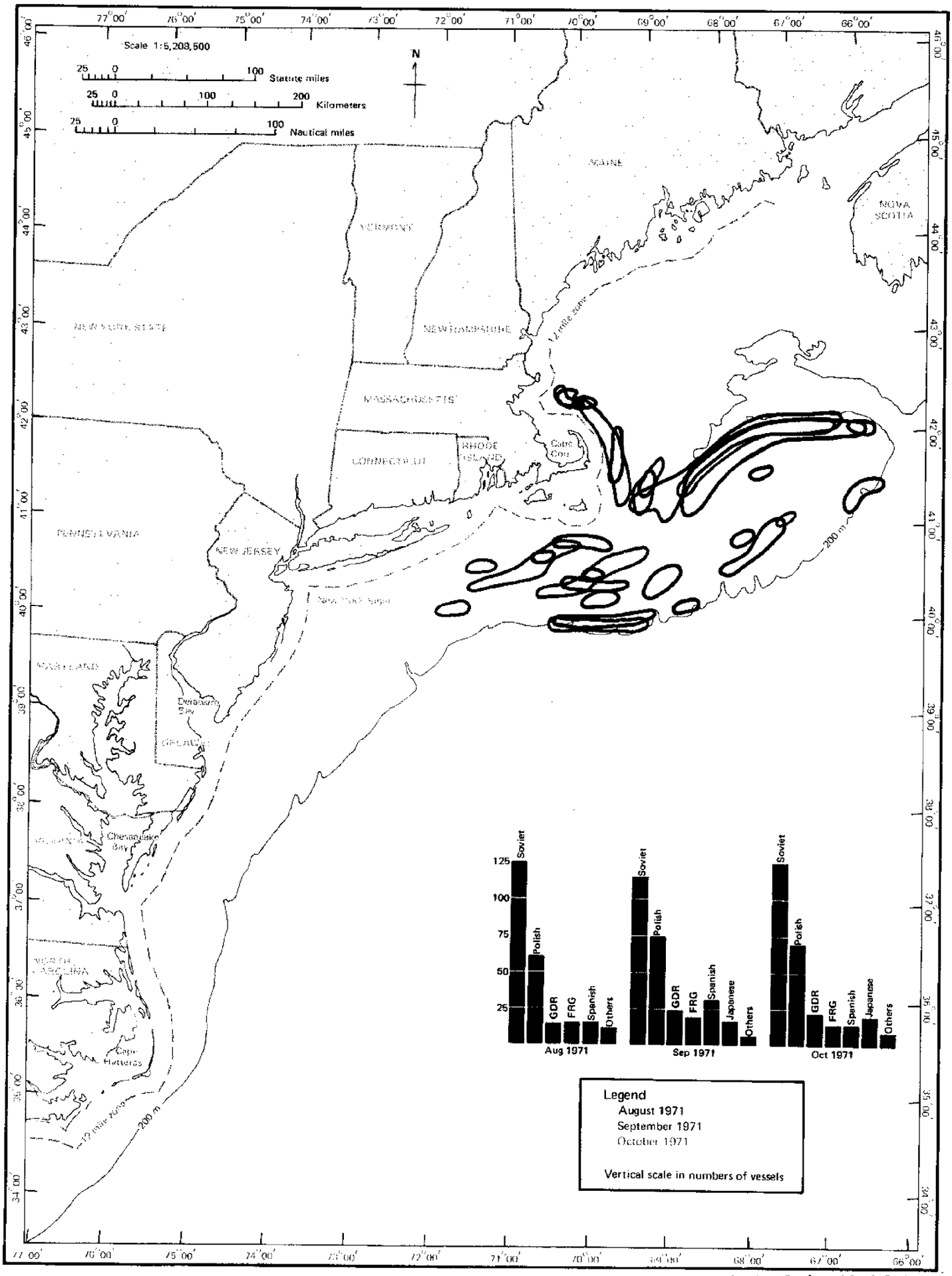
Lambert Conformal Conic Projection

Map 8. Foreign fleets, Northwest Atlantic, May 1971 to Jul 1971

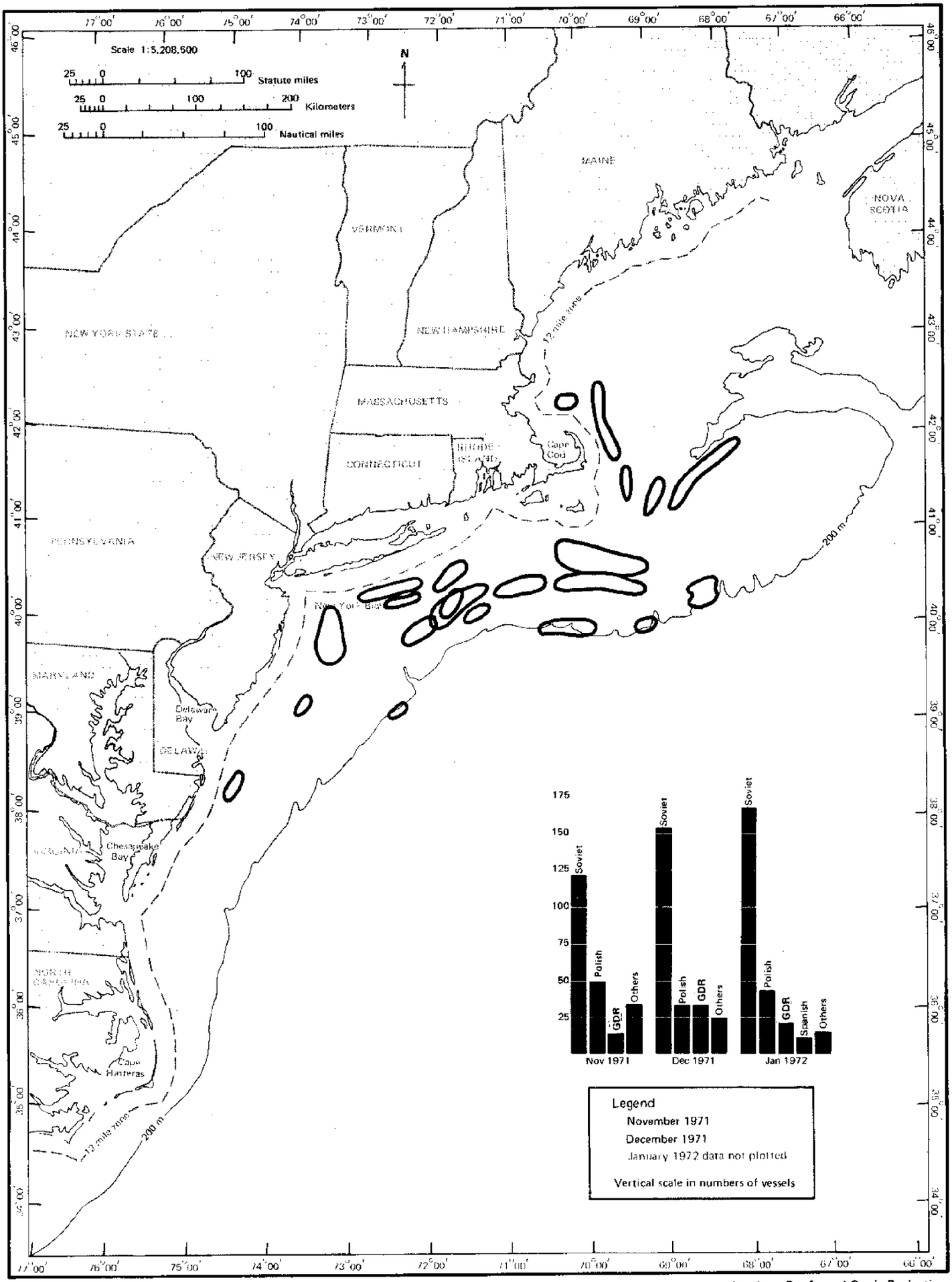


Lambert Conformal Conic Projection

Map 9. Foreign fleets, Northwest Atlantic, Aug 1971 to Oct 1971

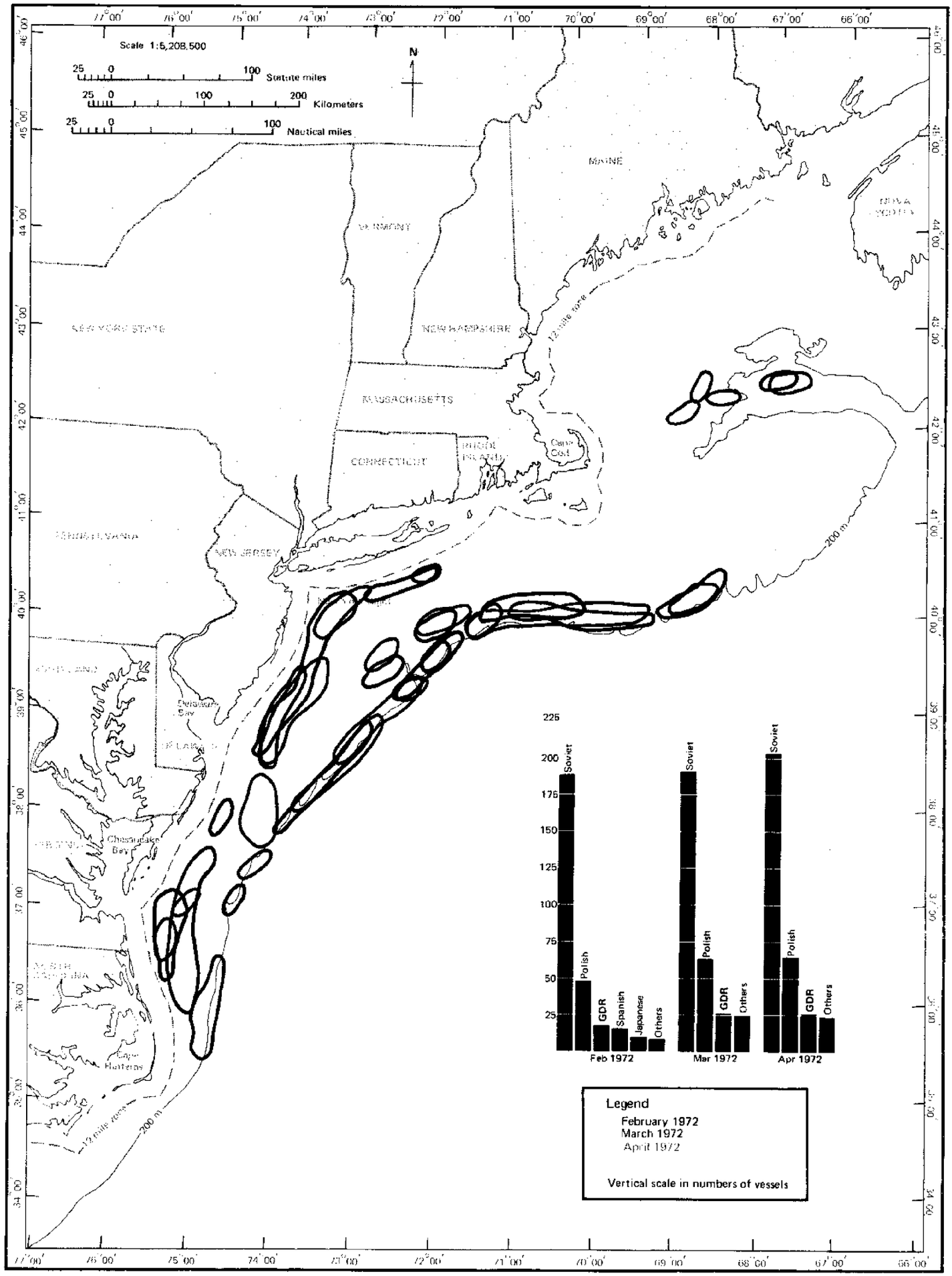


Map 10. Foreign fleets, Northwest Atlantic, Nov 1971 to Jan 1972

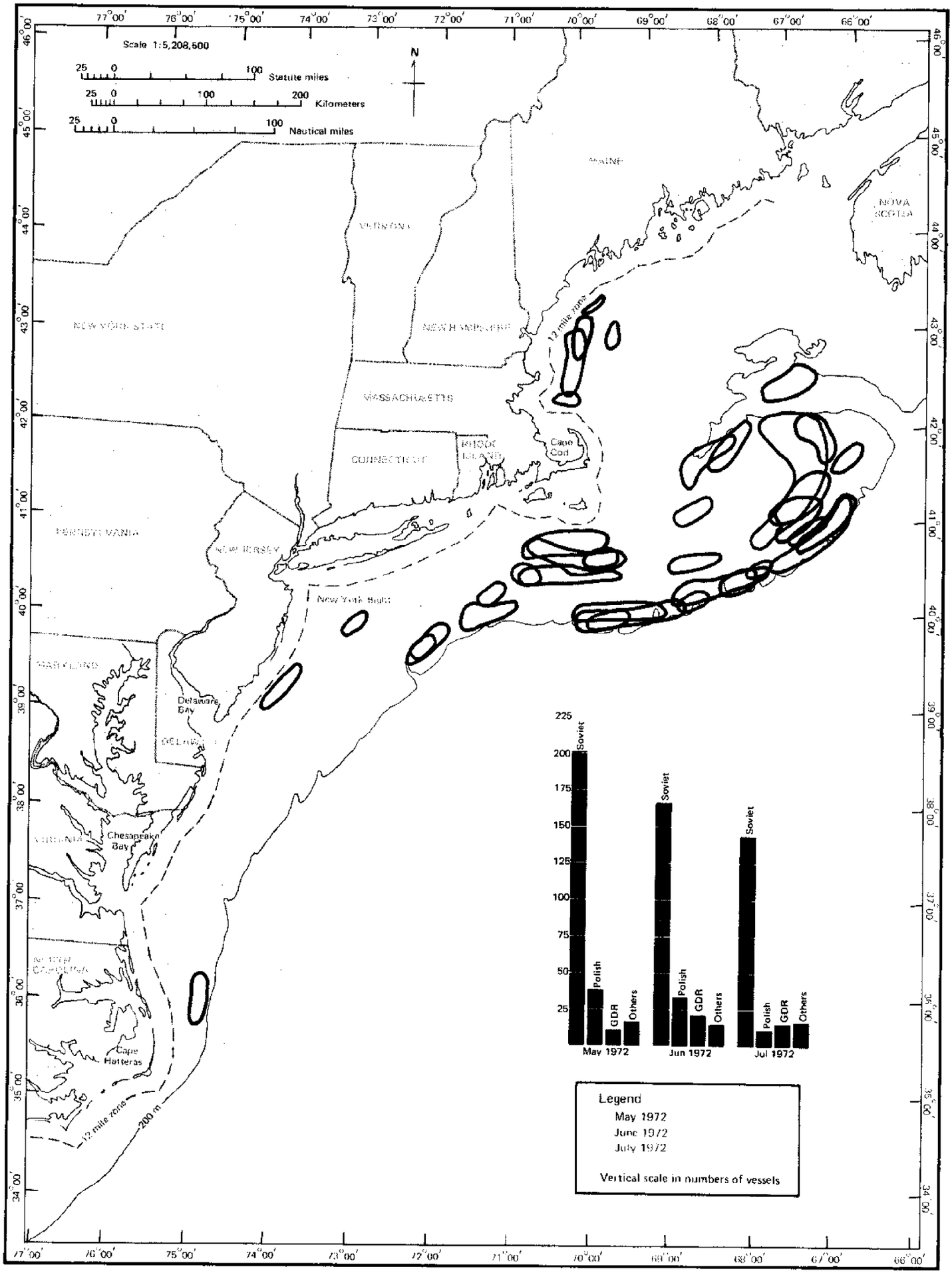


Lambert Conformal Conic Projection

Map 11. Foreign fleets, Northwest Atlantic, Feb 1972 to Apr 1972

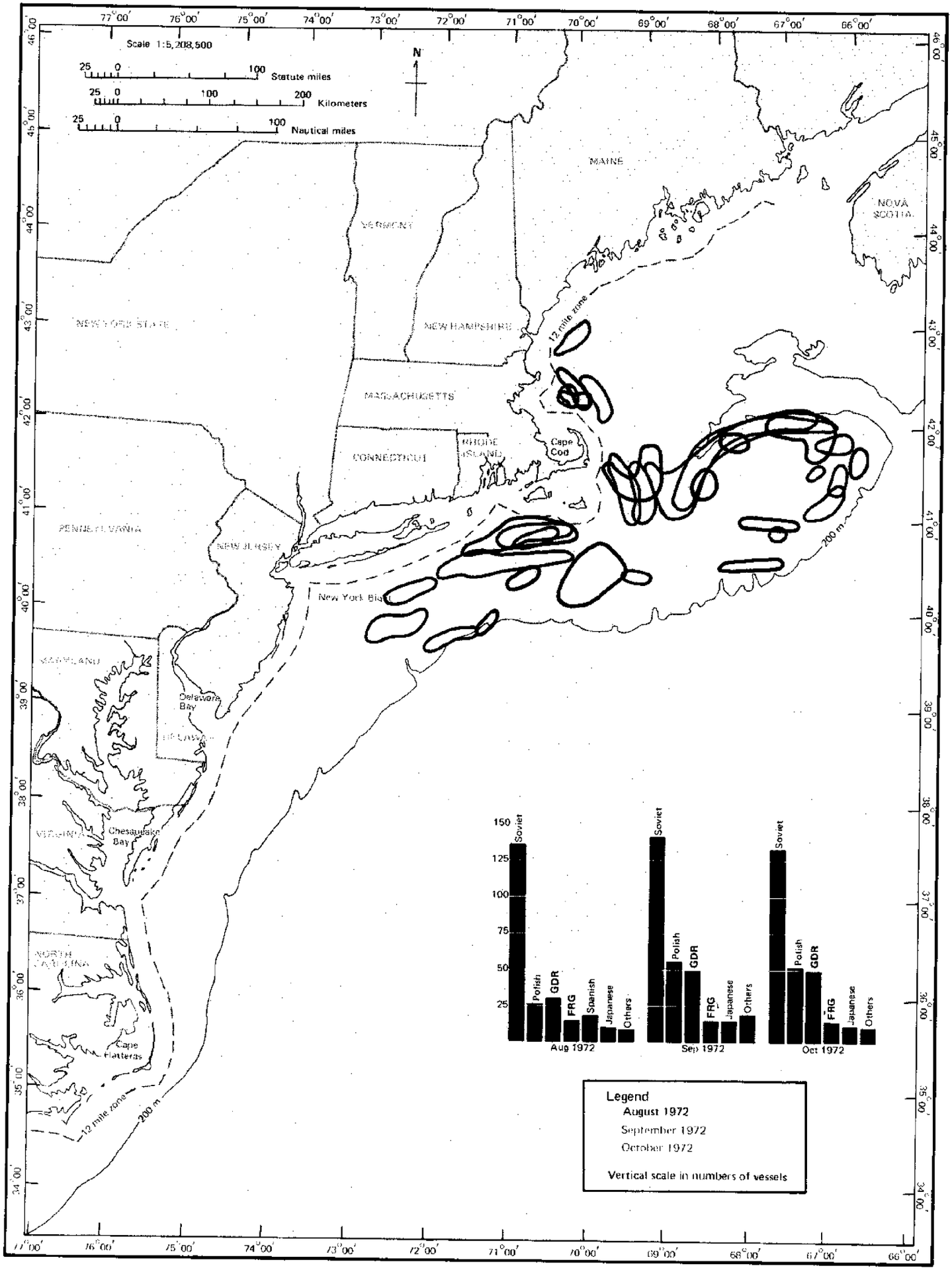


Map 12. Foreign fleets, Northwest Atlantic, May 1972 to Jul 1972



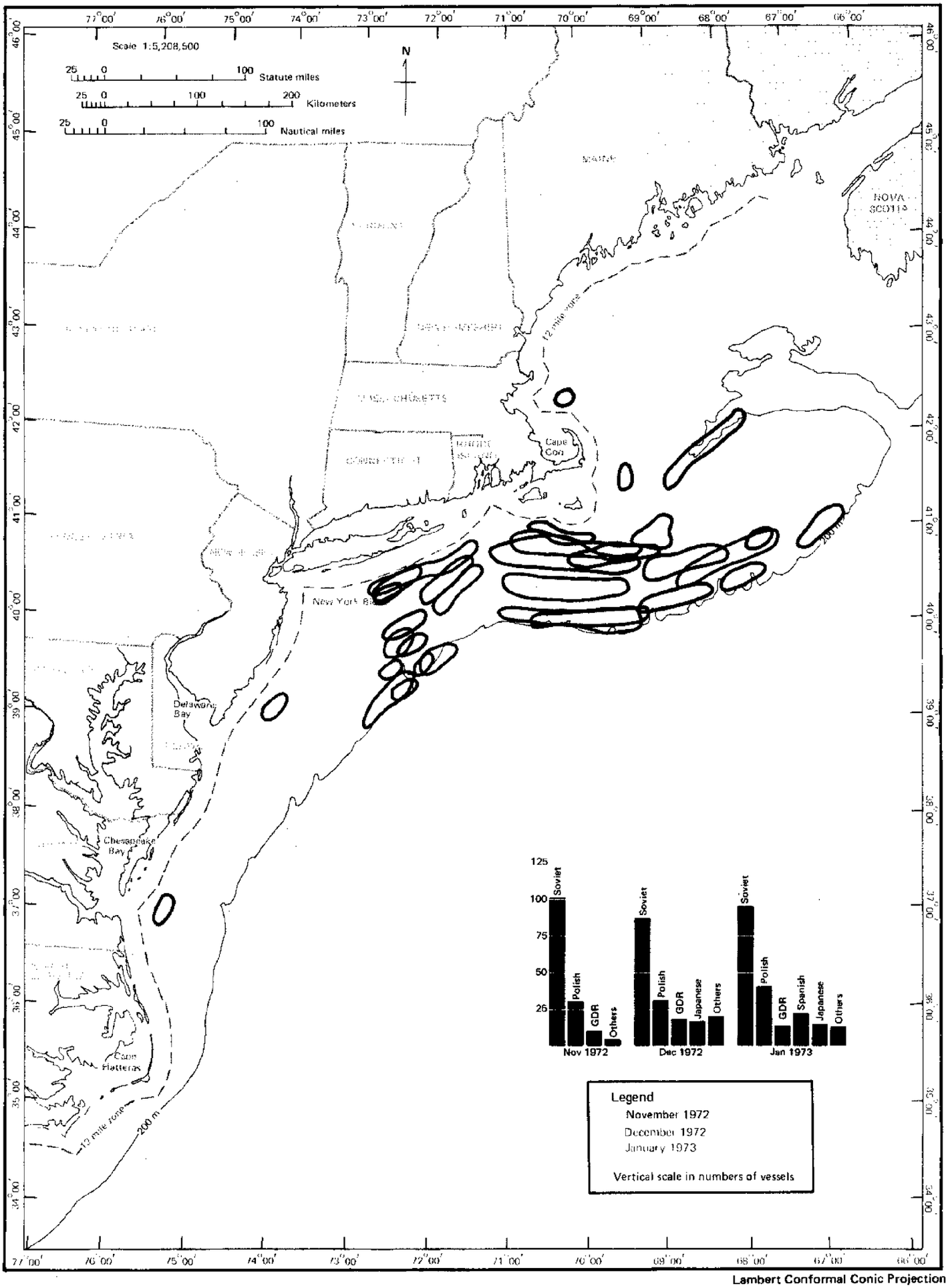
Lambert Conformal Conic Projection

Map 13. Foreign fleets, Northwest Atlantic, Aug 1972 to Oct 1972



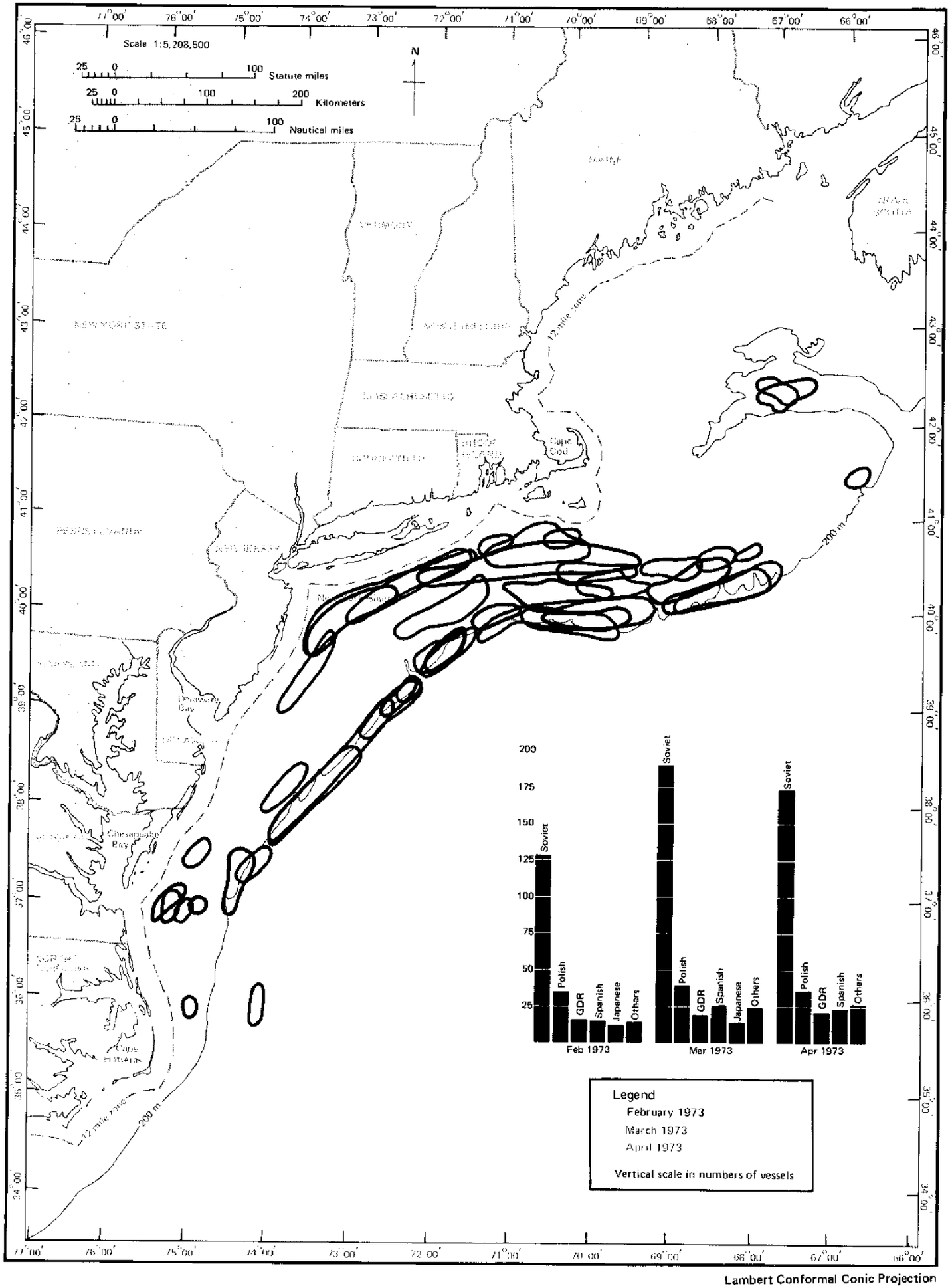
Lambert Conformal Conic Projection

Map 14. Foreign fleets, Northwest Atlantic, Nov 1972 to Jan 1973



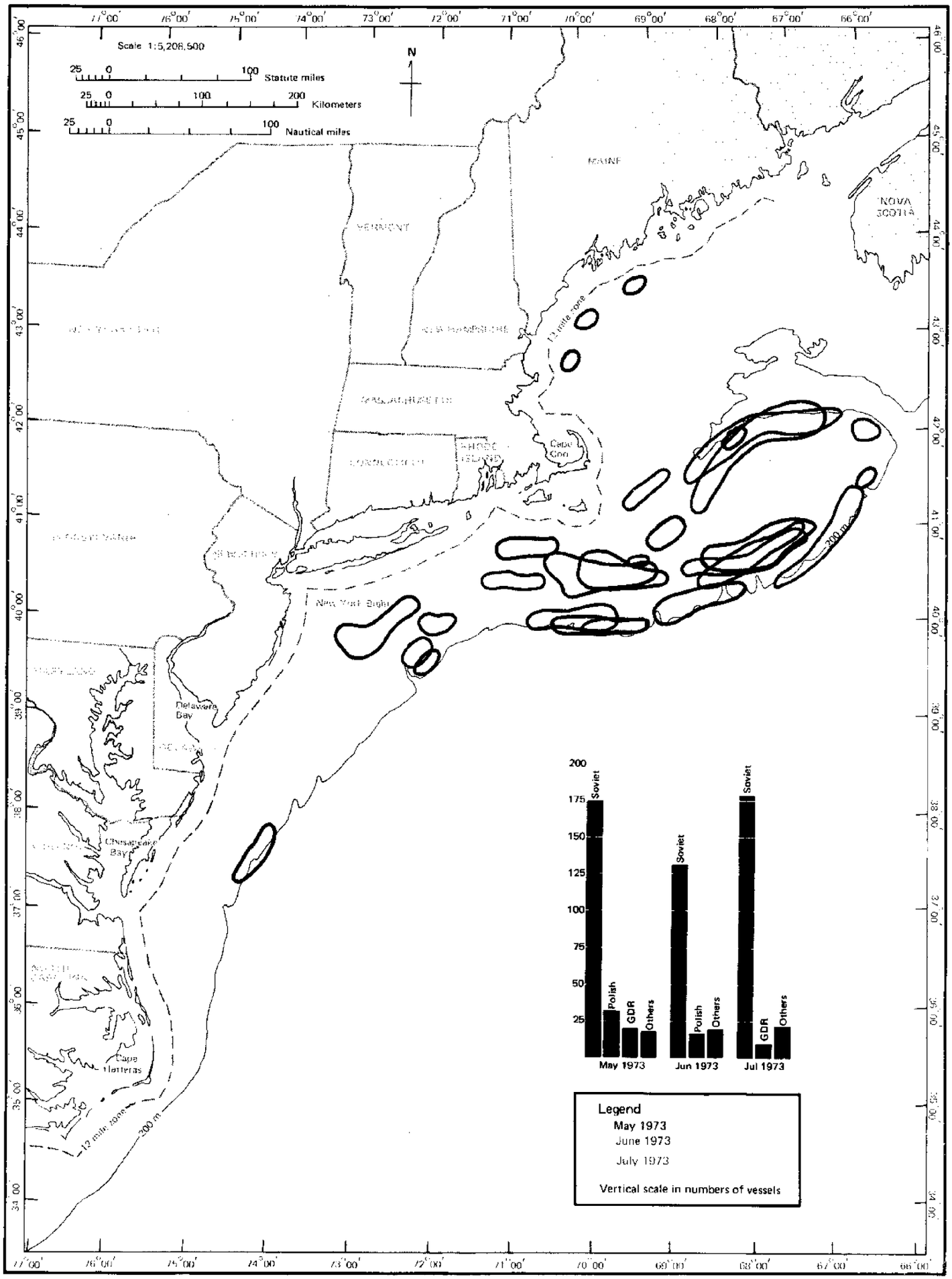
Lambert Conformal Conic Projection

Map 15. Foreign fleets, Northwest Atlantic, Feb 1973 to Apr 1973



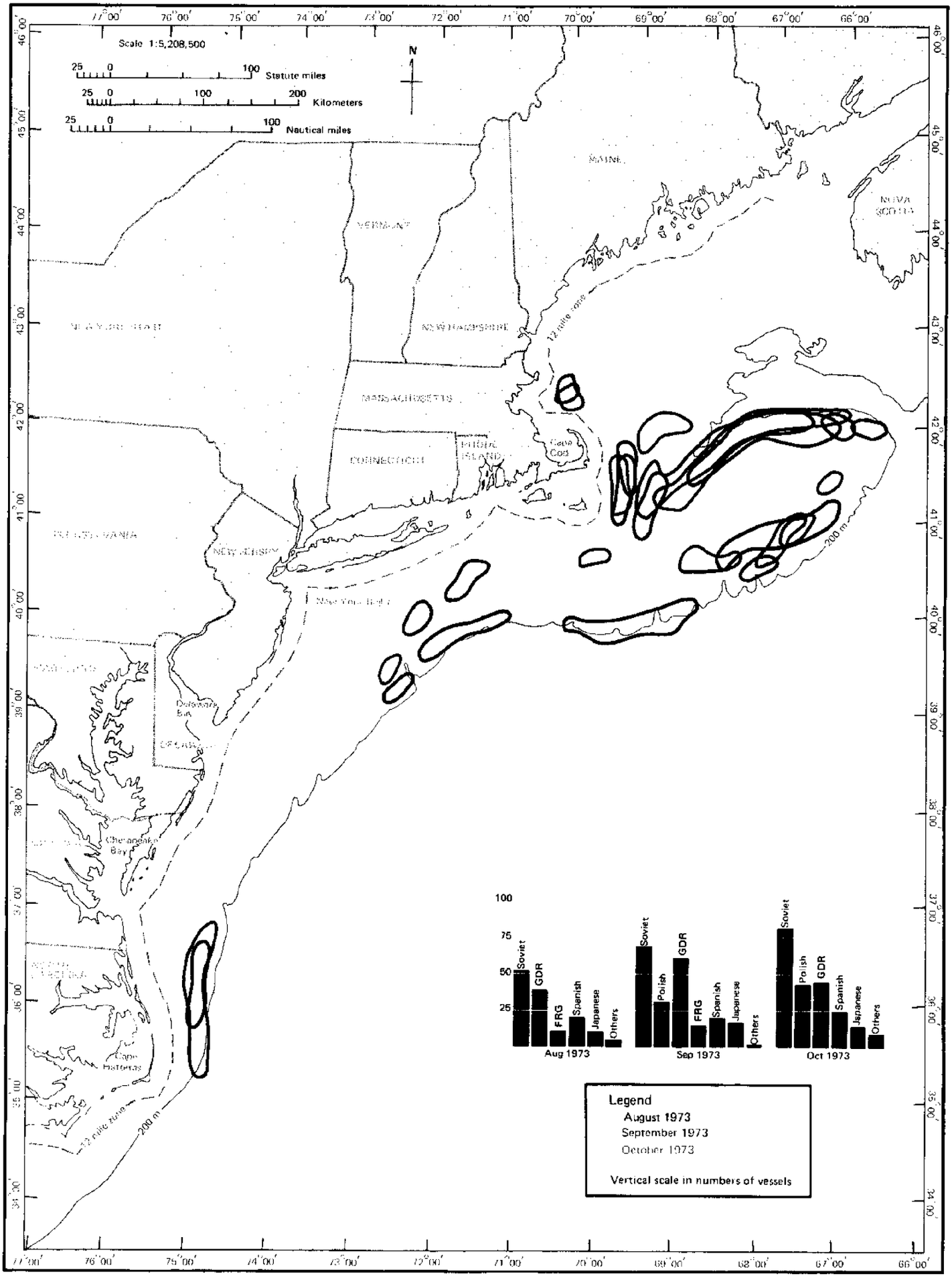
Lambert Conformal Conic Projection

Map 16. Foreign fleets, Northwest Atlantic, May 1973 to Jul 1973



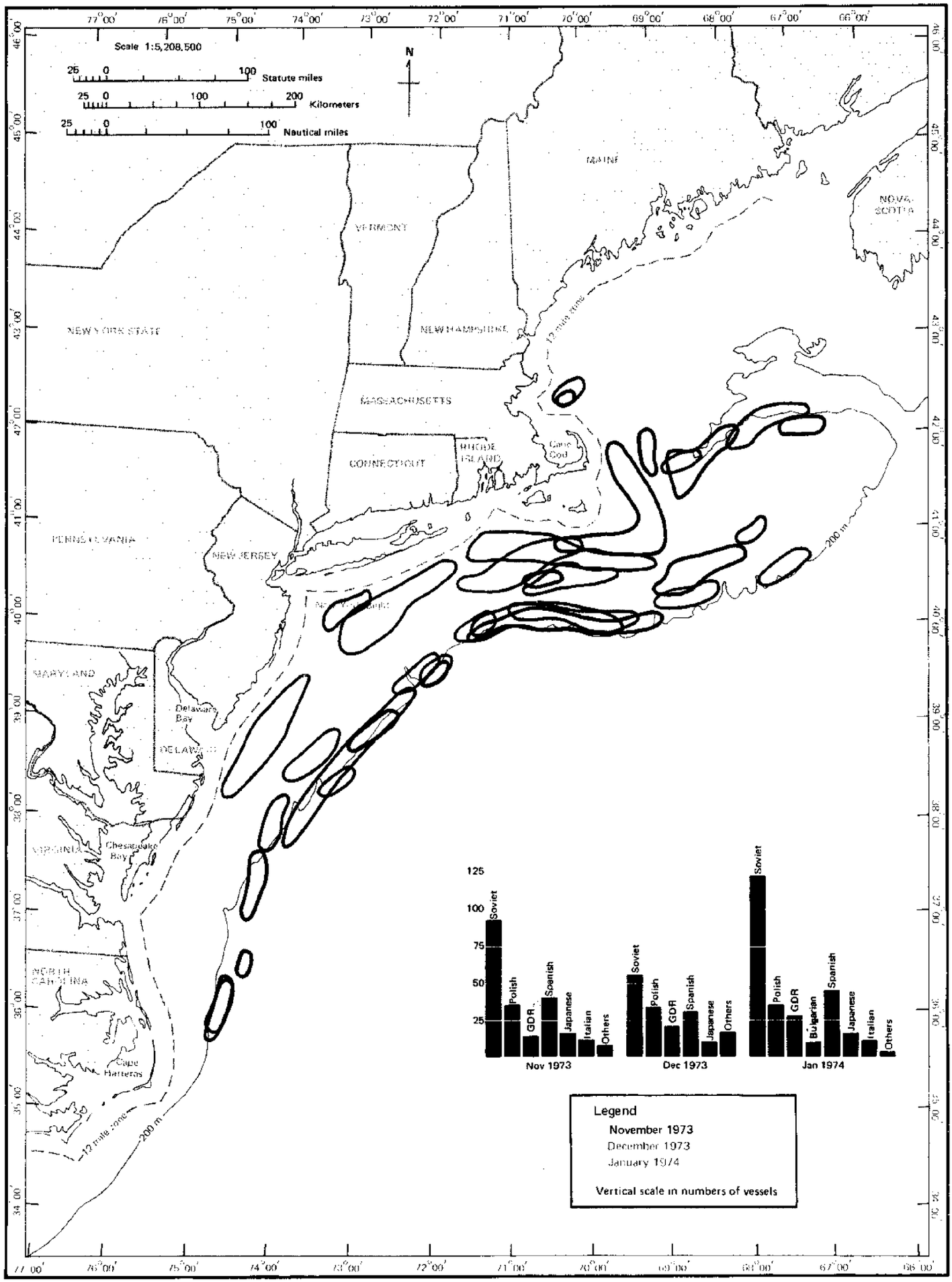
Lambert Conformal Conic Projection

Map 17. Foreign fleets, Northwest Atlantic, Aug 1973 to Oct 1973



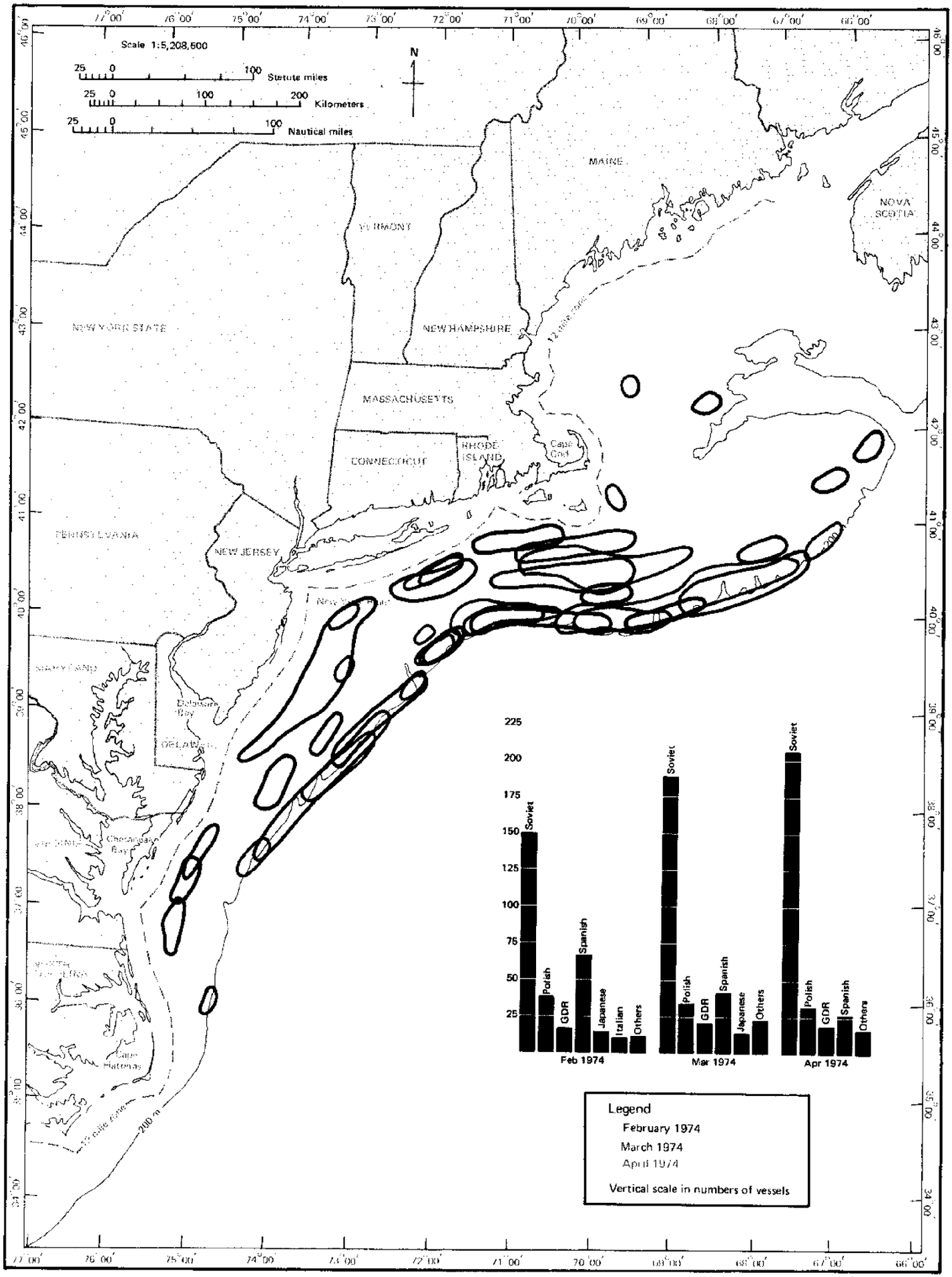
Lambert Conformal Conic Projection

Map 18. Foreign fleets, Northwest Atlantic, Nov 1973 to Jan 1974



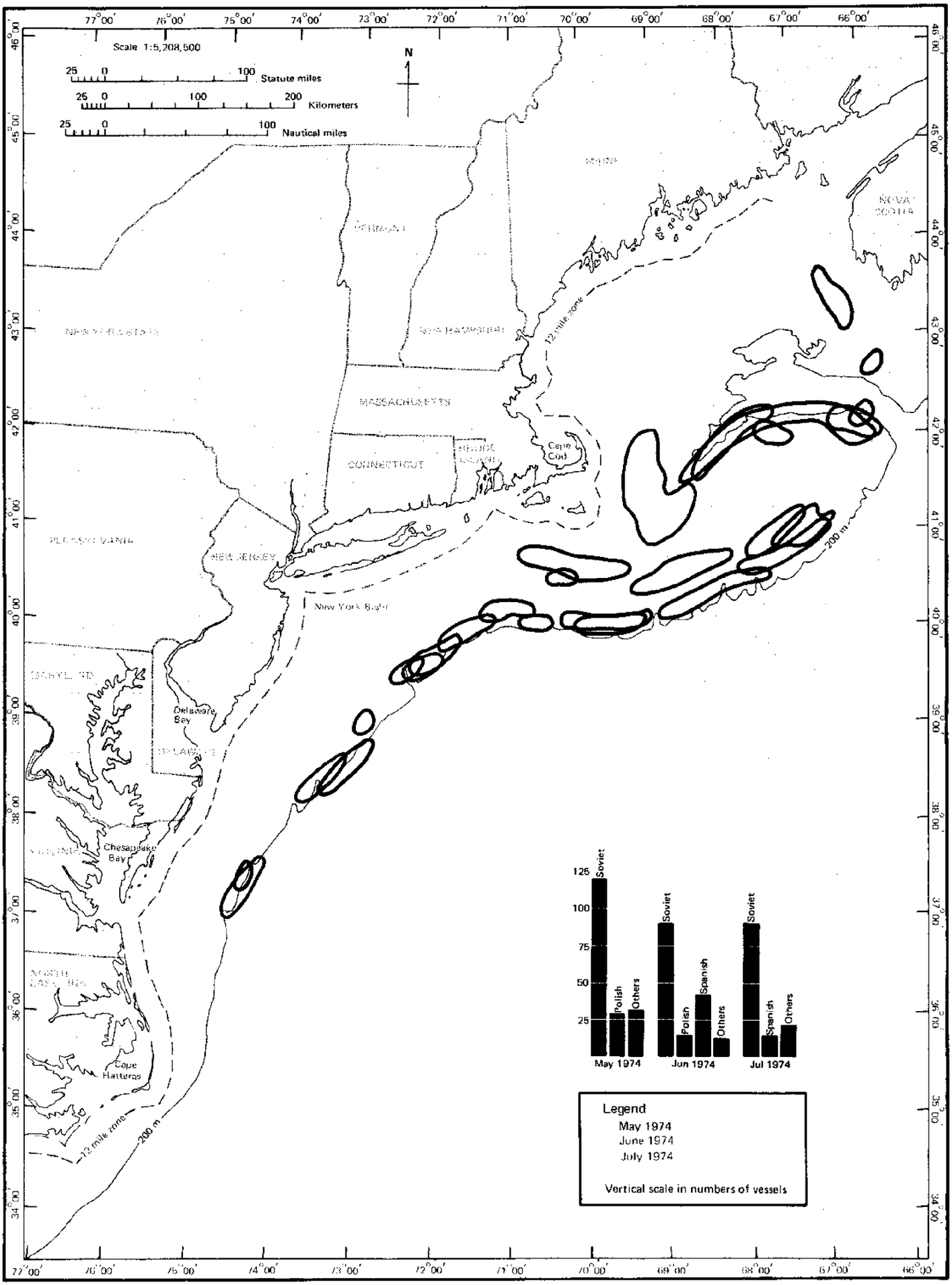
Lambert Conformal Conic Projection

Map 19. Foreign fleets, Northwest Atlantic, Feb 1974 to Apr 1974



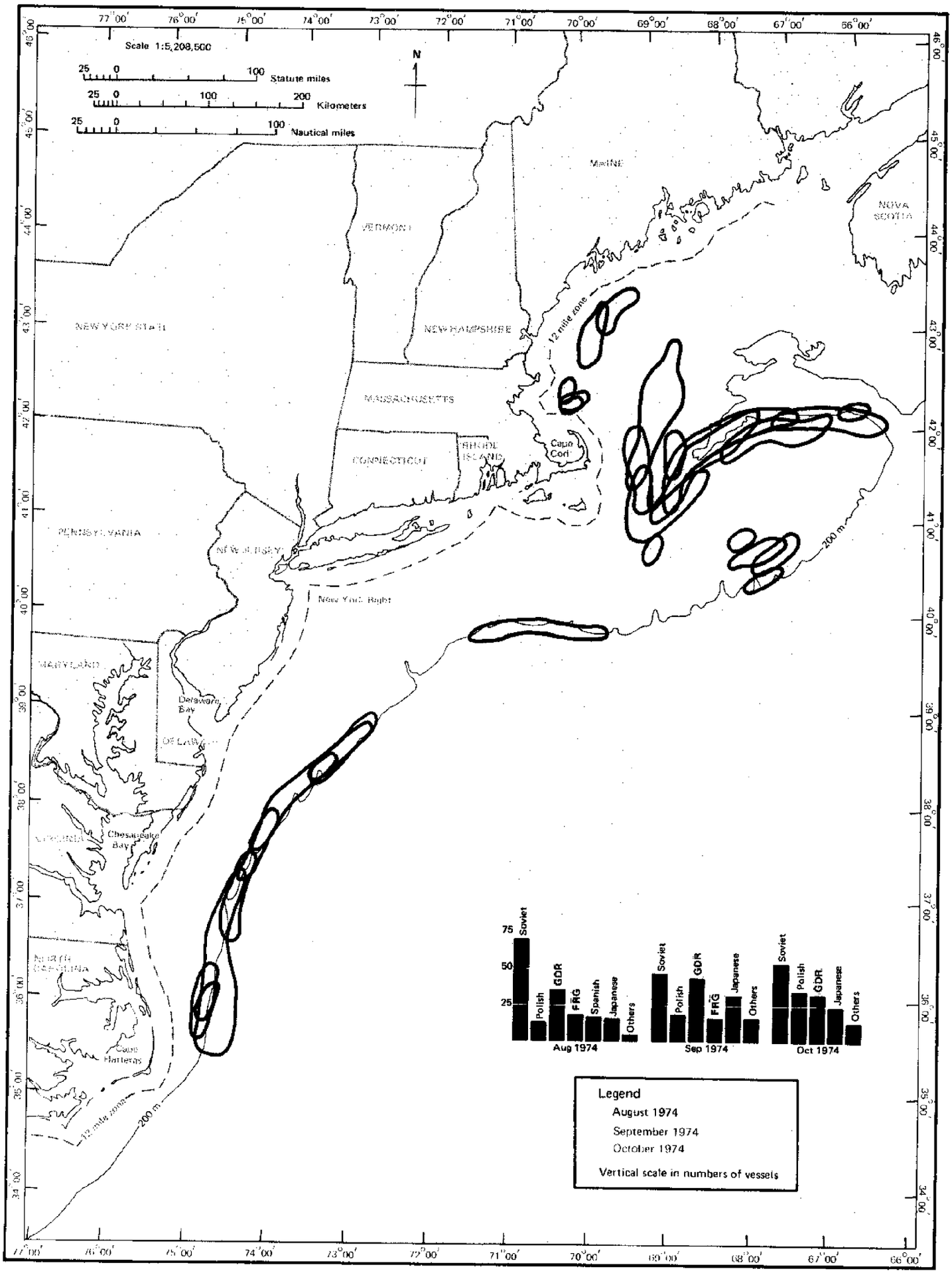
Lambert Conformal Conic Projection

Map 20. Foreign fleets, Northwest Atlantic, May 1974 to Jul 1974

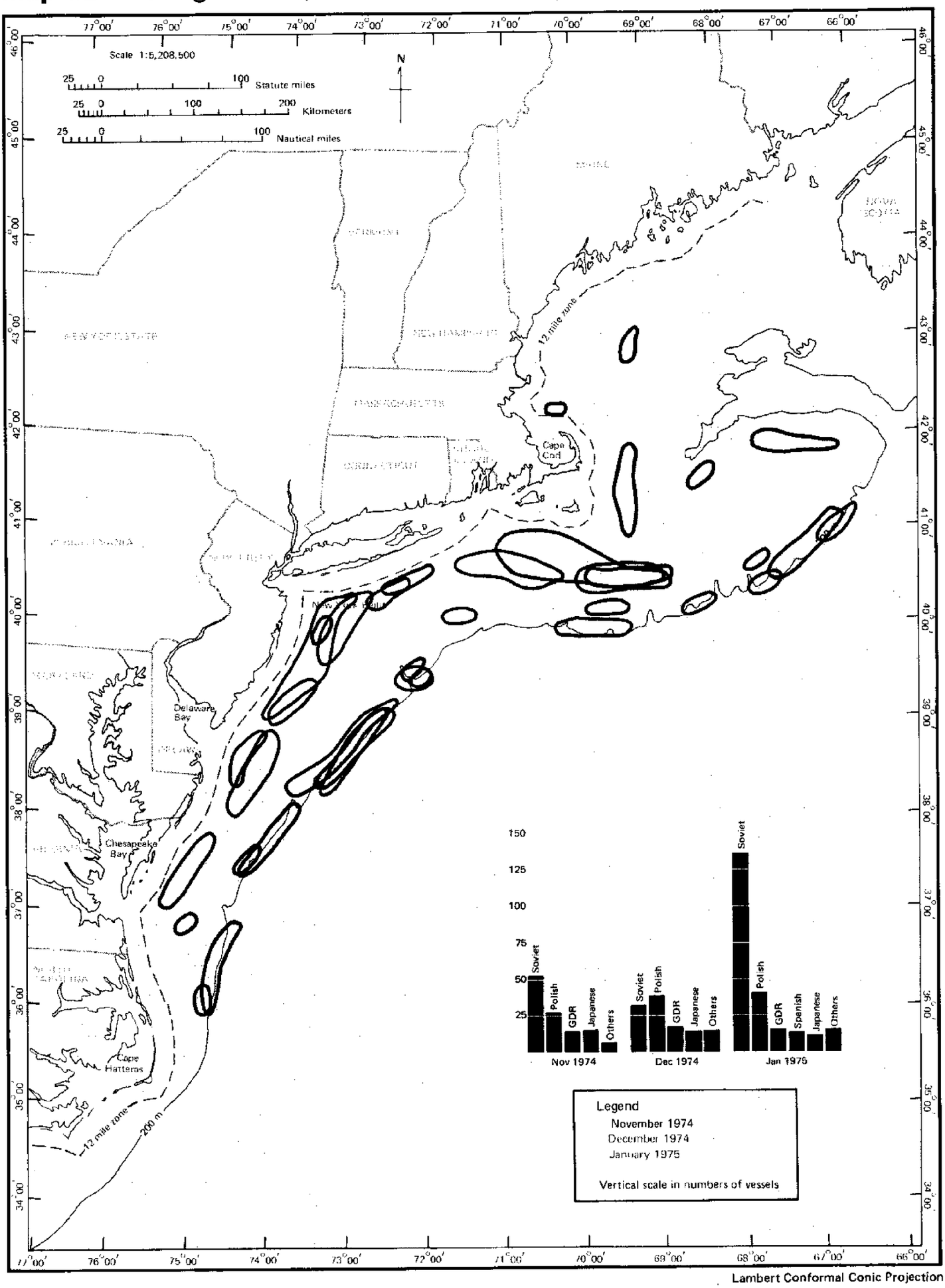


Lambert Conformal Conic Projection

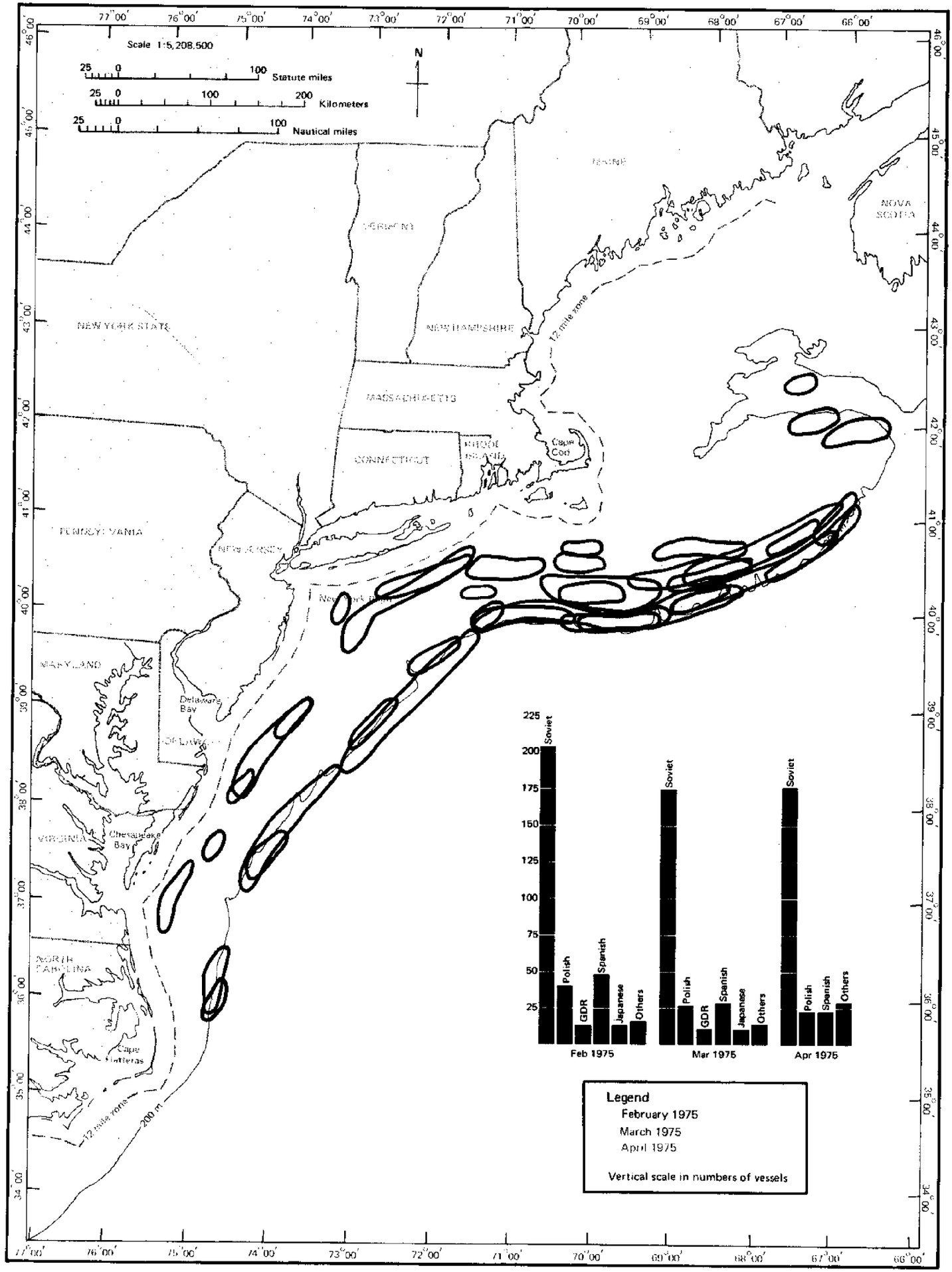
Map 21. Foreign fleets, Northwest Atlantic, Aug 1974 to Oct 1974



Map 22. Foreign fleets, Northwest Atlantic, Nov 1974 to Jan 1975

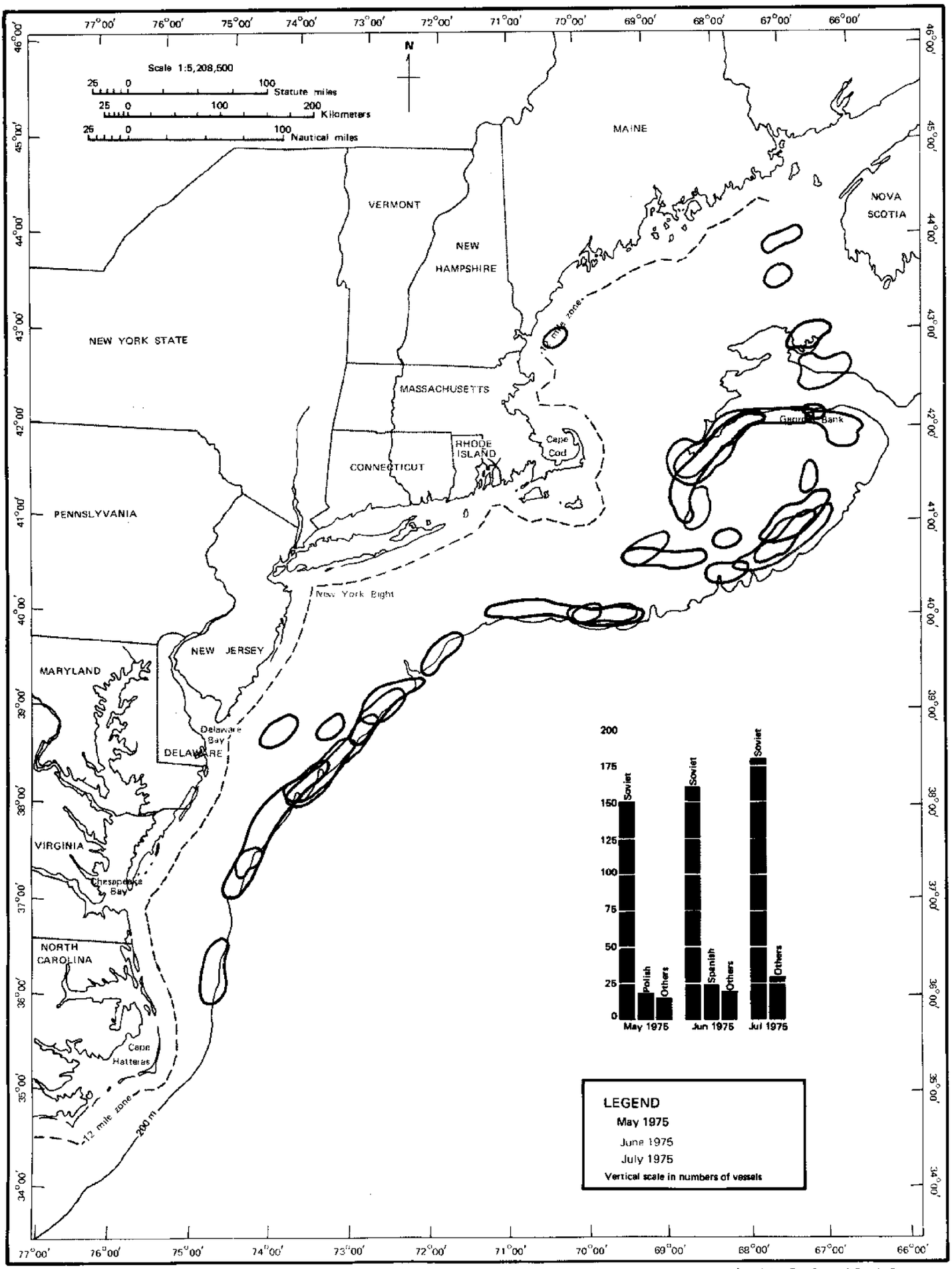


Map 23. Foreign fleets, Northwest Atlantic, Feb 1975 to Apr 1975



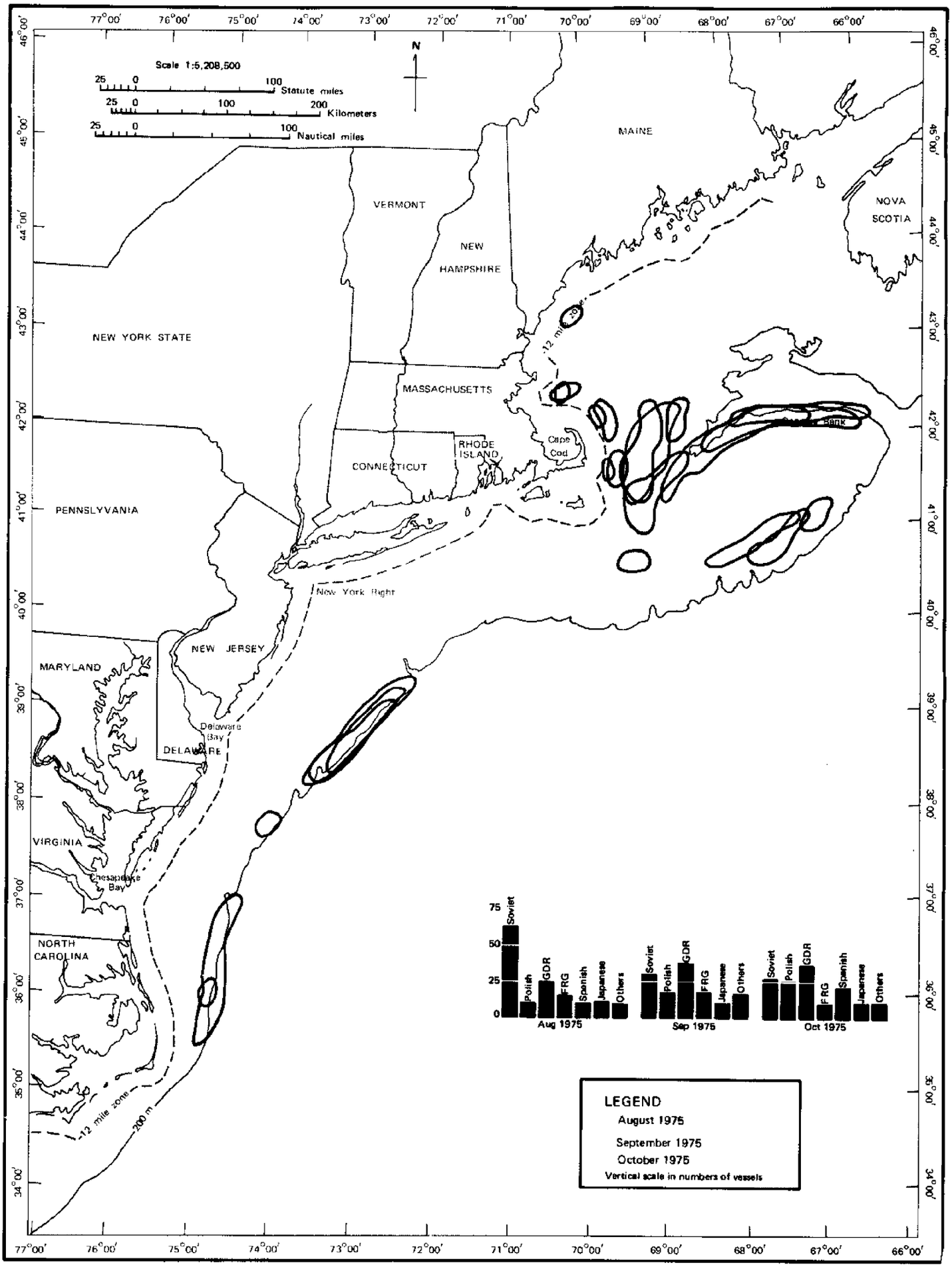
Lambert Conformal Conic Projection

Map 24. Foreign fleets, Northwest Atlantic, May 1975 to Jul 1975

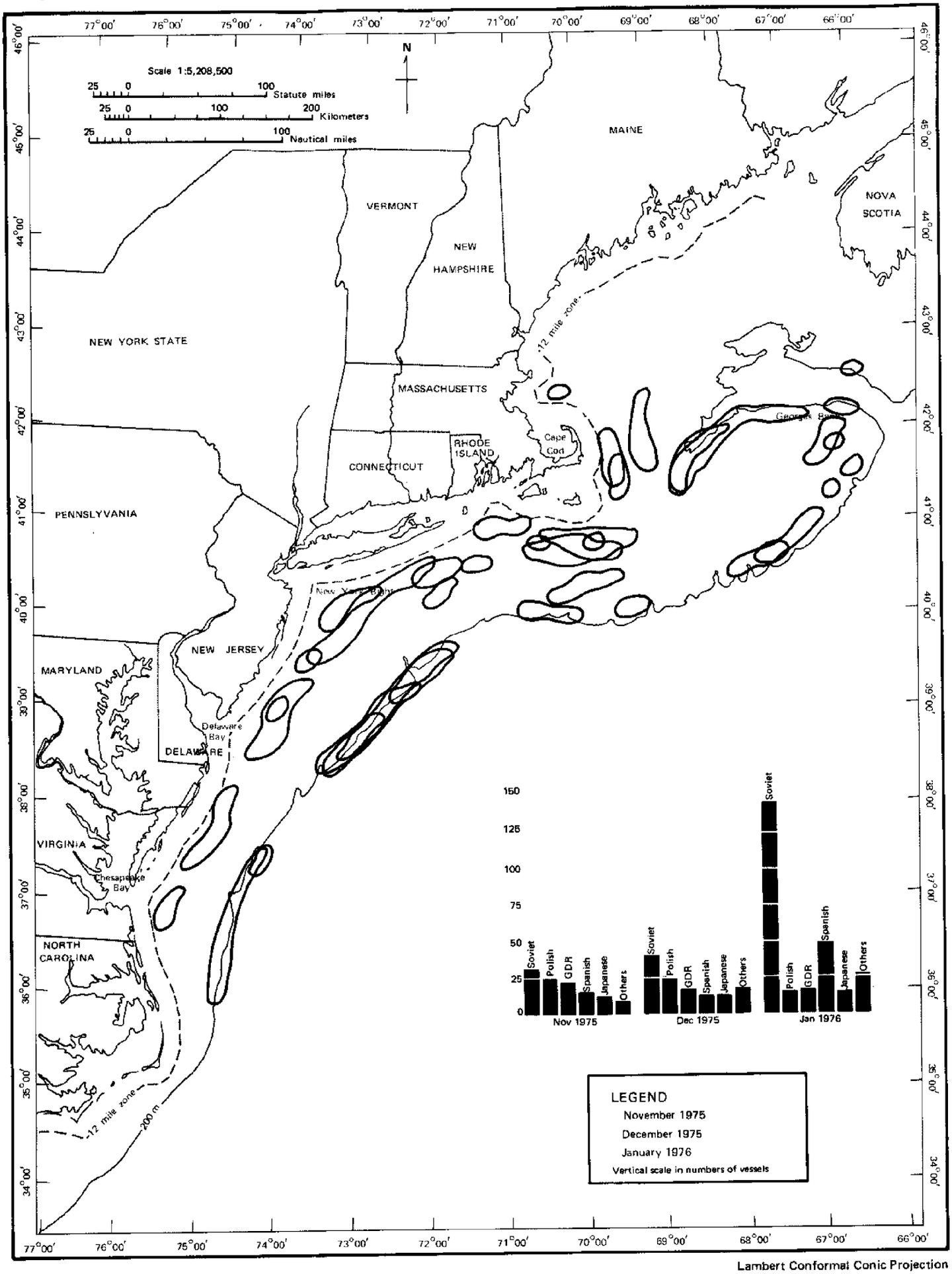


Lambert Conformal Conic Projection

Map 25. Foreign fleets, Northwest Atlantic, Aug 1975 to Oct 1975

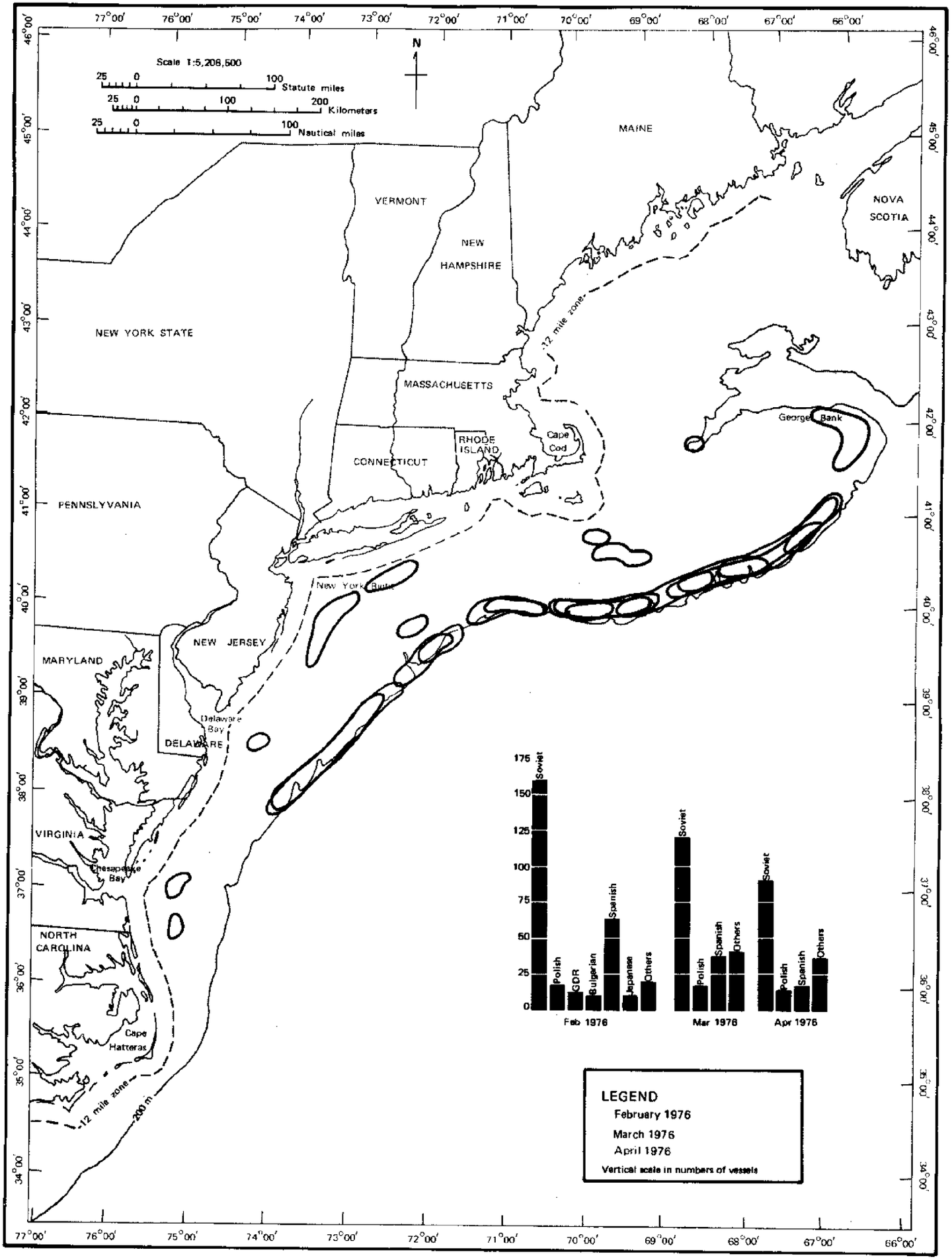


Map 26. Foreign fleets, Northwest Atlantic, Nov 1975 to Jan 1976

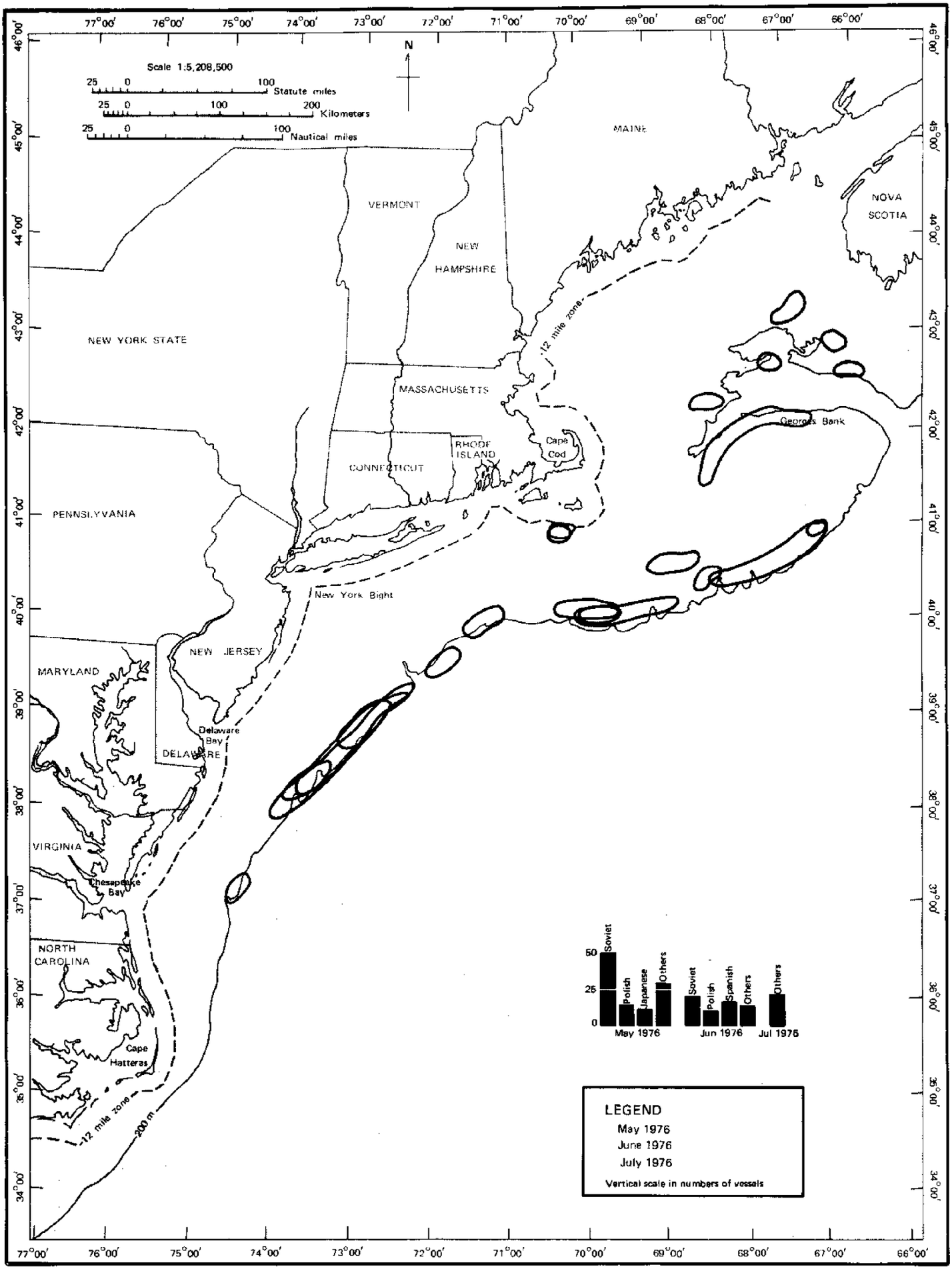


Lambert Conformal Conic Projection

Map 27. Foreign fleets, Northwest Atlantic, Feb 1976 to Apr 1976

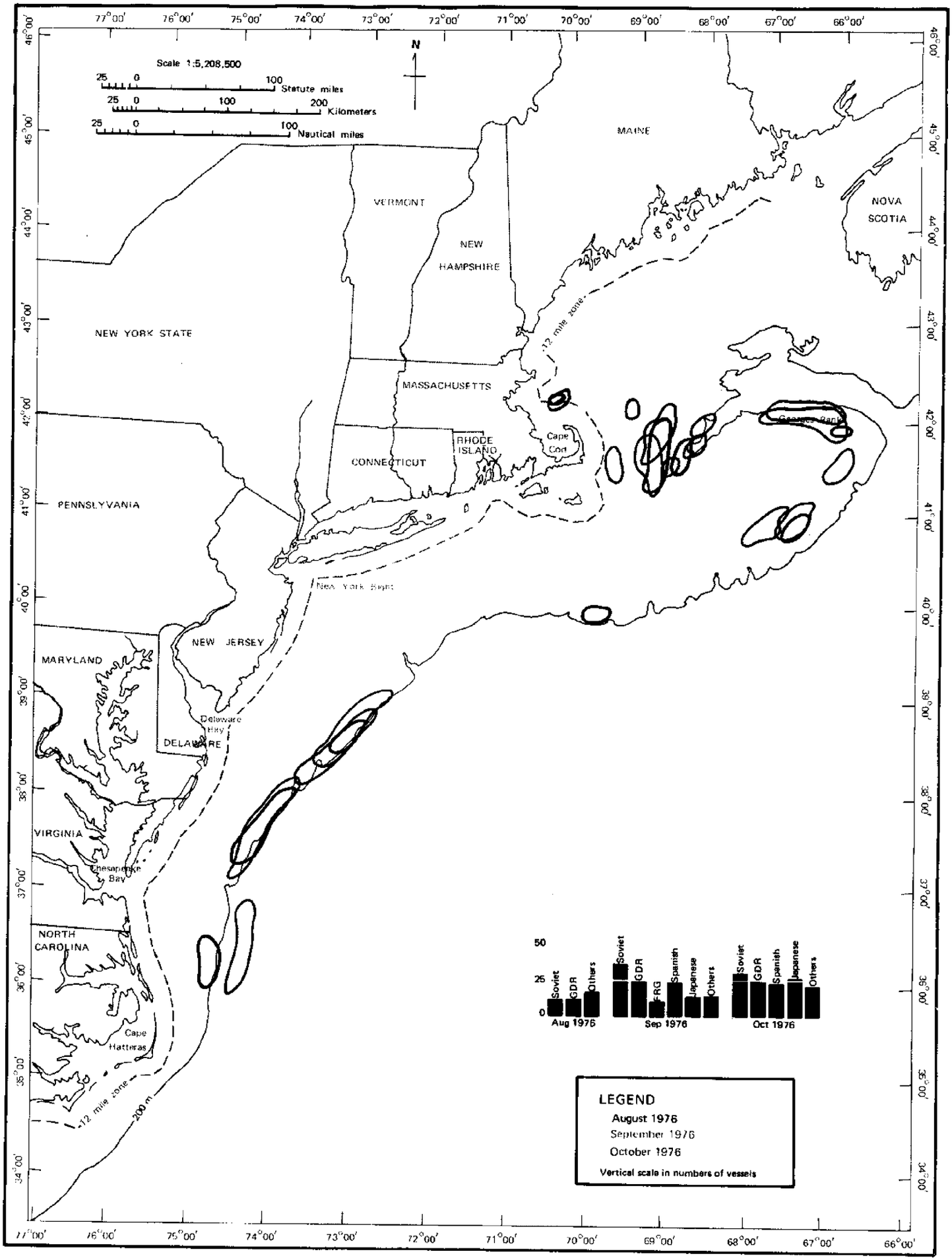


Map 28. Foreign fleets, Northwest Atlantic, May 1976 to Jul 1976

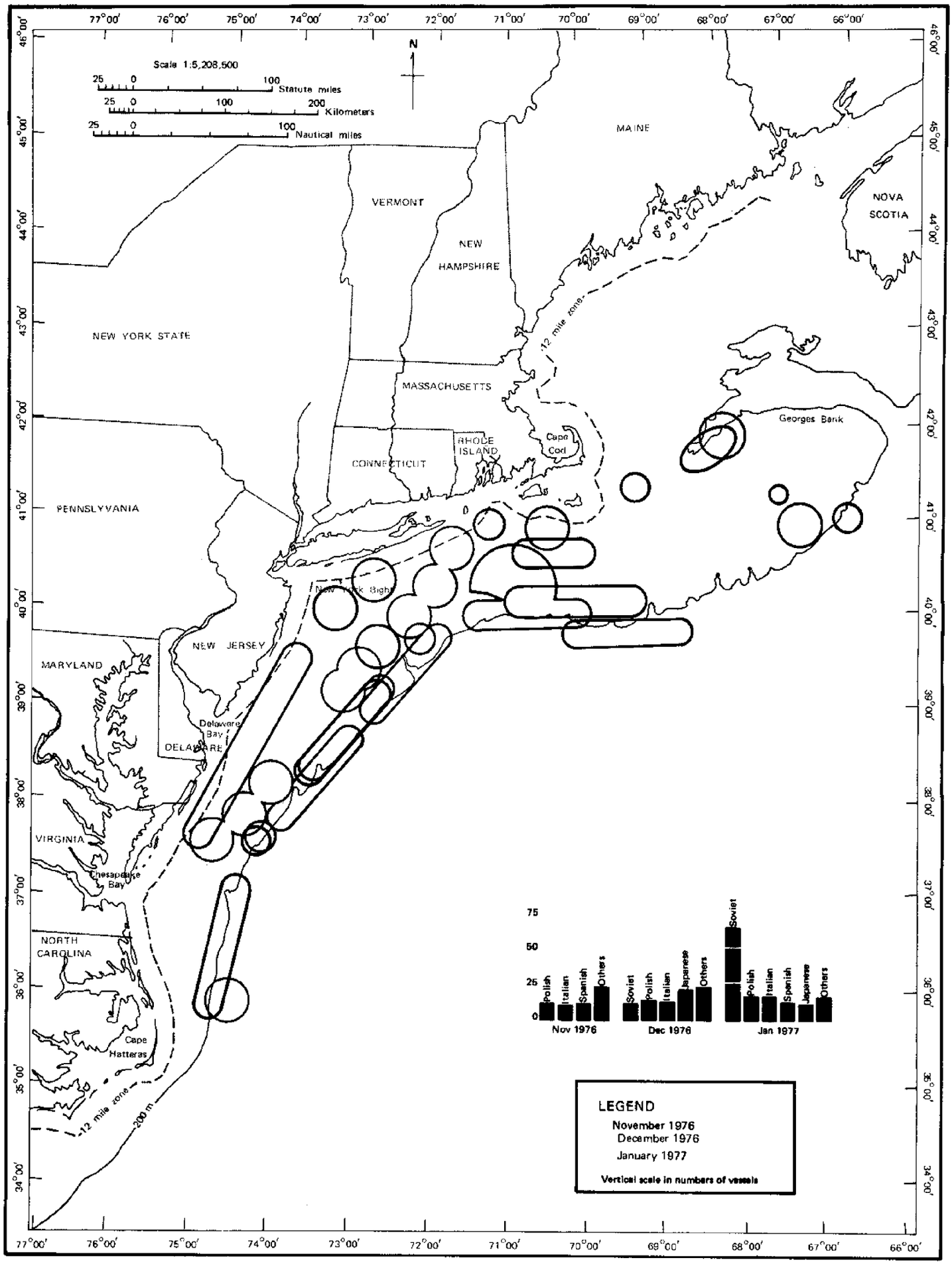


Lambert Conformal Conic Projection

Map 29. Foreign fleets, Northwest Atlantic, Aug 1976 to Oct 1976



Map 30. Foreign fleets, Northwest Atlantic, Nov 1976 to Jan 1977



Lambert Conformal Conic Projection

Table 3. Vessels observed, monthly averages, August 1969 through January 1977

	Number of Vessels	Percent of Total Foreign Fishing
SOVIET UNION		
January	106	53.82
February	155	58.64
March	170	62.12
April	179	67.95
May	154	71.59
June	116	65.77
July	98	62.87
August	93	45.91
September	90	37.03
October	82	36.41
November	70	48.16
December	63	45.11
POLAND		
January	29	16.03
February	38	15.00
March	39	14.02
April	35	12.81
May	29	13.54
June	20	12.33
July	12	10.05
August	26	12.71
September	39	16.11
October	41	19.03
November	28	20.58
December	25	18.52
GERMAN DEMOCRATIC REPUBLIC		
January	13	6.31
February	14	5.66
March	16	5.09
April	14	5.32
May	9	3.88
June	8	4.70
July	6	4.04
August	26	16.83
September	41	19.86
October	37	18.36
November	12	8.49
December	16	10.95
SPAIN		
January	20	8.86
February	31	10.64
March	25	9.37
April	14	5.98
May	5	2.83
June	13	9.97
July	4	4.40
August	11	6.69
September	15	7.29
October	16	8.58
November	9	7.00
December	8	5.84
JAPAN		
January	13	7.84
February	12	5.12
March	9	3.16
April	5	2.17
May	3	2.49
June	3	2.80
July	4	5.82
August	7	4.42
September	13	7.03
October	14	8.06
November	7	6.34
December	10	8.08

Source: National Marine Fisheries Service

extended their season and were counted in every monthly surveillance report. Like the Spanish, the Japanese fishery increased to a peak in 1974 when it averaged 14 vessels per month but decreased slightly in 1975 and 1976. The most notable increase in the fleet's proportion of the total effort occurred from August to December 1974 when the Japanese accounted for 12% to 18% of the total fleet. A 4% to 6% average year-round presence in the foreign fishery is more typical of the Japanese, however. In late 1975 and 1976, the Japanese began a long-line tuna fishery throughout the Middle Atlantic and New York Bight areas. Up to three vessels were seen fishing tuna from October 1975 through January 1976. Japanese tuna fishing was noted again in August, October, and December 1976, with as many as 12 vessels in October. This fishery accounts for the only vessels observed seaward of the continental shelf.

The Federal Republic of Germany (FRG) was consistently part of the foreign fleet from July through October for the period of record but was absent at other times. FRG vessels were reported occasionally from January through June but never more than four vessels for one month. In autumn, the FRG fleet averaged 16 vessels per month for the period of record, or about 8% of the total fleet that season. From 1969 to 1976, the average number of FRG vessels per month for autumn declined from 27 to 8.

Italy is a good example of a new European entrant to the modern foreign fishing fleet. Italy began with occasional exploratory fishing and later sent a year-round fleet. One Italian vessel was observed each month in February, March, April, and December 1971, and January and February 1972, fishing among Spanish and Japanese vessels in the New York Bight area. During December 1972, five Italian vessels arrived and fished through April 1973. Since October 1973 at least one Italian vessel has appeared in the foreign fleet each month, except for August 1975 and 1976. Largest numbers of Italian vessels were usually observed from November through March, although the trend each year since 1973 was to extend the season and increase the fleet size. In 1976, the Italian fishery averaged five vessels per month—ranging from none in August to 12 in December. The greatest number of Italian vessels seen in one month was 16 in January 1977, or about 12% of the foreign fleet that month. The principal catch of the Italian fishery was squid taken from the edge of the continental shelf throughout the Middle Atlantic Bight.

Bulgaria and **Romania** increased their fishing effort during the period of record and tended to concentrate their effort in winter and early spring. Up to three Bulgarian vessels were present from February through June 1970. From February 1971 through July 1973, 2 to 10 Bulgarian vessels were observed every month. In 1972, the peak year of Bulgarian fishing activity, the average was six vessels per month. Since then, annual Bulgarian fishing effort decreased; they did no fishing in summer and autumn. The Bulgarians gradually left the fishery earlier in spring and arrived later in autumn every year after 1973. Their effort December through April, 1971 through 1976, was consistent, averaging between 2% and 3% of the total fleet.

The Romanian fishing fleet was considerably smaller than the Bulgarian fleet and never amounted to more than six vessels in one month. Romanian vessels were never observed in the foreign fleet longer than nine consecutive months. The fleet fished mostly in late summer 1970 through 1972. In 1971, the Romanians began a steady trend of fishing earlier in the spring until 1974 when the first Romanian vessels appeared in January. In 1975, they were virtually absent from the fleet, just two vessels observed in August, September, and October. By 1976, the Romanians were back in the early spring fishery with an average of four vessels per month, January through April.

Cuba first joined the foreign fishing fleet off the US northeast coast in July 1975. One Cuban vessel was seen in May 1969 and again in summer 1972. From July 1975 through May 1976, the Cuban fishery increased from three to nine vessels each month. Cuban fishermen were apparently coached by Soviet fishermen. An NMFS on-board inspection found that one Cuban vessel's captain and nine other key crew members were Soviet citizens. Moreover, the Cuban fleet consistently operated among Soviet vessels, primarily on Georges Bank, fishing herring, hake, and mackerel. Cuba did not return to the foreign fishery in summer and late autumn 1976, but in January 1977, four Cuban vessels were seen. From July 1975 through May 1976, Cuban vessels averaged about 3% of the total foreign fleet per month.

South Korean fishing vessels did not enter the foreign fishery off the US east coast prior to 1975. In November 1975, one South Korean vessel was seen fishing for squid in the Middle Atlantic off New Jersey and Delaware. A second vessel joined the fishery in December and both were active until February 1976. The Koreans returned to the fishery in May 1976, and except for September, had a fleet of one to four vessels fishing through January 1977. The Korean catch was primarily squid and some mackerel.

Other nations participating in the foreign fishery averaged 0.15% per month or less of the total foreign fleet over the period of record (Table 2). Usually these nations were represented by one to three vessels for short times.

The first Irish vessel was reported in January 1973 fishing south of Rhode Island. Irish vessels were not seen again until October 1974. From then until August 1975, a single Irish vessel was observed each month fishing squid. NMFS agents found the Irish vessel fishing for Japanese interests with a mostly Japanese crew. Since Ireland was not party to international agreements regulating the squid harvest like Japan, the total Japanese catch could be increased without restriction. The Irish vessel continued to fish for five months in early 1976 and was seen again in 1977.

French vessels were seen first in September 1972. Since then, French fishing was limited to one to three vessels, usually in late summer and autumn. Herring was reported as their primary catch.

One or two Greek fishing vessels occasionally were observed April through October, 1970 through 1976. No Greek vessels were seen in 1975; 1976 reports included one vessel in June and one in September. Catches were mostly squid, but in June 1976 US officials seized the Greek vessel *Atlanticos II* with 16 kg (35 lb) of American lobsters on board.

Icelandic vessels appeared in the study period only during August, September, and October 1969. Six Icelandic vessels operating out of Gloucester, MA, were observed each month fishing for herring.

Several Norwegian vessels were seen during August, September, and October 1969, and one vessel each in September and November 1970. Norwegian vessels were not seen again until March 1971 and March 1972, with one and two vessels respectively.

Vessels from the Faeroe Islands (Denmark) were observed in April or May 1971, 1972, 1975, and 1976.

British vessels were reported only in one month of the study period, September 1974, but included six stern trawlers. This was the first sighting of British vessels fishing off the US northeast coast since the mid-1960s.

Nigeria was the latest entrant in the foreign fishery, represented by one vessel in December 1976 and January 1977. The single Nigerian vessel was seen fishing for squid and butterfish among the Japanese, Italian, and Spanish fleets in the New York Bight area.

Two vessels each from Mexico and Venezuela were reported in April 1973 fishing on the eastern end of Georges Bank, but were not seen again in the study period.

One Israeli fishing vessel was reported in August 1969 fishing among German vessels north of Cape Cod.

The distribution and national composition of the foreign distant-water fishing fleet appear to have had definite characteristics and trends. Foreign fishing vessel distribution was directly related to the distribution of species harvested, and was entirely within the limits of the continental shelf and slope, except for the Japanese tuna fishery. Fluctuations in vessel number and location are the result of seasonal migrations and abundance of certain species. The data also show a steady decline in total numbers of foreign fishing vessels—mostly Soviet Union vessels—between 1972 and 1976, in spite of the entry of several new countries to the foreign fleet. The average number of Soviet vessels reported each month decreased about 63% from 1972 through 1976. Similar decreases were noted in the fleets of Poland, GDR, FRG, Bulgaria, and Romania. Increases were noted in the fleets of Spain, Italy, Japan, Cuba, and South Korea, but were not large enough to offset the decreases. The change in national composition of the foreign fishery reflects changes in species abundance and a fishing effort shift from heavily fished species such as herring and hake to less heavily fished pelagic species such as squid and butterfish. Ironically perhaps, the most successful recent US fisheries have been for pelagic species—tuna and shrimp—in distant waters off coasts of other countries.

Regulation of International Fisheries

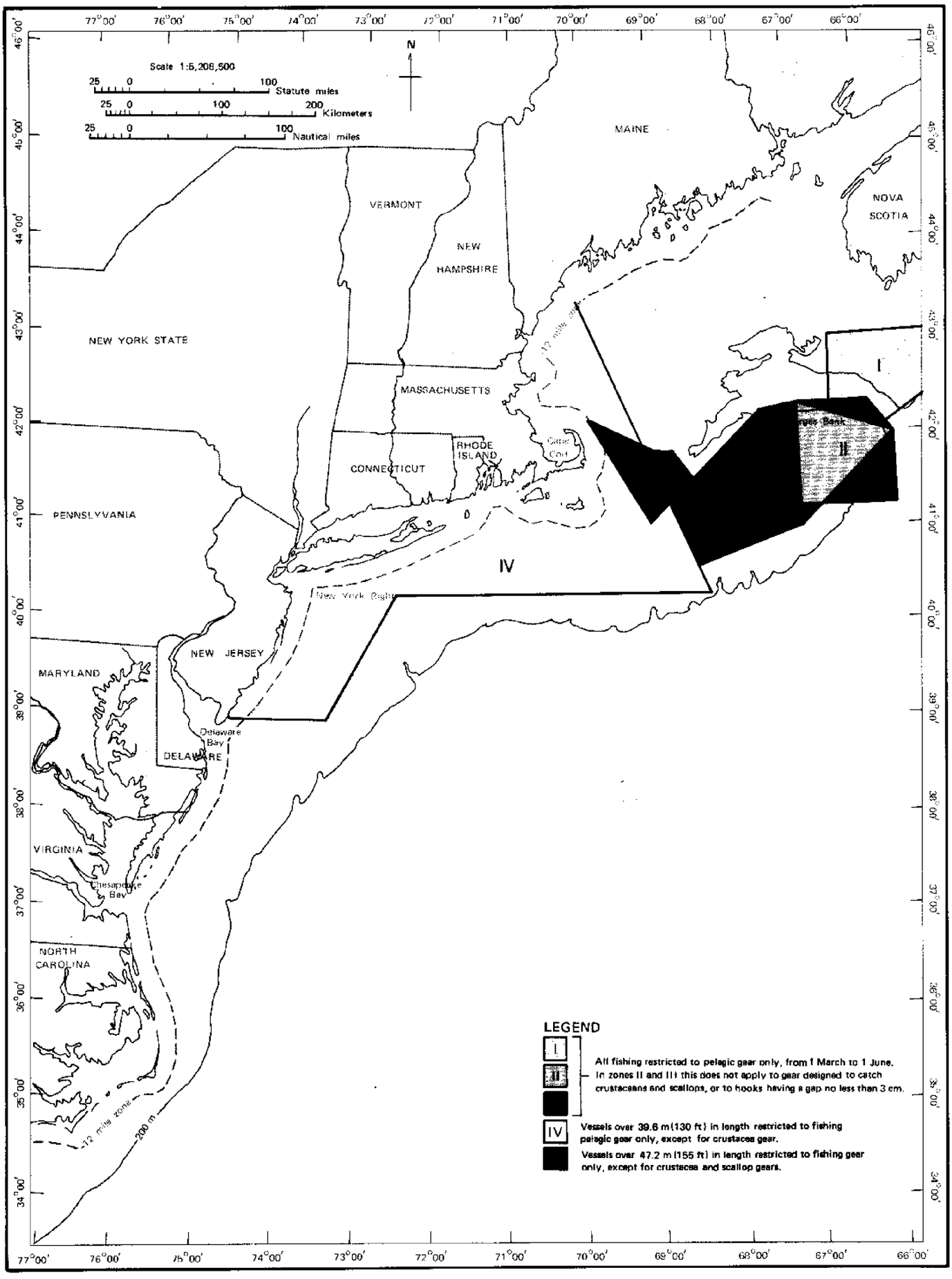
Prior to the twentieth century, fishery stocks were apparently abundant enough for all who could survive the hunt and return to market with a decent catch. Thus, fishery resources on the high seas, outside the territorial claims of any sovereign state, were considered common property—open to fishermen from all nations. Now it is obvious that uncontrolled harvesting of a finite resource, even if it has the natural ability to reproduce itself, eventually results in economic hardship for the harvesting industry, in an unreliable food supply, and in possible ecological dislocation of the resource (Christy and Scott 1965; Hardin 1968).

ICNAF. Developments in fishing technology around the turn of the century, primarily introduction of the otter trawl, increased harvesting efficiency and the likelihood of overfishing. Unlike previous methods, the large otter trawl nets indiscriminately capture fishes of various sizes and species; unmarketable fishes are discarded (Jensen 1967). This unintentional *incidental catch* or *by-catch* has widely affected fishery resources. By the late 1940s, nations operating Northwest Atlantic fisheries generally recognized that international regulation was needed. On 8 February 1949, representatives of 10 nations signed an agreement to establish the International Commission for the Northwest Atlantic Fisheries or ICNAF (Koers 1973; Williams 1975). The original 10 members—Canada, Denmark, France, Iceland, Italy, Norway, Portugal, Spain, the United Kingdom, and the United States—were later joined by the Federal Republic of Germany (FRG), Japan, Poland, Romania, and the Soviet Union.

The two primary functions of ICNAF were to obtain and collate necessary scientific information on the abundance of fish stocks and then, based on these data, recommend regulations to sustain a maximum yield for the fisheries (Koers 1973). Member nations supplied catch data from ICNAF areas and subareas and were expected to enforce ICNAF regulations. Independent enforcement authority was built into the ICNAF agreement as well as a provision that individual members were not bound by any regulation they chose not to accept.

In spite of these shortcomings, ICNAF served a useful purpose with steadily increasing effectiveness beginning in the early 1970s. On 15 December 1971, ICNAF was given power to deal with problems of allocation (Koers 1973). Under this authority,

Map 31. ICNAF conservation areas, 1976



Lambert Conformal Conic Projection

ICNAF adopted a national quota system for overfished species and stocks. Quotas were set for incidental catches as well as directed catches. For example, in 1975 the aggregate catch of haddock was not to exceed 6,000 metric tons (13.2 million lb) from Subarea 5 and incidental catches of haddock for specific countries in this subarea ranged from 50 metric tons (110,250 lb) to over 4,000 metric tons (8.8 million lb), with preference given to US and Canadian fishermen. Special conservation areas for groundfish or demersal species also were established (Map 31). These were designed to prohibit fishing with gear capable of catching demersal species in specified areas during certain seasons with certain size vessels.

Special conservation areas usually were renegotiated annually. The ICNAF system of areas and subareas also proved to be a valuable management tool in reporting catch statistics. Reports from the foreign fisheries, for example, in Subarea 6A—New York Bight—have given the United States a better understanding of the full potential of its continental shelf living resources.

Bilateral Agreements. In additon to the ICNAF agreement, the United States has had several bilateral fishery agreements for the Middle Atlantic region with the Soviet Union, Poland, and Romania. These were designed to reduce fishing effort of these countries for species valuable to US fishermen. The agreements covered areas from south of Long Island to south and east of Cape Hatteras. Controls on foreign fishing under these bilateral arrangements included limitations on specialized fisheries—for example, scup, bluefish, flounders, and menhaden. Other limitations included specified seasons, geographic areas, size of vessels, type of fishing gear, and incidental catches. In return, the United States imposed certain restrictions on US fisheries, allowed foreign fishing vessel entry to certain US ports, and permitted loading and some fishing in small areas close to Long Island and New Jersey shores at specified times. The Coast Guard and NMFS agents were responsible for monitoring compliance with bilateral and ICNAF provisions, but foreign violations of treaties were to be handled by the flag nation. Technically, nothing could be done to enforce conservation standards on high seas fishing for nations not party to the agreements.

Although the multilateral ICNAF and bilateral agreements were extensively negotiated and amended periodically to meet conservation requirements, northeastern US fishermen and fishery biologists recognized deficiencies in these management arrangements. Basically, the international agreements were unable to: 1) deal with increasing numbers of entrants to the foreign fisheries, 2) assure full compliance with agreements, 3) include social and economic considerations, 4) make timely management decisions, or 5) resolve major issues among user groups (Wallace 1976). Public sentiment against the foreign fisheries, more than any reasoned scientific approach, grew on the basis that foreigners were primarily responsible for the decline in US offshore fisheries (Boeri and Gibson 1976).

By 1975, unilateral control over all living marine resources within 200 nmi of the US coast was perceived to be the answer to the problem of regulating international fisheries. Although this was considered a radical step for the United States—a country that ardently defended the concept of free, high seas fishing—many nations had already made similar claims and there was a world-wide trend toward extended national sovereignty over coastal resources (Pabst 1976). Moreover, coastal countries began to realize that unilateral jurisdiction over fisheries could allow access by other countries under treaty and could promote conservation, maximum utilization, equitable allocation, and economic efficiency (Barrie 1975). US fishermen from the Northeast and the Northwest applied pressure to their legislators not to wait for an international agreement on preferential fishing rights, however, and on 13 April 1976 the US Congress passed the Fishery Conservation and Management Act (PL 94-265).

The Fishery Conservation and Management Act, put into force 1 March 1977, established a 197 nmi wide zone, contiguous to the 3 nmi wide territorial sea, in which the United States exercises exclusive jurisdiction over all marine fishery resources. The act also claims exclusive jurisdiction over all anadromous species derived from US waters and continental shelf fishery resources (for example, lobster, crab, clam) extending beyond 200 nmi from the US coast, except if they are within the recognized jurisdiction of another country. Previous unilateral claims to marine resources had been made by the United States for

jurisdiction of the continental shelf under the 1945 Truman Proclamation (Padelford 1970) and fisheries within a contiguous zone extending 9 nmi beyond the territorial sea (this 9 nmi contiguous fishery zone was repealed by the 1976 act). The 1976 act provides more comprehensive authority for conservation of living marine resources than the United States has ever had.

Foreign fisheries are permitted to operate if US fishermen are not able to take and market the total allowable catch within the zone. Countries and owners must sign a governing international fishery agreement or GIFA (not a treaty) by which they recognize US authority over fisheries in the conservation zone and agree to abide by US regulations. Each foreign fishing vessel must have a fishing permit. Purchased permits are valid for one year and include specific conditions and restrictions on fishing activities within the zone. The act directs the Secretary of State to renegotiate all previously existing treaties pertaining to any fishery resource covered by the act, such as ICNAF and the bilaterals, and to conform them to the purposes and provisions of the act. The United States may withdraw from any treaty that does not conform. Hence, the United States withdrew from ICNAF January 1977; the bilateral agreements were superseded by GIFAs.

Enforcement of provisions of the new act is specifically charged to the Coast Guard and the Secretary of Commerce (carried out by NMFS agents) with assistance from other federal or state agencies. Enforcement officers are authorized to board and inspect any fishing vessel subject to the act's provisions and to seize vessels, gear, and fish found in violation.

In New York Bight, Middle Atlantic Bight, and off New England, all previous foreign fisheries are within this jurisdiction (Map 31). The only exception is the Japanese fishery for tuna, which is exempt because tuna is a "highly migratory species," regulated under the provisions of the International Commission for the Conservation of Atlantic Tunas.

Responsibility to manage the fishery resources wisely is an explicit requirement under the act. Prior to 1 March 1977, responsibility to manage marine fisheries within the 3 nmi territorial sea was a function of the individual states. The act did not diminish this responsibility. In fact, it implicitly encourages the states to do better. State fishery management had not worked well in New York Bight, as in most other coastal areas of the United States, because parochial interests, lack of adequate funds and facilities, inadequate scientific knowledge of the stocks, and absence of effective management plans (Ginter 1974) prevented it. The act establishes for the first time a joint, federal-state management mechanism; eight regional management councils were created nationwide to prepare and revise, as necessary, management plans for fisheries operating in the conservation zone. For New York Bight fisheries, plans are devised by the Mid-Atlantic Council, which has jurisdiction from New York through Virginia. As shown by past foreign fishery distributions, some species and stocks represent interregional problems requiring cooperative decision-making with the other councils. Council members represent federal and state interests and include individuals with experience in conservation, government, and recreational and commercial fisheries.

The act requires fishery management planning to prevent overfishing while achieving optimum yield* for each fishery, based on the best scientific information available. Plans are also required to allocate fishery resources equitably among US fishermen from different states and allow for natural fluctuations and contingencies. The optimum yield of a fishery resource is one of the most important determinations made by the regional councils. Since the primary purpose of the act is to give preferential fishing rights to US fishermen while properly conserving the resource, the difference between the amount of fish harvestable by US fishermen and the optimum yield is the amount available to foreign fishermen, or the surplus. Allocation of surplus resources among other nations is determined by the Secretaries of State and Commerce on recommendations by the councils.

Fishery management plans and proposed regulations are submitted to the Secretary of Commerce for review and approval. If a plan is disapproved, the council may revise it or the secretary may prepare one independently. Although devising management plans is a basic responsibility of the councils, implementation of the plans is a federal responsibility through the Secretary of Commerce. Public review of approved plans is mandatory before regulations are put into effect. If this democratic process takes too long to deal with acute fishery problems, the Secretary of Commerce is authorized to publish emergency regulations lasting no longer than 90 days.

In addition to the decision-making process, fishery management would not be effective without adequate scientific information on which to base decisions and enforcement of the resulting regula-

*Defined as including economic, social, and ecological factors relevant to the potential biological production of the resources.

tions. The act specifically requires fishery resource conservation and management to be based on the best scientific information available. The Secretary of Commerce is directed to maintain a comprehensive fishery research program for this purpose. Independent research by the councils may be considered an appropriate and necessary activity. Enforcement and adjudication are provided for by requiring all fishermen to obey published regulations and by assessing civil and criminal penalties for violations.

Several aspects of fishery management are not influenced by the act. First, state jurisdiction over marine fisheries is not extended or diminished, except that the federal government may regulate a fishery within a state boundary if the state's action or inaction substantially and adversely affects implementation of a fishery management plan. State jurisdiction over marine fisheries extends to the 3 nmi limit of the territorial sea. Fish caught beyond this limit may also be subject to state landing regulations. Second, except for fisheries, the extent of the territorial sea or other ocean jurisdiction of the United States remains unaffected. This policy is significantly different from that of other countries, such as Brazil, Ecuador, and Peru, which claim a territorial sea jurisdiction of 200 nmi (Walz 1976). Finally, the act is not intended to discourage US efforts to obtain an internationally acceptable treaty in the United Nations Conference on the Law of the Sea. A provision is included for amending the act to conform to any Law of the Sea treaty to which the United States may become party.

Summary

The foreign, distant-water fisheries in the Northwest Atlantic evolved from unregulated cod fishing into efficient, regulated, multispecies fisheries. For over 400 years, the Northwest Atlantic has been an important food source for distant countries. Beginning off Canadian shores, unregulated harvesting led fishermen on a continuing search for virgin or underutilized fish stocks. The British began the southern expansion of distant-water fisheries in 1603 when they started cod fishing on Georges Bank. The most notable development, however, was the rapid expansion of Soviet Union fisheries from their inception off Canada in the mid-1950s to their dominance in the Middle Atlantic region in less than 10 years. Other nations followed the Soviet lead, either by expanding traditional fisheries southward or by starting distant-water operations for the first time in the Georges Bank and Middle Atlantic areas.

From August 1969 through January 1977, the seasonal pattern of fleet movement was northward in summer and autumn and southward in late winter and spring, reflecting seasonal migrations of herring, mackerel, and hakes. Fisheries for squid and butterfish developed in later years, mitigating pronounced seasonal fluctuations in vessel distribution. Most foreign fishing vessels were present in early spring, and numbers of vessels gradually decreased in summer. A secondary maximum in early autumn was followed by an annual minimum in early winter. Over the period of record, the greatest number of vessels was reported in 1972, but annual averages declined to the smallest numbers in 1976. All foreign fisheries, except for the Japanese tuna fishery, are limited to the continental shelf and slope by the species they seek.

Soviet dominance of the foreign fisheries declined substantially in the mid-1970s—to about 63% from 1972 through 1976. Similar decreases in the fleets of Poland, GDR, FRG, Bulgaria, and Romania were offset slightly by increases in vessels from Spain,

Italy, Japan, Cuba, and South Korea. This overall decline and shift reflects fleet diversification to previously underutilized species such as squid, a decrease in fish abundance (Grosslein, in press), and greater controls imposed by international agreements.

Prior to 1950, marine fishery management in the Middle Atlantic region was a matter of coastal state jurisdiction within the 3 nmi US territorial sea. Except for state landing regulations, offshore fisheries beyond territorial sea limits operated according to the open-to-all advantages of common property resources. Responding to the problem of uncontrolled and expanding fisheries, an international convention established a scientific and regulation recommending body, ICNAF, in 1950. Bilateral agreements with the Soviet Union, Poland, and Romania sought further control of the special resource management problems these foreign fisheries brought to the Middle Atlantic region. International arrangements were judged inadequate, however, and in 1976 the Fishery Conservation and Management Act proclaimed exclusive US jurisdiction over living marine resources in a conservation zone extending 197 nmi from territorial sea limits. Past domestic management of fishery resources was less effective than international approaches (McHugh 1972, 1974); the 1976 act introduced a new morality to management of offshore fishery resources. Comprehensive authorities are given for the first time to deal with allocation, scientific, and enforcement needs of effective management. Foreign fisheries are permitted to harvest stocks surplus to US fishing capabilities. Theoretically, US fisheries can be developed to harvest the total allowable catch of all species, the United States could become a seafood exporter again. Under the 1976 act, the United States takes on a new optimism for living marine resource development and a new responsibility to manage marine resources wisely.

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