



Serial No.1998
(D.a.67)

ICNAF Res.Doc.68/17

ANNUAL MEETING - JUNE 1968

United States Research Report, 1967

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The United States landed fish from Statistical Subareas 3, 4, 5, and 6 and conducted research in these subareas as well.

Subarea 3

A. Status of the Fisheries

I. Redfish

Redfish landings by the United States from Subarea 3 came from Divisions 3N and P (Table 3.1). Because of reduced fishing effort, landings per day fished may not be indicative of true abundance trends.

Table 3.1 US redfish statistics, Subarea 3 (metric tons, round fresh).

<u>Year</u>	<u>Landings</u>	<u>Days Fished</u>	<u>Landings/Day Fished</u>
1962	14,257	932	15.3
1963	12,089	882	13.7
1964	4,692	364	12.7
1965	772	51	15.0
1966	346	38	9.1
1967	150	16	9.3

B. Special Research Studies

I. Environmental Studies

The United States Coast Guard Oceanographic Unit carried out the expanded program initiated in 1966. One of the important problems being investigated is the short term variability of the Labrador Current. The standard sections 1 to 6 were occupied as during 1966. The Ocean Station Program concerning stations Bravo to Echo was carried out as in preceding years.

Subarea 4

A. Status of the Fisheries

I. Haddock

Fishing effort in Subarea 4 was primarily concentrated in Division 4X. Increased landings were a result of higher levels of haddock abundance and effort, though mostly the latter (Table 4.1).

Age compositions for 1966 and 1967 are not available. The increased abundance is presumed to be a result of recruitment of the larger than average 1962 and 1963 year classes. This trend of increasing abundance should continue over the next year or two.

Table 4.1 US Haddock statistics, Division 4X (metric tons, round fresh),

<u>Year</u>	<u>Landings</u>	<u>Days Fished</u>	<u>Landings/Day Fished</u> ^{1/}
1962	6,388	875	7.3
1963	7,223	1,111	6.5
1964	8,488	1,132	7.5
1965	3,685	567	6.5
1966	2,473	526	4.7
1967	5,014	928	5.4

^{1/} Landings per day are based on Browns Bank statistics.

II. Cod

United States cod landings from Subarea 4 were 1,453 metric tons in 1967 compared to 983 metric tons in 1966. This increase in landings is related to the rise in effort of the haddock fleet.

III. Redfish

Redfish landings by the United States from the Gulf of St. Lawrence (Table 4.2), Divisions 4R, S, and T increased in 1967. This seems to be a result of rising abundance, continuing the trend of recent years. US redfish landings from the Nova Scotian shelf (Division 4V, W, X) declined sharply in 1967 due to decreased abundance and effort (Table 4.3). Total landings (all countries) from this area declined sharply in 1964-65 but nearly doubled in 1966.

Table 4.2 US redfish statistics, Divisions 4R, S, T (metric tons, round fresh),

<u>Year</u>	<u>Landings</u>	<u>Days Fished</u>	<u>Landings/Day Fished</u>
1962	68	8	8.7
1963	4,879	508	9.6
1964	12,278	735	16.7
1965	17,099	803	21.3
1966	12,766	608	21.0
1967	15,482	622	24.9

Table 4.3 US redfish statistics, Divisions 4V, W, X (metric tons, round fresh),

<u>Year</u>	<u>Landings</u>	<u>Days Fished</u>	<u>Landings/Day Fished</u>
1962	29,375	3,376	8.7
1963	23,282	3,104	7.5
1964	15,636	2,369	6.6
1965	13,082	1,246	10.5
1966	16,680	1,183	14.1
1967	6,407	593	10.8

B. Special Research Studies

I. Environmental Studies (See under Subarea 3).

II. Biological Studies

1. Haddock. The cooperative study by the US and Canada on age and length compositions of the stocks in Division 4X is continuing. All data for the years 1962 through 1966 has been processed to provide estimates of the numbers landed, by length and age categories. These data are now being analysed to provide estimates of mortality and effects of fishing.

Studies of the dynamics of haddock stocks, based on analysis of seasonal research surveys conducted from 1963-1965 are also underway.

2. Groundfish surveys. A fall trawl survey by the Albatross IV covered most of Division 4X. This is part of a more general survey, reported under Subarea 5 research.

Subarea 5

A. Status of the Fisheries

I. Haddock

United States haddock landings from Georges Bank (Division 5Z) dropped sharply in 1967 (Table 5.1). The decline was caused primarily by decreased haddock abundance.

Age compositions (Figure 1) show four and five year olds (1963 and 1962 year classes) dominating the catch in 1967. Albatross IV surveys since 1963 indicate that the four year classes subsequent to 1963, have been much below average (Table 5.2). Hence, further decreases in abundance on Georges Bank are expected through 1970.

Table 5.1 US haddock statistics, Divisions 5Y and 5Z (metric tons, round weight)

Year	SA5	5Y	5Z		
	Landings	Landings	Landings	Days Fished	Landings/Day Fished
1962	54,412 ^{1/}	5,003	49,378	7,838	6.3
1963	48,892 ^{1/}	4,742	44,126	10,029	4.4
1964	51,895	5,383	46,512	8,775	5.3
1965	57,027	4,204	52,823	9,432	5.6
1966	57,497	4,579	52,918	11,759	4.5
1967	39,580	4,852	34,728	9,370	3.7

^{1/} Total includes a small amount for which the Division of catch was unknown.

Table 5.2 Research vessel index of relative year class abundance, based on Autumn catches of 0-group fish.

Year	Index	Year	Index
1958	8.5	1963	12.6
1959	9.6	1964	2.0
1960	2.4	1965	1.2
1961	1.4	1966	1.5
1962	2.6	1967	0.0

II. Cod

Cod landings from the Subarea by the US (Table 5. 3) increased slightly in 1967. Cod are generally taken incidental to haddock and the catch rate, while not an exact measure of abundance, indicates a generally stable abundance over the last few years.

Table 5. 3 US cod landings, Subarea 5 (metric tons, round weight).

<u>Year</u>	<u>Landings</u>	<u>Landings/Day Fished</u>
1962	18,626	1.2
1963	16,734	1.8
1964	15,478	1.0
1965	15,011	.9
1966	15,343	1.1
1967	18,057	1.0

III. Silver Hake

Landings of silver hake for food (Table 5. 4) decreased sharply in 1967. Industrial landings which accounted for a small proportion of the total were slightly higher. The abundance trend continued downward in 1967. In 1961, the US accounted for 100% of the landings. In 1966, when total landings had increased 381% to 162,144 metric tons, the US share was 25%.

Table 5. 4 US silver hake statistics, Subarea 5 (metric tons, round weight).

<u>Year</u>	<u>Total SA5</u>	<u>SA5 North*</u>		<u>SA5 South**</u>	
		<u>Landings</u>	<u>Landings/Day</u>	<u>Landings</u>	<u>Landings/Day</u>
1962	49,604	44,271	18.5	5,333	--
1963	47,737	39,247	17.4	8,490	5.9
1964	53,145	39,479	15.1	13,666	11.5
1965	41,809	33,774	11.3	8,035	4.4
1966	40,200	37,545	12.7	2,655	2.0
1967	30,947	27,082	9.3	3,865	2.7

*Primarily foodfish from north of Cape Cod.

**Primarily industrial from south of Cape Cod.

IV. Redfish

United States redfish landings from Subarea 5 were higher in 1967 than in 1966 (Table 5. 5). Landings per day, however, leveled out after sharp increases in 1965 and 1966. The recent level of fishing is relatively low, and the stocks are evidently recovering from the intense fishing of the 1950's.

Table 5.5 US redfish statistics, Subarea 5 (metric tons, round weight).

Year	Total SA5 Landings	Division 5Y (Gulf of Maine)		
		Landings	Days Fished	Landings/Day Fished
1962	12,540	10,196	2,549	4.0
1963	8,871	6,785	1,655	4.1
1964	7,812	6,137	1,427	4.3
1965	6,986	5,045	742	6.8
1966	7,204	4,719	429	11.0
1967	10,442	6,746	649	10.4

V. Yellowtail

Total US yellowtail landings in 1967 was about 82 percent of that in 1966 (Table 5.6). Apparent abundance increased slightly; the drop in landings was caused by reduced effort.

In 1967 the age composition (Figure 2) of yellowtail from Subarea 5 was dominated by three year olds (1964 year class). The strength of this year class and the incoming, 1965 year class (two year olds) was responsible for increased abundance, which is expected to remain near the same level in 1968.

Table 5.6 US yellowtail statistics, Subarea 5 (metric tons, round weight).

Year	Landings	Days Fished	Landings/Day Fished
1962	25,538	8,238	3.1
1963	35,220	9,031	3.9
1964	36,340	9,822	3.7
1965	37,190*	11,997	3.1
1966	31,020*	15,510	2.0
1967	25,376*	11,534	2.2

* 1965-67 figures contain a small amount of industrial yellowtail landings.

VI. Red Hake

Red hake landings by the US in 1967 came to 5,759 (Table 5.7) metric tons, or about 1,500 metric tons more than landed in 1966. Landings per day increased for the first time since 1964, but is still relatively low.

Table 5.7 Red hake statistics, Subarea 5 (metric tons, round weight).

Year	Total Landings	Div. 5Y Landings	Div. 5Z ^{1/}		
			Landings	Days Fished	Landings/Day Fished
1962	2,471	1,076	1,395	--	--
1963	3,166	579	2,584	165	15.7
1964	24,573	143	24,430	1,733	14.1
1965	13,493	192	13,301	1,462	9.1
1966	4,280	634	3,646	1,585	2.3
1967	5,759	92	5,667	1,049	5.4

^{1/} Predominately industrial statistics.

VII. Industrial Groundfish Fishery

New England industrial landings (Table 5. 8) decreased 16 percent in 1966. In 1967 this trend was reversed. Species composition of the industrial catch changed considerably in 1966 and 1967 with decreases in red and silver hake, and an increased eel pout and flounder catch.

Table 5. 8 New England groundfish landings for Subarea 5 for industrial purposes (metric tons, round weight).

Year	Total Landings	Percent Species Composition				
		Silver Hake	Red Hake	Flounder	Eel Pout	Other
1962	26,666	--	--	--	--	--
1963	26,020	19.5	43.7	4.4	2.1	30.3
1964	27,899	20.0	42.6	11.6	0.9	24.9
1965	34,044	20.4	38.0	6.9	1.8	32.9
1966	28,337	9.6	10.2	18.2	25.0	37.0
1967	38,688	10.2	14.7	18.5	18.9	37.7

VIII. Herring

The catch of herring in the State of Maine continued to be poor in 1967 with total landings of 29,302 metric tons. A catch of 15,423 metric tons in Central Maine was the best since the two good years of 1962 and 1963. The big change in the sardine landings for Maine has been the decrease in Western Maine where the smallest catch since 1951 was made in 1967. In 1966 and 1967, Western Maine contributed only an average of 27% of the state's landings as compared to an average of 40.5% from 1953 through 1964. The cause of the continuing trend for the fishery to decline in Western Maine is not understood but this decline has been coincidental with declining sea water temperatures. Our sampling has revealed no evidence for an unusual abundance of parasites or diseases that could explain the decline in Western Maine.

Age composition of the Maine sardine landings are shown in Table 5. 9. The 15 percent contribution of four year old fish is the highest on record in the Maine sardine industry reflecting both the scarcity of younger fish and the expansion of the use of purse seines in the fishery.

Table 5. 9 Age composition of the Maine sardine landings in 1967.

<u>Age-group</u>	<u>Year Class</u>	<u>Percentage</u>
I	1966	9
II	1965	51
III	1964	22
IV	1963	15
V and greater	1962 or earlier	3

The 1961 year class dominated the samples taken from Georges Bank during June, September, and October. Adult herring samples taken from Coastal Gulf of Maine were predominantly of the 1963 year class; those taken in Nova Scotia were predominantly of the 1961 year class. The range in ages of herring taken from all three areas was from three to eight years. Length ranges were as follows: Georges Bank 20.3 to 33.7 cm, Coastal Gulf of Maine 17.4 to 33.8 cm, and Nova Scotia 20.6 to 34.0 cm.

IX. Lobsters

The US catch of lobsters in 1967 was about 12,240 metric tons compared with 14,000 metric tons in 1966. About 1,950 metric tons were taken by the offshore fishery.

X. Sea Scallops

United States sea scallop landings from Georges Bank increased somewhat in 1967 (Table 5.10). Research vessel indices for 1967 indicated an increase in stock abundance, however, the landings-per-day fished did not increase. Increased effort apparently effected the increase in landings.

Table 5.10 US sea scallop statistics, Subarea 5 (metric tons, weight of adductor muscle only).

<u>Year</u>	<u>Landings</u>	<u>Days Fished</u>	<u>Landings/Day Fished</u>	<u>Research Vessel Index</u>
1962	5,687	8,806	1.1	99.1
1963	7,906	7,906	1.0	95.4
1964	6,296	6,296	1.0	40.0
1965	1,509	2,156	.7	33.5
1966	901	1,001	.9	48.0
1967	1,309	1,870	.7	63.0

B. Special Research Studies

I. Environmental Studies

Hydrographic studies. The Albatross IV made temperature observations on all cruises conducted in the area. In general, temperatures continued the decline that has been observed during the past few years.

A study of the long term temperature trends in the upper 100 meters of water in the Gulf of Maine-Georges Bank area was completed and is reported in another research document.

The US Coast Guard conducted two hydrographic cruises (in September and December) occupying a grid of stations in Subarea 6 and the northern part of Subarea 5. Results are reported in another research document.

The ESSA Coast and Geodetic Survey vessels Explorer and Peirce made two cruises each in March and April 1967 gathering oceanographic data for studies of the Gulf Stream which flows in a meandering path along the south edge of the ICNAF area. During these cruises the Stream was fairly typical for this region. Between Cape Hatteras and approximately 63°W the Stream meandered within its usual limits. Wave-like features occupied an envelope approximately 100 miles wide and during at least part of the period propagated quite rapidly to the east. An anticyclonic (warm) eddy about 60 miles in diameter as defined by the position of the 15°C isotherm in the sharp thermal front at 200 meters depth was observed in the process of detaching itself from the stream and drifting into ICNAF Subareas 4X and 5Z. Temperatures from 17.0°C to 17.5°C were found in the upper 250 meters within the eddy, and the 10°C isotherm was depressed below 400 meters. Current speeds comparable to the Gulf Stream were encountered in transversing this eddy. Almost simultaneously and in the same longitude (66°W) a cyclonic eddy was reported by Navy and WHOI researchers to have separated on the Sargasso Sea side of the Stream.

Environmental monitoring was conducted at Boothbay Harbor, Maine throughout the year. Continuous recordings were made of sea surface temperature (-5 ft. MLW), air temperature, precipitation, bottom temperature (-22 ft. MLW), salinity, tide level, wind speed and direction, dew point, and barometric pressure.

Surface water temperatures during the first six months of 1967 were much lower than those of recent years, but the last six months saw temperatures about the same or higher than those of the last year or two. The annual mean for 1967 was 7.3°C., the lowest since 1940.

The Woods Hole Oceanographic Institution continued its lightship program and its program of bottom and surface drift measurements in the western part of Subarea 5.

Plankton productivity. The Institution carried out a special study in the Gulf of Maine to determine the productivity of marine phytoplankton. It was demonstrated that the total annual production of organic matter in the marine environment requires more nutrient materials than can be found in the near-surface waters at any given time of the year. The observed rate of production must be maintained by the regeneration of nutrients in the biological cycle and by vertical mixing. The results indicate that nearly half of the daily requirement for nutrients may be met by the regeneration of elements. The phytoplankton population has a very rapid turnover rate and the necessary nutrient elements are supplied by rapid recycling. Instead of a single crop during the year, as is typical of terrestrial communities, the oceanic population produces several crops during the year. The ratio between the available supply and the requirement for nutrients indicates a recycling six to ten times each year in coastal waters.

Coastal plankton. Plankton studies along the coastal Gulf of Maine were carried out by the Boothbay Harbor Laboratory. Observations on the seasonal variations in the composition, abundance, and distribution of zooplankton in coastal waters of the Gulf of Maine was continued in 1967. As in each of the previous years of the survey since 1963, mean-annual volumes were highest in the western area (Cape Ann, Massachusetts to Cape Elizabeth, Maine), moderate in the central area (Cape Elizabeth to Mt. Desert Island, Maine) and low in the eastern sector (Mt. Desert Island to Machias Bay, Maine). Volumes in 1967 were about two times higher in the western area (11 cc/100m³) than in 1966, but in the central and eastern areas volumes for the two years were not significantly different. The between-year differences in volumes in the western area resulted from an increase in the abundance of the euphausiid, Meganyctiphanes norvegica. The predominant zooplankters in the samples were copepods. Eight other groups (taxa) constituted more than one percent of the zooplankton; three were holoplanktonic (appendicularians, cladocerans, and euphausiids), and five were meroplanktonic (fish eggs, crustacean eggs, and larval cirripeds, decapods, and brachyurans). The predominant copepod species, Calanus finmarchicus, was less numerous than in the previous year. The lower mean-annual water temperatures (the lowest recorded in 20 years) along the coast may have delayed the summer breeding of C. finmarchicus.

Collections of zooplankton made offshore were also examined during the year. The distribution of pontellid copepods was used to delineate the region of mixing between coastal and oceanic surface waters during an incursion in summer of Gulf Stream water over Georges Bank. The greatest changes in the distribution of pontellids were at 21°C and between 32.5 ‰ and 33.0 ‰ salinity.

During the year determinations were made of the food utilized by herring in coastal waters of the Gulf of Maine. Larval herring preyed on copepod nauplii, copepodites and adults; crustacean eggs; gastropod eggs; unidentified invertebrate eggs; pelecypod larvae; cirriped larvae; and decapod larvae. Copepods were the predominant prey organisms. Species occurring most frequently were in the genera Acartia, Temora, Eurytemora, Oithona, and Pseudocalanus. The variety of food organisms increased with the length of larvae from hatching in autumn to juvenile metamorphosis in late summer. This is the result of the onset of breeding among many of the meroplanktonic zooplankters in spring and summer. Juvenile herring of the 1965 and 1966 year-classes preyed heavily on copepods; the prey species occurring most frequently and in greatest numbers was the copepod Calanus finmarchicus. Larger herring of the 1961 and 1962 year-classes also preyed primarily on copepods, particularly C. finmarchicus and Centropages typicus.

As part of the US-USSR Cooperative Plankton Sampling Investigation comparisons were made of the catching efficiencies of the Gulf III and paired Brown-McGowan (bongo) zooplankton samplers. In each of the 30 replicate hauls completed, the Gulf III undersampled several of the abundant copepod species, indicating that the bongo nets collect more of the forage organisms utilized by herring, and provide better samples of forage distribution and abundance than the Gulf III sampler. Replicate sampling is being continued through each of the seasons in 1968.

Benthic studies. The US continued its studies of the benthic fauna in the area between Hudson Canyon and Nova Scotia. The results showed that the macrobenthos is most plentiful (averaging 1,000 to 5,000 specimens and 100 to 500 grams per square meter of bottom) on the continental shelf in a broad band around the periphery of the Gulf of Maine and extending southward along the coastal area to New Jersey, and offshore in southern New England to the Hudson Canyon region. A particularly large area of high abundance occurs in a band 30 to 60 miles wide in the region south of Martha's Vineyard and extending eastward about 150 miles to the eastern part of Georges Bank. Low densities (less than 100 specimens and less than 50 grams per square meter of bottom) of benthic animals generally occur in the deeper portions of the Gulf of Maine, the shelf area southeast of Nova Scotia, and in the offshore deepwater beyond the edge of the continental shelf.

II. Biological Studies

Haddock. Studies of the abundance trends and effects of fishing are continuing. A new method of estimating abundance from commercial statistics is being developed that will more accurately reflect population abundance, and be less susceptible to changes in the distribution and type of fishing effort.

Analysis of the data collected by the seasonal groundfish survey cruises has been started. This data provides a set of random observations of the population abundance independent of that derived from commercial statistics. The integration of the two types of information will provide more meaningful study of the population dynamics.

Analysis of data from the 9 seasonal surveys from August 1963 to February 1966 has provided some interesting information on mortality rates.

In 1964, landings from 5Z were 63,620 metric tons. In 1965 they were 149,591 tons, an increase ratio of 2.35. The total mortality rates for the two periods, calculated from the survey data were as follows:

Age Groups	Total Mortality	
	1964	1965
III	0.40	1.98
IV	0.90	1.46
V	0.66	0.75
VI	0.86	1.06
VII	0.90	1.08
VIII	0.48	0.94
Total	0.70	1.08

This represents an overall increase of 154%, but increases in the younger age groups were considerably higher than for the older age groups.

The two year old fish are normally being recruited, even to the small mesh survey trawl, during the year, so that often the apparent abundance is greater at the end of the year than the beginning. The two year old age group recruited during 1964 gained in apparent abundance by factor of 1.50, but the same age group declined in apparent abundance by a factor of 0.82 during 1965. This indicates that perhaps the two year old fish were also more heavily fished in 1965 than in 1964, assuming that recruitment rates did not change.

At any rate, there appears to have been an increase in fishing rate from about 70%, which has been the average rate for many years, to 80 or 90% in 1965. Landings decreased somewhat in 1966, but the fishing rate was still much higher than that corresponding to the estimated maximum equilibrium yield level.

Yellowtail. Studies of age and growth, and total mortality have been completed during 1967, and have been submitted for publication in ICNAF's Research Bulletin.

Studies of nylon mesh selectivity were also completed, and the results documented for the 1968 annual meeting.

These studies enabled us to re-assess the effects of mesh size on yields, and a document summarizing the assessment has been prepared.

Silver hake. Studies of age and growth have continued. These are complete to the extent that routine ageing of survey catches and commercial landings has begun.

Studies of effects of fishing are continuing. Part of the joint US-USSR groundfish survey studies will be applicable to this aspect of work.

Red hake. Studies of age and growth are continuing. Population abundance trends are being monitored, but lack of good abundance indices limits the conclusions which can be drawn. This aspect will be studied more intensively in the coming year.

Joint US-USSR groundfish surveys. The US Albatross IV and the USSR Albatros conducted joint trawling operations in Divisions 5Z west and statistical Subarea 6 during October, 1967. These operations included experimental designs to measure the effects of the two vessels and two different trawls on the catch of groundfish, and a coordinated comprehensive survey of the entire area.

The operations were most successful, and a report of the studies of the data is included in the Research Document series.

Herring. Von Bertalanffy growth curves were calculated for herring from Western and Eastern Maine, Nova Scotia and Georges Bank. Herring from Georges Bank are faster growing and reach an ultimate smaller size than do herring from Nova Scotia and Maine. The growth parameters agree with findings made with meristic characters that herring from Georges Bank are not of the same group as herring from Nova Scotia or Maine.

The abundance of larvae within the bay and estuarine region of Boothbay, Maine was low during the year, continuing into a fifth year downward trend coincidental with a decline in the coastal sardine fishery. Comparisons of the distributions of larval herring and salinity suggested that the larger catches of larvae were associated with the plumes of estuarine discharge along the coast of the Gulf of Maine. Analyses of collections of larval herring suggest that they enter the coastal area from beyond the offshore limits (28 km) of our sampling area as well as being spawned locally.

Tuna (tagging). Investigations involving the tagging of tuna and tuna-like species has continued in 1967. Release and recaptures in 1967 (Jan-Sept) and the period 1954-1967 were as follows:

	Bluefin	Skipjack	Sailfish	White Marlin	Greater Amberjack	Other	Total
Total Recapture	802	0	11	5	33	2	853
1967 Release*	721	13	676	430	185	112	2,137
Total							
1954- Recapture	1,529	85	64	37	217	37	1,969
67 Release	8,793	2,034	8,550	4,181	2,060	2,796	28,414
*(Jan-Sept)							

Twelve percent of the recaptures of bluefin in 1967 were tagged in 1967, the same percentage as recorded in 1966. The average age of bluefins in 1967 landings was 2.4 years compared to 1.4 years in 1966. Recruitment of one year olds into the fishery was the poorest in several years.

Examination of release and recapture data has resulted in some preliminary insight into migration patterns and delineation of stocks, however, more detailed analyses and study is needed before final conclusions can be drawn.

Salmon. Atlantic salmon tagging projects in the State of Maine were continued in 1967; about 82,000 hatchery smolts were tagged. In addition, tagging of adult spawners was continued. Fishway trapping facilities on the Machias and Narraguagus Rivers permitted the tagging of a large proportion of the fish in the spawning runs into these rivers.

Tags from the 1967-tagged smolts were returned from the same areas and in about the same order of magnitude as were the tags from the 1966-tagged smolts. Through mid-summer the postsmolts were captured in the herring fisheries in the Bay of Fundy. During late July tagged postsmolts were recovered from the mackerel fishery operating in the vicinity of Halifax, Nova Scotia.

Tag returns in 1967 from the 1966-tagged smolts and from the post-kelts were a little more variable. In 1967 (second sea-year) the 1966-tagged smolt salmon were found during July around the southern and easterly coasts of Newfoundland, along the Labrador coast, and a few fish were in the vicinity of the Greenland coast. Late summer and fall captures came mostly from the Greenland fishery. However, by early winter the fish had apparently left the Labrador Sea area and were migrating southward along the northeasterly and easterly Newfoundland coasts. The tagged post-kelts were taken in the same areas as in past years, but possibly in greater numbers. Tags from post-kelts tagged in Maine were returned in 1967 from the southern, eastern and northeastern Newfoundland coasts as well as from the Greenland salmon fishery.

Lobsters. Since January, 1965 experiments have been conducted on the life history and population dynamics of the "inshore" lobster, Homarus americanus, in the Gulf of Maine. An external tag was developed and field tested; the back tag ("Sphyrion" tag) does not effect growth, mortality or behavior of the lobster and is retained through the moult. Estimates of survival, mortality (fishing and natural), exploitation, growth, migrations and population size have been made for a population endemic to Monhegan Island. A two-year study of the ecology of the lobster was made using SCUBA. Lobster habitat, predators and associated bottom organisms were documented through underwater photography. Population structure as a function of depth, habitat and water temperature was studied. Nocturnal behavior during the four seasons of the year has been studied.

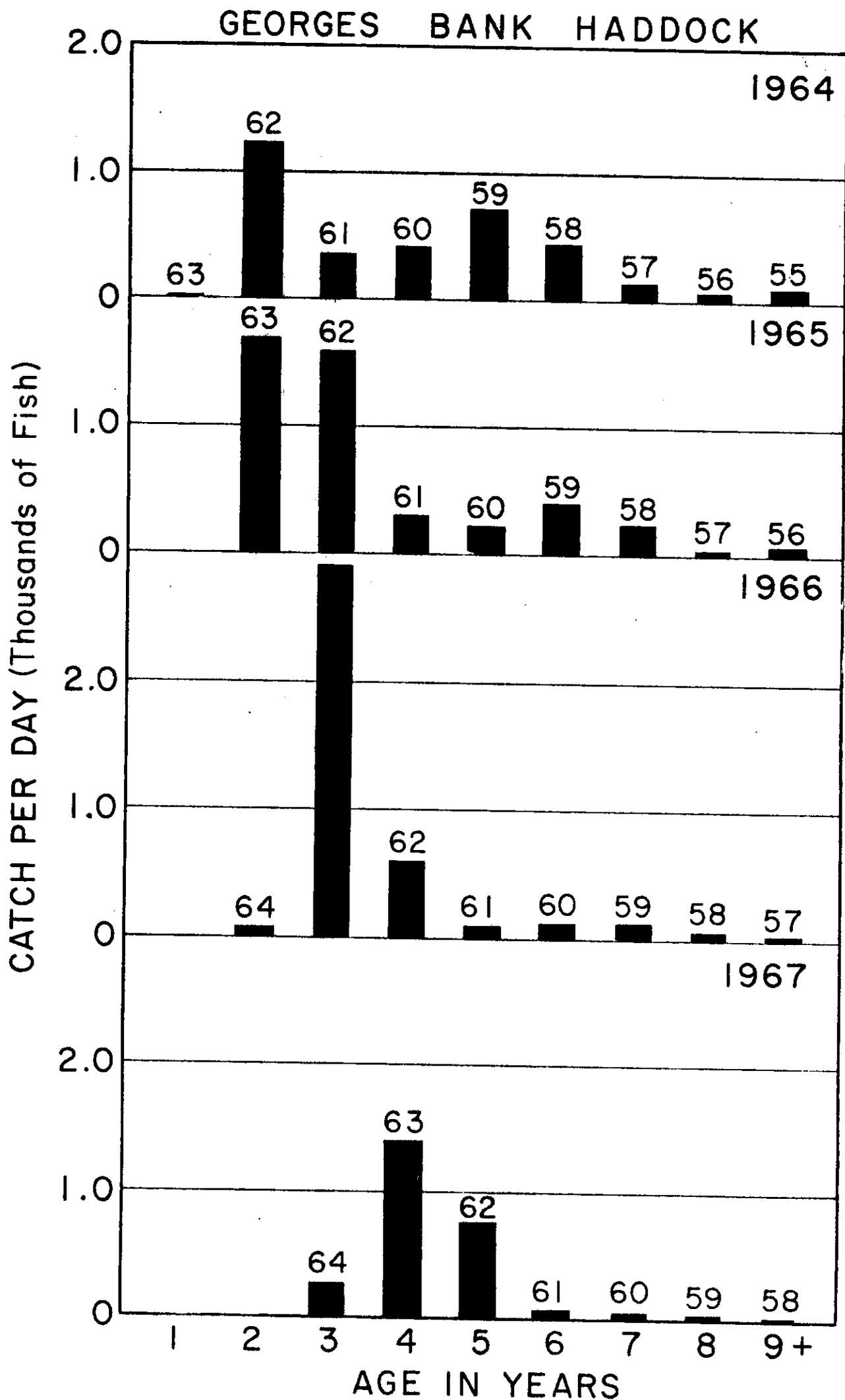


Figure 1. Age composition of Georges Bank haddock.

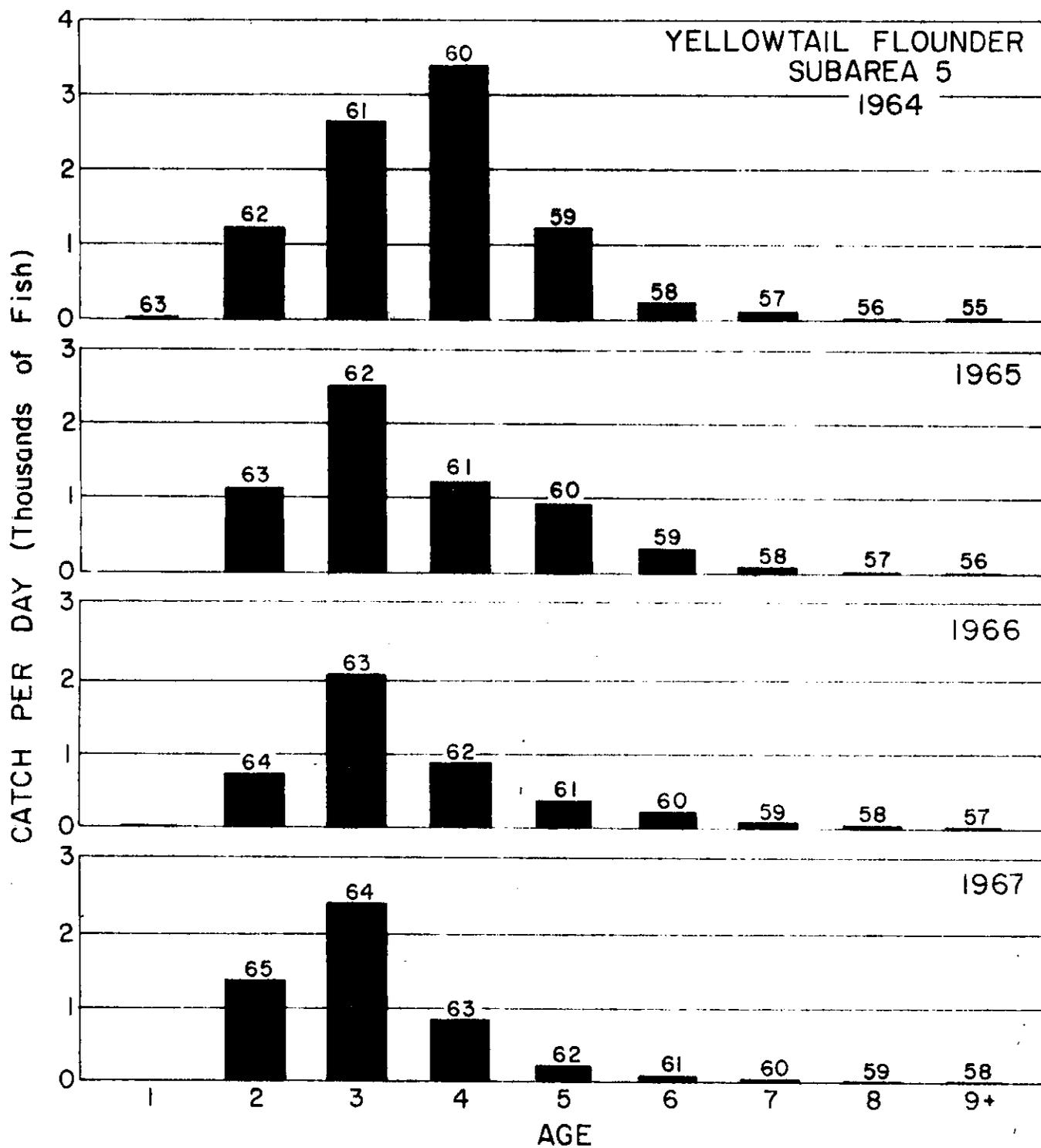


Figure 2. Age composition of Subarea 5 yellowtail flounder.