

United States Research in the Convention Area during 1961

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Routine sampling of the landings of the major species was continued at the New England fishing ports. A detailed review of the interviewing and sampling procedures used at the fishing ports has been completed. As a result of this review, the sampling program has been expanded in some cases.

Concomitant with the improved interviewing and sampling program, we are developing a program to handle all of the data by automatic data processing equipment. As this program develops, we shall be able to work back into a large accumulation of historical records.

Research is also continuing to determine the optimum number and size of samples needed to obtain reliable estimates of the number of fish of each length and age taken from the Convention Area.

8.

Silver hake (Merluccius bilinearis (Mitchill))

The fishery. -- The silver hake fishery in New England declined in 1960 due to the curtailment of the industrial fishery. In 1961 a drop in landings for food fish was due apparently to lowered availability and possibly abundance.

Table 3. -- Trends in the New England silver hake fishery

| Year  | For food | For industrial | For animal food | Total |
|-------|----------|----------------|-----------------|-------|
| 1952  | 117      | 9              | 2               | 128   |
| 1953  | 85       | 16             | 3               | 104   |
| 1954  | 90       | 21             | 6               | 117   |
| 1955  | 111      | 23             | 10              | 144   |
| 1956  | 89       | 30             | 11              | 130   |
| 1957  | 117      | 38             | 16              | 171   |
| 1958  | 107      | 23             | 17              | 147   |
| 1959  | 110      | 26             | 20              | 156   |
| 1960* | 103      | 4.6            | 20              | 127.6 |
| 1961  | 87       | 6.3            | 16              | 109.3 |

\* preliminary estimates

Research. -- In the past year research on silver hake has included studies on behavior and selection (see section on mesh selection), and on availability and abundance. Although the data have not been fully analyzed at this time; a marked seasonal and secular change in availability of the population on different grounds is apparent in different years. Temperature appears to play a complex role in these local fluctuations in abundance.

Industrial Fishery

The industrial trawl fishery remains a minor factor in harvesting fish on the New England grounds. The production of meal is negligible, of mink food moderate but slowly increasing, and of cat and dog food, also moderate but with the potential for a sharp increase in the near future. Pending resolution of the difficulties facing the fish flour producers, their production is also low and will remain so at least for the time being. In the past two years, 1960-61, less than 50 million pounds of industrial trawl fish have been landed each year to serve the needs of all of these fisheries.

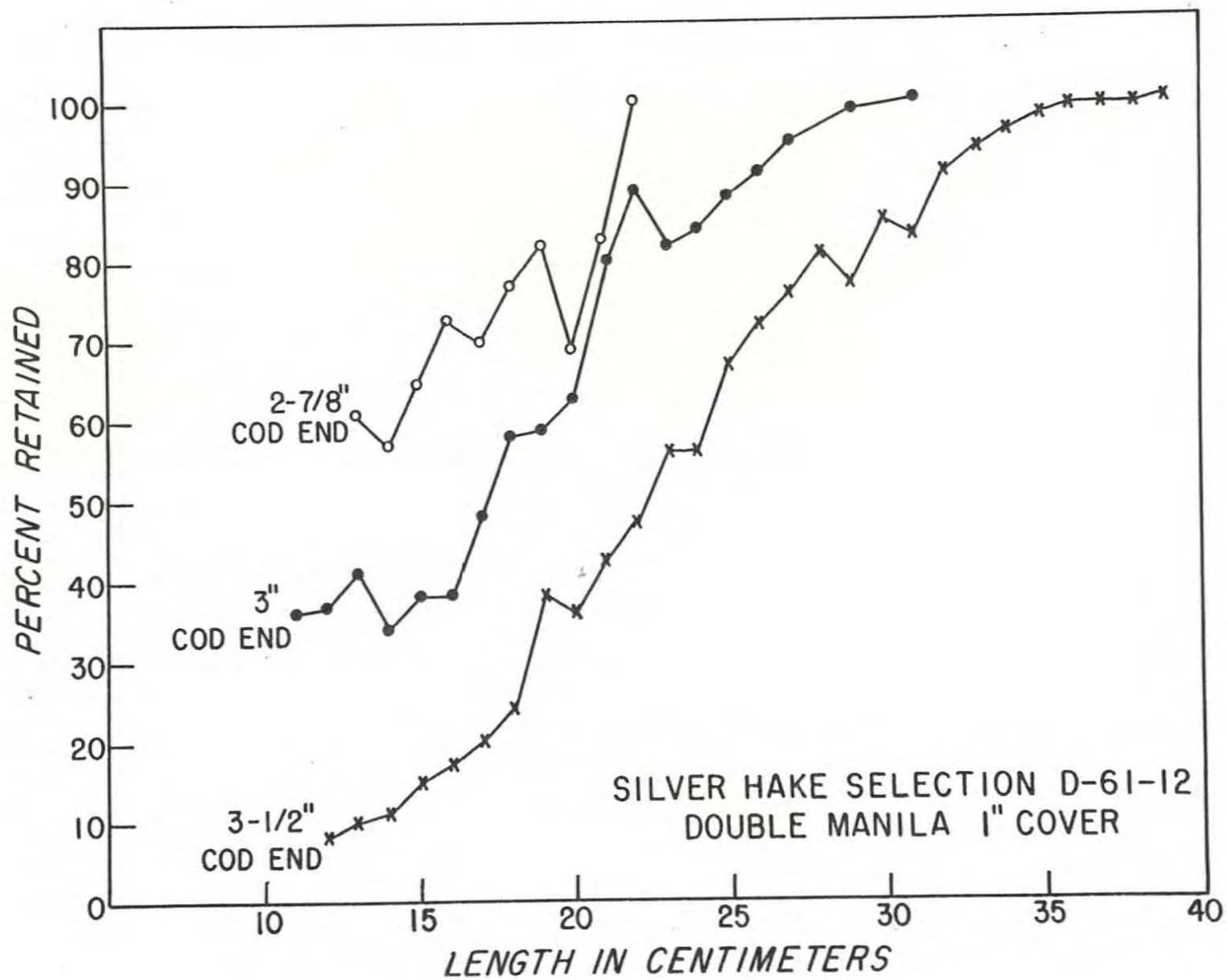
There is little research being done at this time on these fisheries as specific entities. Routine sampling continues.

### Mesh Selection

Extensive experimentation was carried out in August 1961, (Delaware cruise no. 81-12) by the Woods Hole Laboratory personnel on the possibilities of differentially selecting species as well as controlling the sizes retained.

Silver hake selection experiments were also carried out using 2-1/2, 3, and 3-1/2-inch double manila codends. For these experiments the basic net was a No. 36 Yankee of single manila 2-inch mesh twine. The lower half of the codend was lined with 1-inch cotton twine. The upper portion was covered with an additional loose bag (cover) of 1-inch cotton to retain those fish that escaped. All individuals of all species in both the cover and codend were measured, providing useful escapement data on all species captured in any number.

Silver hake appear to have reasonably sharp selection characteristics (fig. 2). There was some evidence that gilling might account for some of the minor irregularity at the upper end of the selection curve. Unfortunately, there were relatively few fish in the population between 18 and 22 centimeters in length, accounting for the scatter in the data for those lengths.



The differential selection experiments were interesting and revealing although no immediately useful technique was developed that would enable a commercial boat to selectively catch either silver hake or haddock, the two species of principal concern. Different species did behave quite differently in the net. It was possible to differentially select for approximately 70 percent of the silver hake and about 80 percent of the cod and haddock, and in addition, to control in the usual manner, the sizes retained of each of these groups. The variability of species selection was considerable, and further behavioral research will be required before this variability can be reduced to reasonable limits.

Mesh Assessment

We have continued our studies of the effects on the yield of increasing the size of mesh in codends of trawl nets. These studies involve two different aspects: one is assessing the effectiveness of the current 4-1/2-inch mesh regulation for cod and haddock; the other is how increases in mesh size would effect the yields of other species.

The latter studies have been carried out in conjunction with the mesh assessment working group of ICNAF, and the initial results are summarized in Document 20 of the 1961 Annual Meeting of ICNAF. The important redfish, silver hake, and industrial fisheries in sub-area 5 could not be sustained with a mesh as large as 4-1/2 inches; however the dynamics of the species involved are not well enough known to provide a precise estimate of the effects of various mesh sizes. These studies are continuing as further information becomes available.

We have tried, by several methods of analysis, to determine the effects of the current 4-1/2-inch mesh regulation on haddock yield-per-recruit. The results of these analysis have not been defnitive. Only one complete year class has passed through the fishery since the regulation has been fully implemented. Additional data from subsequent year classes are needed for further analysis.

Sea scallop (Placopecten magellanicus (Gmelin))

The fishery. -- United States landings of sea scallop meats from Subarea 5 in 1961 were greater than in 1960, the previous record year.

Table 6. -- Trends in the sea scallop fishery

| Year | Landings<br>(millions of pounds) | Days<br>fished | Average landings<br>per day (pounds) |
|------|----------------------------------|----------------|--------------------------------------|
| 1952 | 12.1                             | 7,742          | 1,563                                |
| 53   | 16.2                             | 10,031         | 1,625                                |
| 54   | 15.5                             | 9,343          | 1,659                                |
| 55   | 18.3                             | 11,619         | 1,575                                |
| 56   | 17.5                             | 12,246         | 1,429                                |
| 57   | 17.3                             | 10,500         | 1,651                                |
| 58   | 14.4                             | 9,775          | 1,637                                |
| 59   | 18.7                             | 8,556          | 2,189                                |
| 1960 | 21.9                             | 8,039          | 2,725                                |
| 61   | 23.6                             | 8,666          | 2,724                                |

Research. -- One cruise was made to test the effect of various combinations of ring size and ring linkage on the size composition of the catch. Two survey cruises were made to collect data on the abundance of the fishable stock, and strength of the pre-recruit year-classes. Results of the analysis of these data are reported elsewhere in Commission documents.

An experiment was conducted in a large aquarium tank to see if the tag used in previously reported tagging experiments inhibited movement. Results show that tagged animals move about in the same manner as untagged animals, and that the small amount of dispersion of recaptured tagged scallops from the point of release can be regarded as typical of the untagged part of the population as well.

Two meetings were held during the year between Canadian and United States biologists interested in the sea scallop fishery to discuss and compare results of their programs of investigations. The reports of these meetings are to be found in other Commission documents.

Benthic Studies

Studies of bottom sediments, macroscopic benthic invertebrates, and food habits of groundfish were continued in 1961. A preliminary examination of bottom sediment samples recently taken from the central and northern sections of the Gulf of Maine indicate that silt and clay are the principal substrate components. However, in some shallow areas, such as Cashes Ledge and Jeffreys Ledge, mixtures of sand and gravel are predominant. Also, in certain deepwater areas near Browns Bank and in moderately shallow water between Browns Bank and the Lurcher Shoal region, sand and shell are the major sediment components.

Although haddock are exceedingly omnivorous feeders and were long considered to be non-selective in their choice of foods, recent information has been obtained which reveals selective feeding, at least in some localities. Haddock from the northeastern section of Georges Bank appeared to favor crustaceans and, to a lesser extent, echinoderms, over mollusks, annelids, and miscellaneous groups.

Table 7.--Comparison of haddock diet and available bottom food on northeastern Georges Bank

| Group         | Benthic fauna<br>(% weight) | Haddock stomachs<br>(% volume) |
|---------------|-----------------------------|--------------------------------|
| Mollusca      | 38                          | 22                             |
| Echinodermata | 10                          | 13                             |
| Miscellaneous | 34                          | 27                             |
| Annelida      | 10                          | 6                              |
| Crustacea     | 8                           | 32                             |
| Total         | 100                         | 100                            |

A study of food habits of haddock from one locality throughout a one-year period has shown there are no important differences between males and females in the kinds of animals preyed upon or the quantities of food ingested. A moderately low feeding rate prevailed throughout the year except in June when feeding was intensified remarkably. Differences in diet composition were associated with haddock size and season of the year.

Environmental Studies

Bureau of Commercial Fisheries Studies

Plankton. -- Analysis of the zooplankton samples collected in 1953 have been completed and the analysis of the 1955 samples is under way.

Hydrography. -- Temperature norms for the area bounded by latitudes 39°00' N. and 45°30' N. and longitudes 64°00' W. and 72°00' W. are being computed by analysis of bathythermographic and hydrographic station data collected between 1940 and 1960.

## HYDROGRAPHY

Dean F. Bumpus  
Woods Hole Oceanographic Institution  
Woods Hole, Massachusetts

Hydrographic research by the U.S. A. in the Convention area was carried out by three agencies during 1961: the U.S. Coast Guard, the Bureau of Commercial Fisheries, and the Woods Hole Oceanographic Institution.

A. The U.S. Coast Guard, as the agency operating the International Ice Patrol, examined the temperature and salinity distribution from the surface to 1,500 meters in 4 network surveys in the Grand Bank regions. The first survey, 2-15 April, covered waters over and immediately seaward of the southern and eastern slopes of the Grand Bank from just westward of the tail of the Bank northward to the latitude of Flemish Cap. The second survey, 29 April to 5 May, covered the area immediately seaward of the northeastern slope of the Grand Bank from Flemish Cap northward as far as, but not including, the Bonavista triangle. The third survey, 25 May - 5 June, covered an area similar to the first. The fourth survey, 14-22 June, covered an area similar to the second but included the Bonavista triangle. The post season cruise, 3-11 July, occupied the Bonavista triangle and the Labrador - Cape Farewell section to within 6 miles of Cape Farewell.

The season was characterized by an abnormal amount of sea ice on the east coast of Newfoundland and the eastern part of the south coast. Labrador Current water along the eastern slope

of the Grand Banks was below normal and south of the latitude of Flemish Cap very nearly absent in early April. This was followed by a steady return toward normal conditions which were reached about mid-June. The cold subsurface temperatures in the Labrador Current were warmer than normal in early season and also returned to about normal values in June. On the post-season cruise both the Labrador Current off the South Wolf Island and the West Greenland Current off Cape Farewell showed positive anomalies in volume and temperature.

The report in toto will be published in U. S. Coast Guard Bulletin No. 47.

B. The Bureau of Commercial Fisheries Biological Laboratory at Boothbay Harbor undertook a number of temperature surveys at monthly intervals from Gloucester, Massachusetts, to off Eastport, Maine.

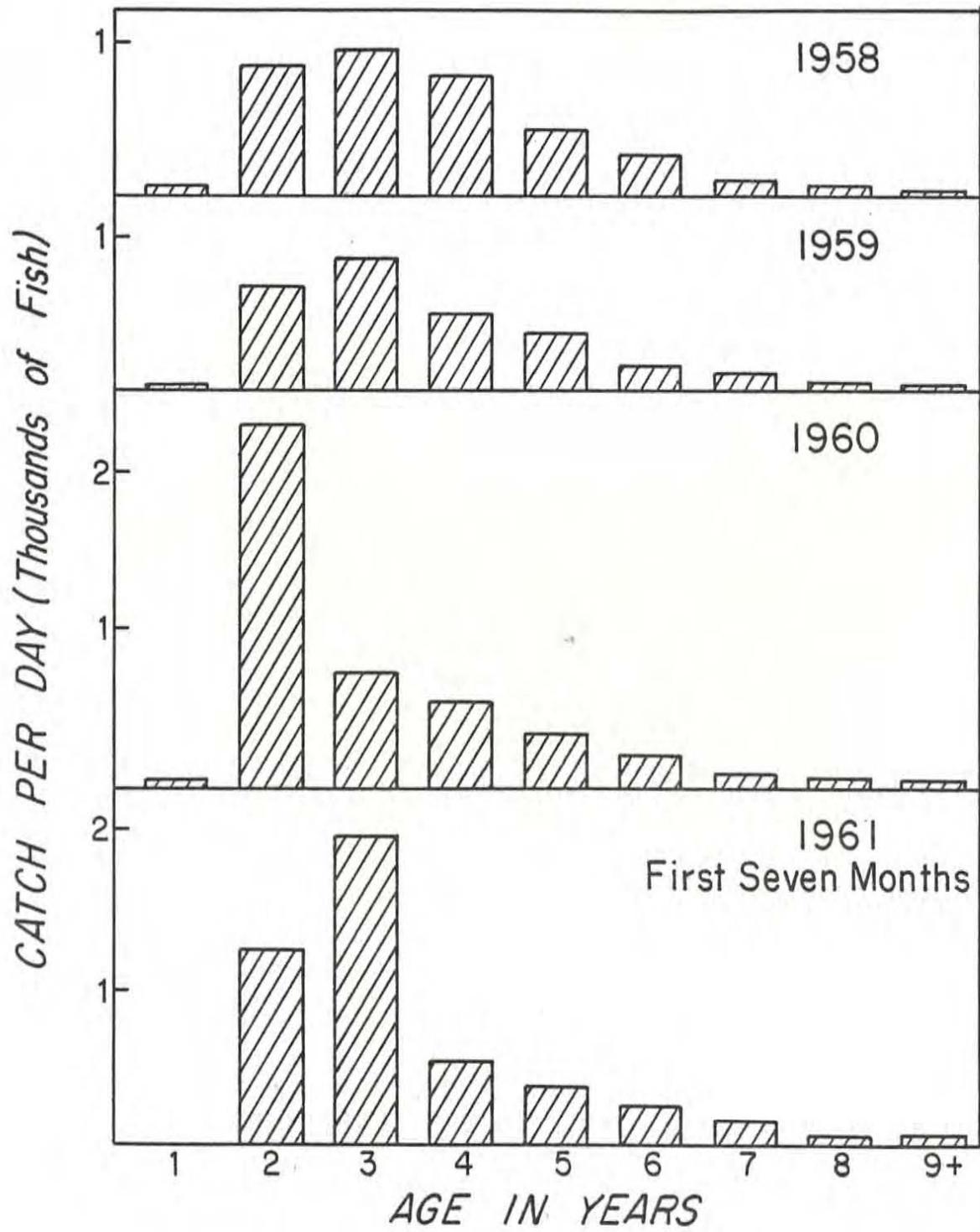
C. The Woods Hole Oceanographic Institution together with the Fisheries Research Board of Canada released 23, 372 drift bottles in areas 4 and 5 throughout the year with approximately 10 percent return.

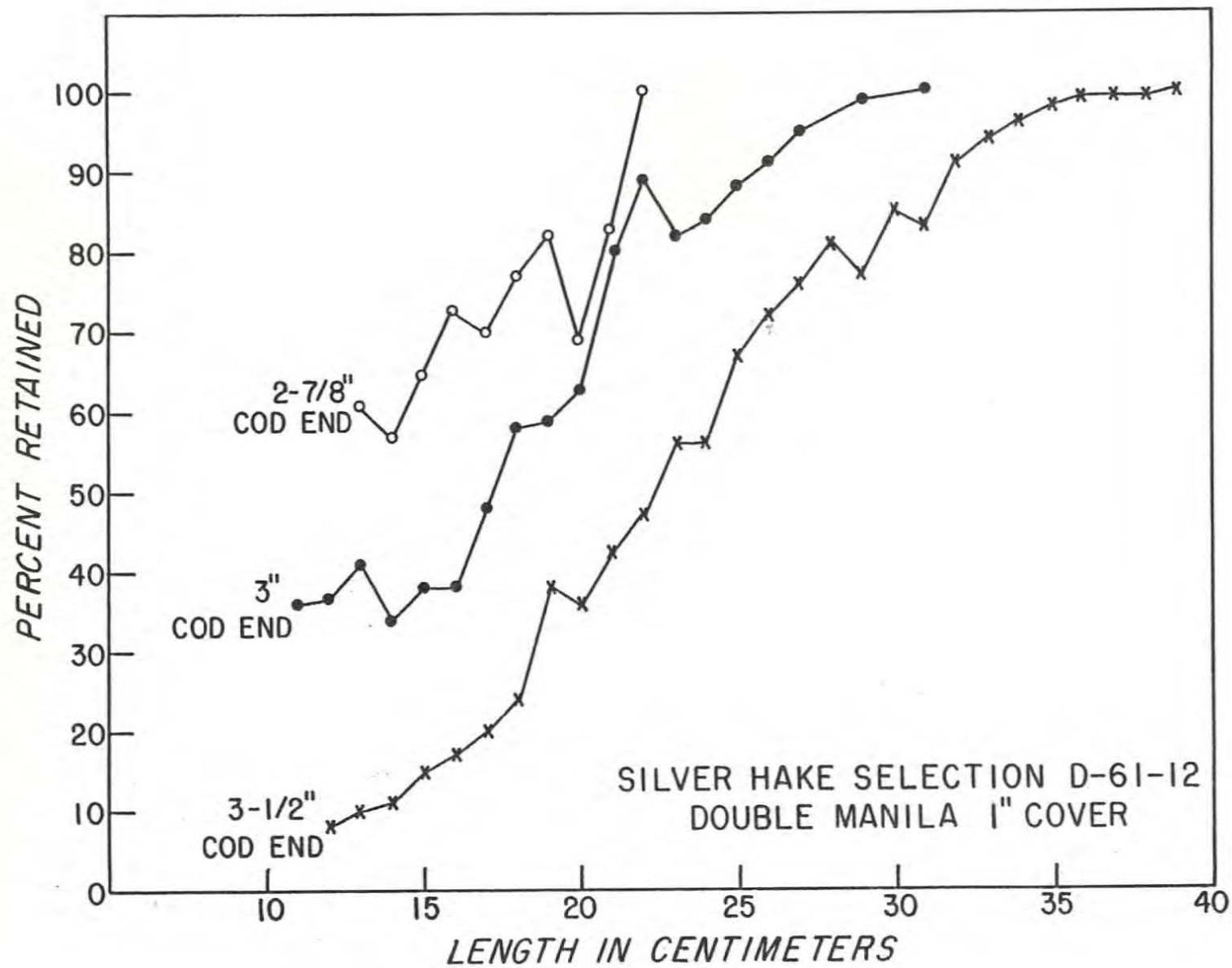
The examination of non-tidal drift at the bottom using Woodhead Sea Bed Drifters was commenced during the year in area 5.

The 13 lightship stations from Maine to Georgia equipped, at the end of 1955 as observation posts to collect surface temperature and salinity observations daily, bathythermograms daily and bottom

water samples weekly, have continued in operation supplemented with surface water temperatures from several shore stations and Texas Towers 2 and 3. Many of the lightships also released drift bottles daily as part of the drift bottle program mentioned above.

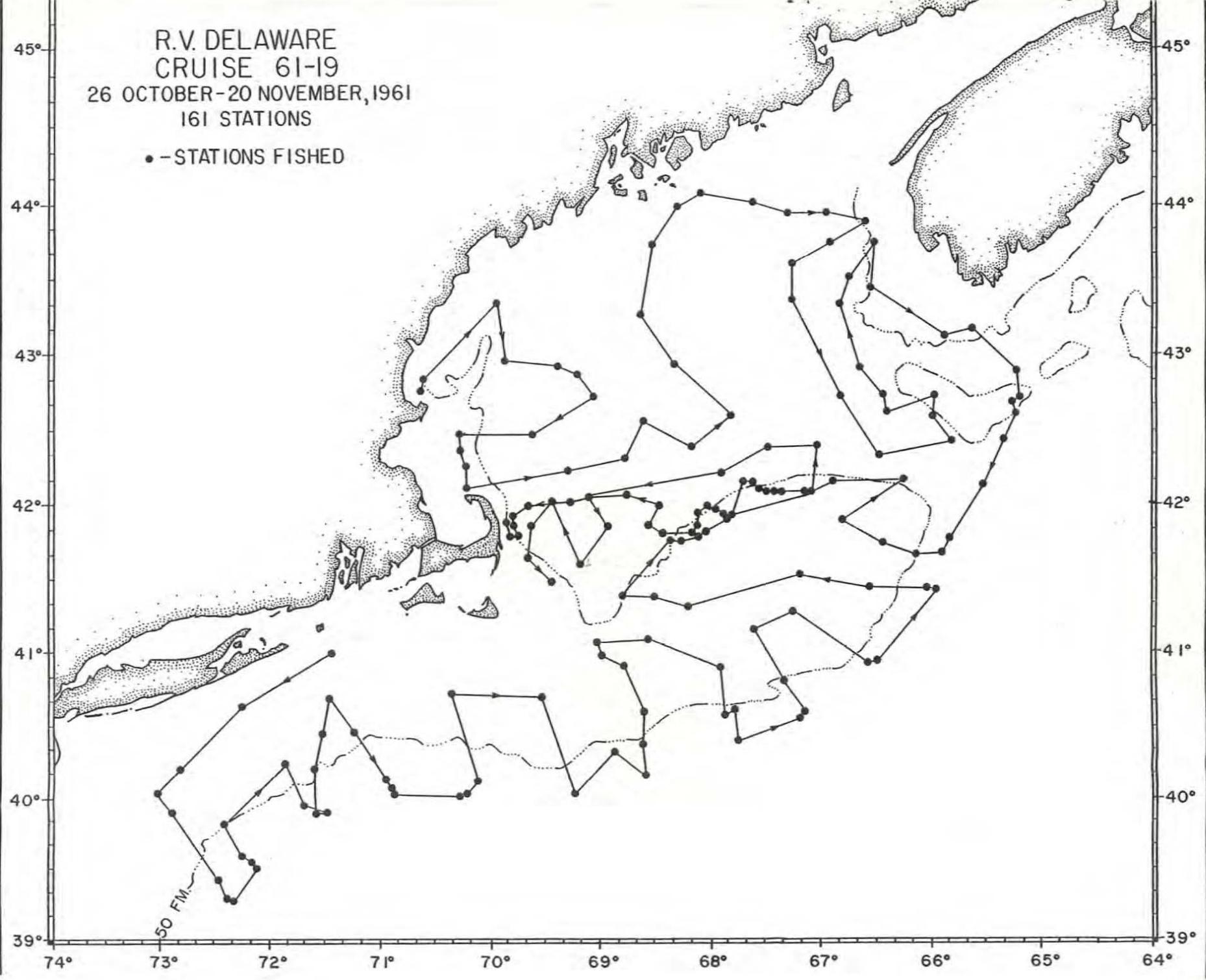
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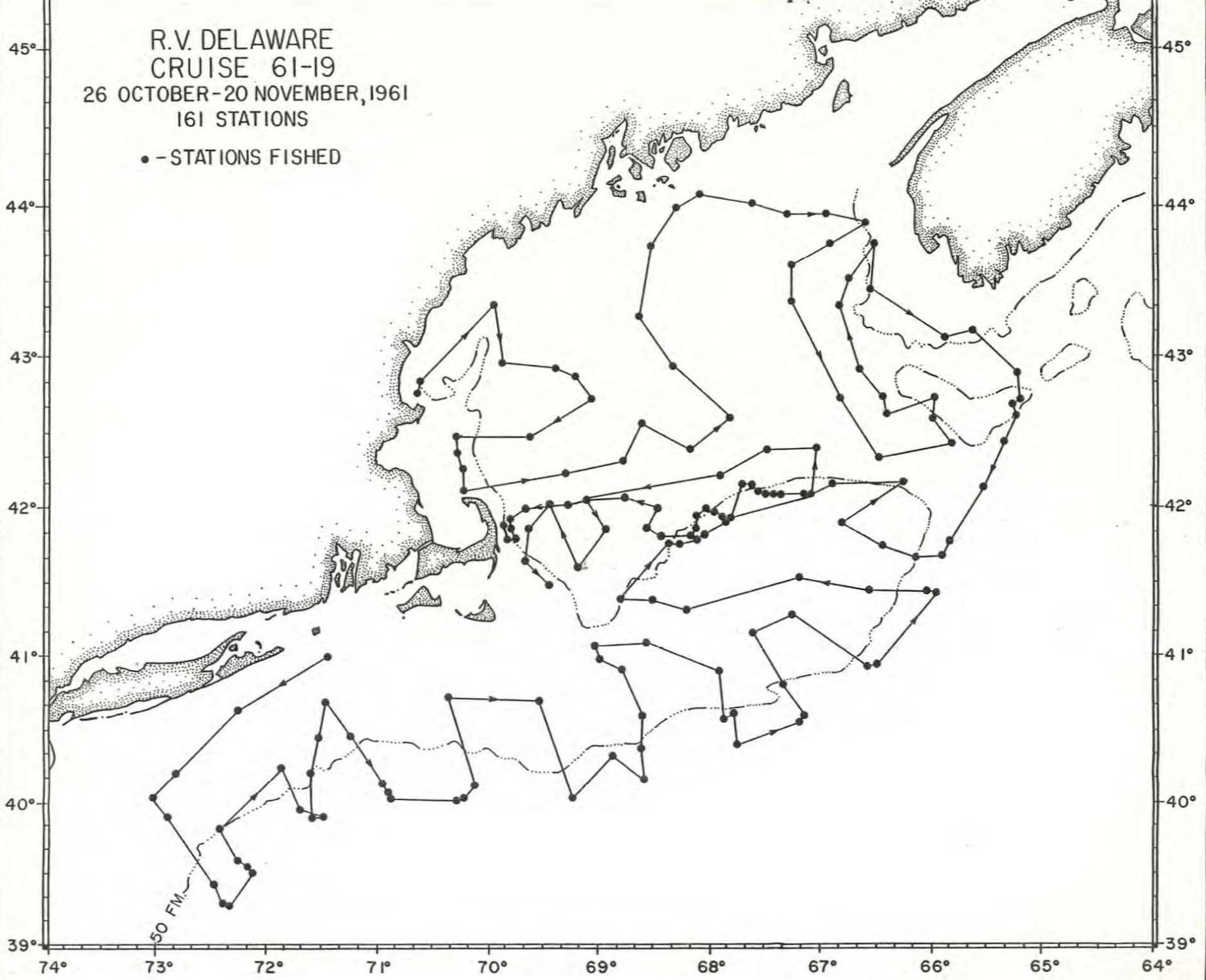
R.V. DELAWARE  
CRUISE 61-19  
26 OCTOBER-20 NOVEMBER, 1961  
161 STATIONS

• - STATIONS FISHED



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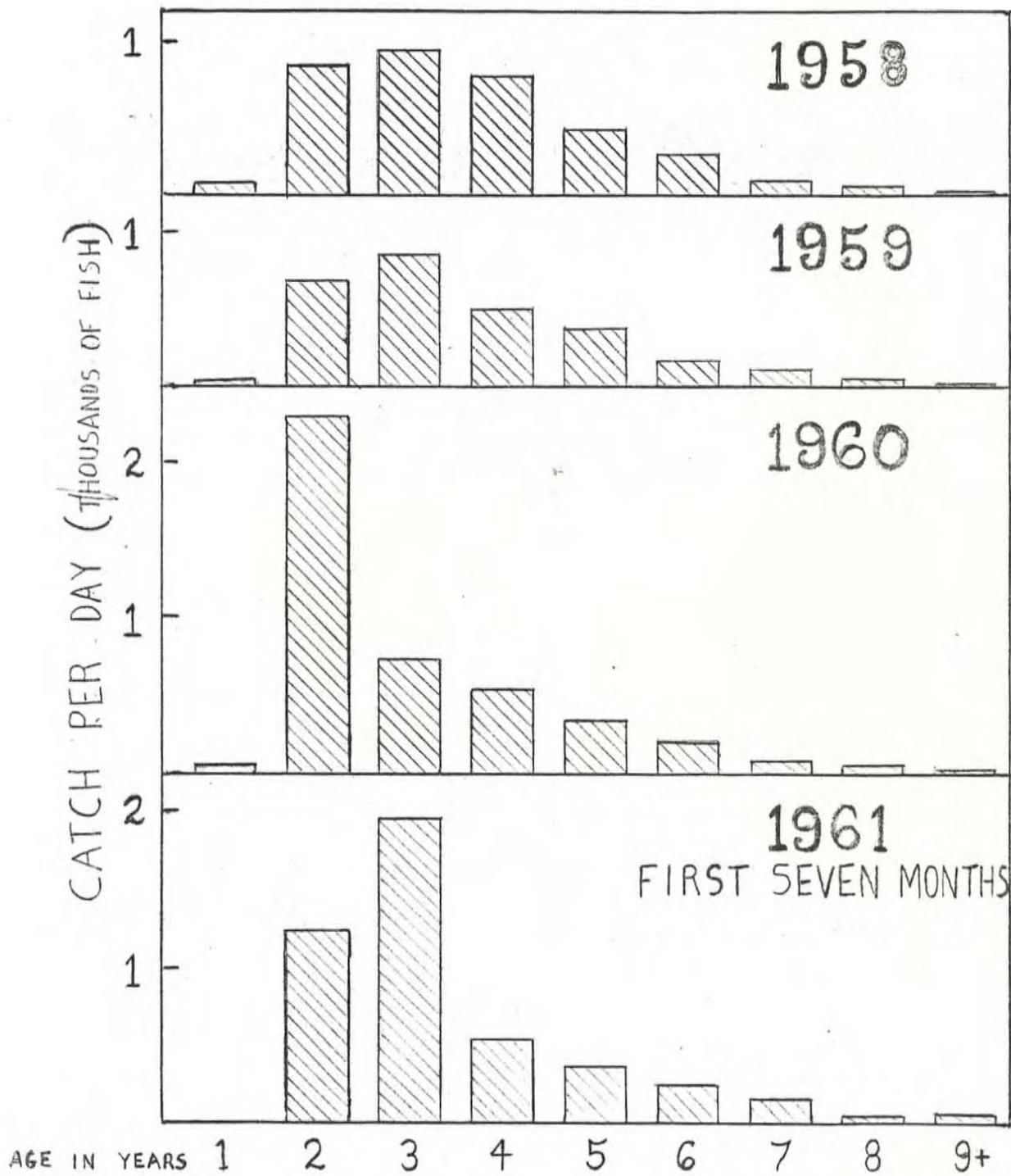


Figure 1. Catch per day at each age, Georges Bank haddock, 1958-61.

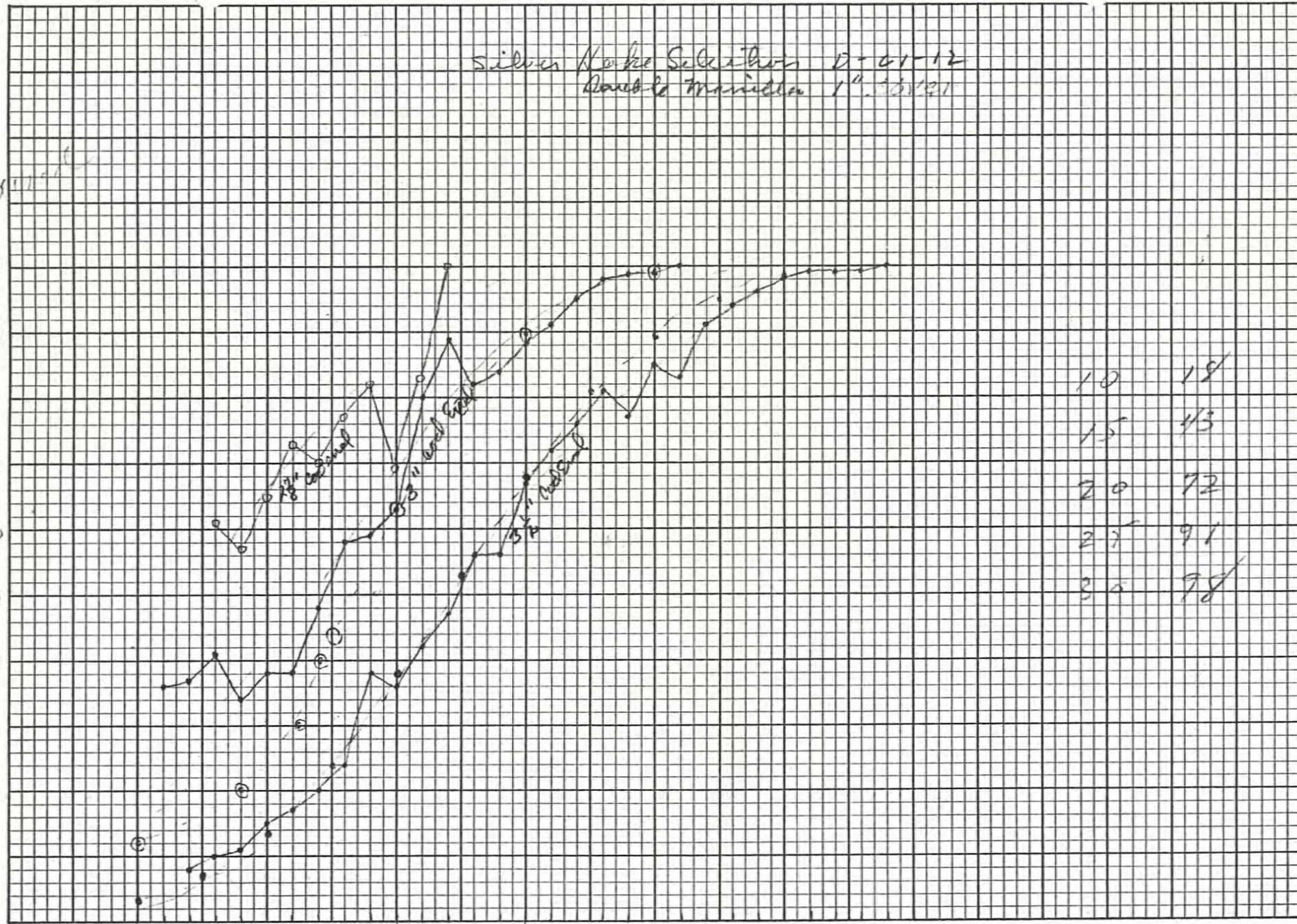
Silver Nitrate Solution 0-41-12  
Rancho Marinillo 14. 13/12/1

% Ret. of <sup>114</sup>Sn

100  
90  
80  
70  
60  
50  
40  
30  
20  
10  
0

10 15 20 25 30 35 40

length cm.



|    |    |
|----|----|
| 10 | 18 |
| 15 | 43 |
| 20 | 72 |
| 25 | 91 |
| 30 | 98 |

115 ... *Convention Area* <sup>1</sup>  
*Survey 1961*

ICNAF SA-5 Research Summary

*H. J. L. D.*  
*B. C. F.*

Market Sampling

Routine sampling of the landings of the major species was continued at the New England fishing ports. A detailed review of the interviewing and sampling procedures used at the fishing ports has been completed, <sup>*As a result of this review*</sup> and the sampling program has been expanded. *in some cases.*

Concomitant with the improved interviewing and sampling program, we are developing a program to handle all of these data by automatic data processing equipment. As this program develops, we shall be able to <sup>*work back into a large accumulation of historical*</sup> ~~develop more fully the analysis of historical~~ *records.* ~~data.~~

Research is also continuing to determine the optimum number and size of samples needed to obtain reliable estimates of the number of fish of each length and age taken from the Convention area.

2/13/62

~~Activity in haddock program for inclusion in annual ICNAF report of U. S. Research~~

*Haddock abundance in Georges Bank (L.)*

The fishery

In the first seven months of 1961, haddock abundance on Georges Bank exceeded that for 1960 and it was the highest since 1956 (Table 1). A major part of this increase was attributed to the strong 1958 year class as 3-year-old fish (Figure 1). An important contribution to 1961 landings also was made by the 1959 year class (age group 2) which was about twice as large as the 1956 and 1957 year classes but only one-half as large as the 1958 year class.

Small catches of young-of-the-year haddock in the 1960 and 1961 fall survey cruises suggest that abundance may drop again in 1962 and 1963 when the 1960 and 1961 year classes enter the fishery as two-year-old scrod.

Predictions of year-class strength

Distribution of young-of-the-year haddock on fall survey cruises was examined with respect to geographic location, depth and bottom temperatures. In the South Channel the largest catches of "zero" haddock consistently occurred in the depth range 50-100 fathoms, and at temperatures below 45° F. On the northern edge of Georges Bank this same relationship was observed in some years; but in other years equally high catches were made in shallower and warmer water. These data suggest that improvements in precision of year-class predictions may be obtained by appropriate stratification of grounds for survey purposes.

U.S. -Canadian 4X Program

Substantial movement of haddock between subareas 4X and 5Y, as shown by Canadian tagging studies, makes it necessary to consider the stocks in these subareas jointly. The U.S. -Canadian cooperative exchange of data on subarea 4X haddock was reviewed, and an agreement was made for its continuation. Essentially this consists of exchange of catch-effort statistics and size-age samples with Woods Hole assuming primary responsibility for analyzing commercial landings. Work was begun on a backlog of 4X haddock otoliths after <sup>reviewing</sup> evidence supporting validity of otolith age readings .  
~~was reviewed.~~

*Trends*  
 Table 1. ~~Stock and effort~~ in the Georges Bank  
 haddock fishery.

(4)

| YEAR                  | Landings<br>(thousands of pounds) | Days<br>fished | Average landings<br>per day (pounds) |  |  |  |  |
|-----------------------|-----------------------------------|----------------|--------------------------------------|--|--|--|--|
| 1952                  | 83,645                            | 5,933          | 14,098                               |  |  |  |  |
| 1953                  | 69,476                            | 6,511          | 10,671                               |  |  |  |  |
| 1954                  | 89,710                            | 5,807          | 15,448                               |  |  |  |  |
| 1955                  | 78,942                            | 5,059          | 15,603                               |  |  |  |  |
| 1956                  | 94,505                            | 6,794          | 13,910                               |  |  |  |  |
| 1957                  | 89,251                            | 7,825          | 11,406                               |  |  |  |  |
| 1958                  | 68,655                            | 7,836          | 8,761                                |  |  |  |  |
| 1959                  | 69,350                            | 9,432          | 7,353                                |  |  |  |  |
| 1960                  | 79,470                            | 7,669          | 10,362                               |  |  |  |  |
| 1961*                 | 53,293                            | 4,476          | 11,906                               |  |  |  |  |
| * First seven months. |                                   |                |                                      |  |  |  |  |

1961 ICNAF Annual Report

Cod (Gadus morhua L.), ~~by Albert C. Jensen~~

The Fishery. Total US cod landings in 1961 reached a 10-year high of nearly

44 million pounds<sup>(Table 2)</sup>. Although each of the important New England ports reported increases<sup>y</sup> in cod landings during the year, the largest increase--over 3 million pounds--was reported from Boston, Massachusetts.

Research. Preliminary analysis of cod otoliths collected aboard the research vessel Delaware, revealed marked differences in the clarity of the hyaline zones for otoliths from different fishing grounds in the New England area.

<sup>The zones in</sup> Otoliths from fish collected in the offing of Cape Cod ~~feature zones that~~ are not <sup>so</sup> as sharply defined as those in otoliths collected in Ipswich Bay, north of Boston.

A critical study of scales and otoliths from the same fish is underway with material collected from 300 cod covering a wide range of sizes. Results of the study will be used to determine whether scales only, otoliths only, or a combination of the two will be used for routine age determination of commercial landings of cod.

Table 2

Trends in ~~the~~ cod fishery ~~landings~~

| Year   | Pounds landed (thousands) | Boston only              |        |       |
|--------|---------------------------|--------------------------|--------|-------|
|        |                           | lg.                      | subt.  | scrod |
|        |                           | (thousands of pounds)    |        |       |
| 1952   | 42,401                    | 7,022                    | 11,672 | 2,910 |
| 1953   | 31,899                    | 5,718                    | 9,410  | 1,528 |
| 1954   | 35,239                    | 7,291                    | 7,234  | 2,006 |
| 1955   | 32,369                    | 6,504                    | 6,835  | 1,945 |
| 1956   | 32,760                    | 8,165                    | 8,019  | 1,334 |
| 1957   | 31,911                    | 7,608                    | 8,319  | 1,559 |
| 1958   | 37,784                    | 5,194                    | 6,612  | 4,377 |
| 1959   | 40,758                    | 5,739                    | 8,098  | 3,872 |
| 1960   | 40,381                    | 4,774                    | 8,078  | 2,695 |
| 1961 ✓ | 43,700                    | (Data not yet available) |        |       |

✓ Preliminary

(N.B. Market categories are as follows: scrod, cod that weigh between 1 1/2 and 2 1/2 pounds; market, cod that weigh between 2 1/2 and 10 pounds; large, cod that weigh between 10 and 25 pounds.)

(N.B. weights of market category:  
 scrod - 1 1/2 - 2 1/2 pounds  
 market - 2 1/2 - 10 pounds  
 large - 10 - 25 pounds)

~~whole  
 lg. 10-25  
 mkt 1/2-10  
 scrod 1 1/2-2 1/2~~

~~Cod annual ICNAF Report-1961 A. C. Jensen~~

~~Serological studies were begun to further delimit the groups or stocks~~  
*of cod blood were started in an*  
*effort to further delimit the groups or stocks*  
of cod in New England waters. Results of the blood-group studies will be used  
to complement the extensive tagging study carried out in 1955-1958. (The  
tagging study is the subject of a paper presently being prepared for publi-  
cation. ~~An evaluation of the tags and the tagging technique were described~~  
~~in a paper presented at the ICNAF Marking Symposium in Woods Hole.~~)

and secular changes in availability of the population on different  
*is apparent*  
grounds, in different years. Temperature appears to play a  
complex role in these local fluctuations in abundance.

2/19/62

United States Research in the Convention Area during 1961.  
Redfish (Sebastes marinus)

The fishery. United States redfish landings for 1961 totalled about 131 million pounds, the lowest ~~amount~~ since 1944 and approximately half the amount landed in ~~the~~ 1951, the peak year of the U.S. fishery. Since 1955 fishing effort has ~~ranged~~ <sup>varied</sup> between 7500 and 8000 boat-days fished annually with landings ranging between 134 and 157 million pounds. This fishing effort has been distributed in varying proportions among the four main fishing grounds, Gulf of Maine, Nova Scotia Banks, Gulf of St. Lawrence and the Grand Banks. Preliminary estimates indicate that the greatest portion of United States fishing effort in 1961 was expended on the Nova Scotia Banks with decreasing amounts in the Gulf of Maine, Grand Banks and Gulf of St. Lawrence, in that order. Fishing effort in the Gulf of St. Lawrence in 1961 was reduced to about 100 days, less than 5 percent of what it was 5 years earlier.

The trend in United States redfish landings and catch-per-day shown in table \_\_\_ give little cause for optimism concerning the prospect of future increases in landings for the United States fishery. The concurrent reduction in both catch-per-day and fishing effort in the Gulf of Maine and on the Grand Banks in 1960 suggests that future increases in fishing effort on these grounds may <sup>RAISE</sup> increase landings temporarily, but will further reduce the level of catch-per-day. The increases in fishing effort, landings and catch-per-day on the Nova Scotia Banks in 1960 appear to represent the second maximum peak reached on those grounds since 1950. This maximum probably is the result of harvesting the redfish stocks that

accumulated during the mid-1950's when fishing effort was diverted to the Gulf of St. Lawrence and Grand Banks redfish stocks. The reduced landings from the Nova Scotia Banks in 1961 may indicate the start of the decline of landings from this recent maximum.

Research. The results of tagging redfish on the opercle with Petersen discs were reported to the ICNAF Marking Symposium in May 1961. The effect of this tagging technique on the growth rate of the tagged fish was clearly shown. Growth was reduced to a very low value after the fish were tagged, ~~and the~~ *that's* reduced rate of growth persisted for about 2½ years. ~~The reduced growth was interpreted as the result of the Petersen disc, pinned through the opercle, causing the fish to be less able to catch live food in the normal manner, the reduction in food causing a diminution in growth. After 2½ years, the growth rate~~ *after which the rate* of tagged fish increased gradually until it approached the pre-tagging rate at the end of 4½ years.

Recent recaptures of Eastport redfish tagged with plastic dart spaghetti tags through the dorsum indicate that tagging in this manner has little effect on growth rate. Fish tagged with plastic darts on the dorsum grew an average of 31 mm. in 16 months, compared with the average of 1-2 mm. per year recorded earlier for Petersen discs on the opercle.

A small number of dart tags was recovered from fish that were tagged first with Petersen discs through the opercle and later were tagged with plastic darts through the dorsum. The fish grew an average of 17 mm. in 37 months while tagged with Petersen discs. When the Petersen discs were removed from the opercle and plastic darts were inserted in the muscle of the dorsum, the growth rate increased to an average of 23 mm. in 14 months. The difference in growth rate is thought to be mainly the result of the position of the dorsal tag <sup>which did</sup> not interfere ~~with~~ with feeding, as did the opercle tag, rather than due to the difference in the type of tag used for tagging.

The pigmentation of pre-extrusion larvae of Sebastes ~~was~~ from several locations in the western Atlantic was studied ~~with~~ <sup>in</sup> relation to the morphometric measurements of the females. Variations in the caudal pigmentation were found to be more complex than that reported earlier by Templeman and Sandeman (1959). The number of caudal melanophores ranged between zero and four, and there was a relatively broad range in the number of melanophores found on the young from a single female. These variations indicate the value of counting the number of caudal melanophores as a possible racial characteristic rather than the less meaningful determination of the presence or absence of pigmentation reported earlier.

G. F. Kelly  
Feb. 19, 1962

Table 4.--Trends in the redfish fishery

| Year                        | Landings (thousands of pounds) | Calculated fishing effort (days fished) | Catch per day (thousands of pounds) |
|-----------------------------|--------------------------------|---|-------------------------------------|
| <u>Gulf of St. Lawrence</u> |                                |   |                                     |
| 1951                        | 8,517                          | 353.1                                   | 24.12                               |
| 52                          | 9,949                          | 463.4                                   | 21.47                               |
| 53                          | 16,026                         | 681.7                                   | 23.51                               |
| 54                          | 37,981                         | 1517.4                                  | 25.03                               |
| 55                          | 76,586                         | 2397.1                                  | 31.95                               |
| 56                          | 54,729                         | 2024.0                                  | 27.04                               |
| 57                          | 40,385                         | 1960.4                                  | 20.60                               |
| 58                          | 16,611                         | 843.6                                   | 19.69                               |
| 59                          | 11,489                         | 551.6                                   | 20.83                               |
| 1960                        | 2,861.1                        | 128.1                                   | 22.34                               |
| 61                          | 2,500*                         | --                                      | --                                  |
| <u>Grand Bank</u>           |                                |   |                                     |
| 1951                        | 29,900                         | 445.5                                   | 67.12                               |
| 52                          | 45,129                         | 818.6                                   | 55.13                               |
| 53                          | 73,593                         | 1647.9                                  | 44.66                               |
| 54                          | 68,936                         | 1785.9                                  | 38.60                               |
| 55                          | 29,555                         | 1125.9                                  | 26.25                               |
| 56                          | 29,330                         | 942.5                                   | 31.12                               |
| 57                          | 10,575                         | 288.5                                   | 36.65                               |
| 58                          | 23,939                         | 687.9                                   | 34.80                               |
| 59                          | 36,337                         | 1093.8                                  | 33.22                               |
| 1960                        | 33,576.1                       | 1038.2                                  | 32.34                               |
| 61                          | 31,400*                        | --                                      | --                                  |
| <u>Nova Scotian Banks</u>   |                                |   |                                     |
| 1951                        | 151,679                        | 6922.8                                  | 21.91                               |
| 52                          | 83,933                         | 5013.9                                  | 16.74                               |
| 53                          | 29,606                         | 1837.7                                  | 16.11                               |
| 54                          | 46,065                         | 1899.5                                  | 24.25                               |
| 55                          | 20,569                         | 1099.9                                  | 18.70                               |
| 56                          | 35,963                         | 1460.7                                  | 24.62                               |
| 57                          | 46,519                         | 1895.6                                  | 24.54                               |
| 58                          | 67,830                         | 2555.8                                  | 26.54                               |
| 59                          | 54,448                         | 2391.2                                  | 22.77                               |
| 1960                        | 79,958.5                       | 3320.5                                  | 24.08                               |
| 61                          | 70,700*                        | --                                      | --                                  |
| <u>Gulf of Maine</u>        |                                |   |                                     |
| 1951                        | 68,213                         | 9814.8                                  | 8.95                                |
| 52                          | 47,128                         | 6042.1                                  | 7.80                                |
| 53                          | 37,017                         | 4459.8                                  | 8.30                                |
| 54                          | 28,633                         | 3858.9                                  | 7.42                                |
| 55                          | 30,675                         | 3089.1                                  | 9.93                                |
| 56                          | 31,720                         | 3266.7                                  | 9.71                                |
| 57                          | 36,306                         | 3862.3                                  | 9.40                                |
| 58                          | 35,725                         | 3671.6                                  | 9.73                                |
| 59                          | 34,414                         | 3599.8                                  | 9.56                                |
| 1960                        | 25,036.7                       | 2966.4                                  | 8.44                                |
| 61                          | 26,200*                        | --                                      | --                                  |

\* preliminary estimate - data for January-September 1961.

ICNAF REPORT, 1961  
Flounder Program Research

[Insert scientific names]

Flounders.

The 5 species of flounders landed at New England ports, yellowtail, <sup>winter flounder</sup> blackback, fluke, <sup>American plaice</sup> American plaice, and witch, make up about 20 percent of the value of total fin fish caught in this region. Currently, biological studies are being carried out on the first 3 of these, ~~yellowtail, blackback, and fluke~~ <sup>winter flounder</sup> which make up most of the flounder landings.

YELLOWTAIL FLOUNDER

To follow

<sup>Stock</sup> Group identification studies of yellowtail indicate that there are 3 relatively distinct groups. Landings by ground and average landings per day of effort, 1950 - 1960, for the 2 groups which are of greatest importance in the catch, ~~these from the southern New England and Georges Bank grounds~~, are given below. An examination of grounds where yellowtail are caught suggested that <sup>fishing</sup> effort could not be estimated on the basis of ground fished, alone, since a number of other species also are found in abundance on parts of these grounds. Landings per day was therefore based on trips landing 75 percent or more yellowtail.

(insert table here)

<sup>Relative</sup> abundance has increased on both grounds in recent years, and it ~~has~~ consistently <sup>now</sup> been higher <sup>est</sup> on Georges Bank. Age composition studies show that strong year classes in 1955, 1956, and 1958 have been principally responsible for the increases. The total New England landings from all grounds in 1961 were approximately 37 million pounds, the highest since 1948.

Preliminary information on the 1959 year class suggests that it is of about average size. <sup>However,</sup> The landings during 1962 will probably remain at a high level because they will consist largely of fish from the strong 1958 year class. ~~The 1961/1962/1963/1964/1965/1966/1967/1968/1969/1970/1971/1972~~ Total catch very likely will be between 30 and 35 million pounds.

The fish come into the catch at age 2 and they make their greatest contribution to landings at ages 3 and 4.

Table 5. Trends in the New England yellowtail fishery.

| year               | New England ground              |                            | Georges Bank |              |
|--------------------|---------------------------------|----------------------------|--------------|--------------|
|                    | Southern Landings <sup>1/</sup> | Landings/day <sup>1/</sup> | Landings     | Landings/day |
| 1950               | 6,369                           | 3.6                        | 7,002        | 5.5          |
| 1951               | 3,787                           | 3.8                        | 7,913        | 5.5          |
| 1952               | 4,172                           | 3.1                        | 6,751        | 5.3          |
| 1953               | 3,255                           | 3.4                        | 6,356        | 5.3          |
| 1954               | 1,477                           | 3.4                        | 5,956        | 4.7          |
| 1955               | 2,919                           | 3.3                        | 6,049        | 5.4          |
| 1956               | 4,956                           | 4.0                        | 3,489        | 4.6          |
| 1957               | 7,586                           | 5.4                        | 5,074        | 6.7          |
| 1958               | 15,895                          | 5.8                        | 9,995        | 8.0          |
| 1959               | 13,294                          | 3.8                        | 9,106        | 4.7          |
| <sup>2/</sup> 1960 | 13,855                          | 4.1                        | 9,804        | 5.4          |
| 1961 <sup>?</sup>  | 17,100                          |                            | 12,100       |              |

<sup>1/</sup> All figures for landings and landings per day are in thousands of pounds. Landings are those at Massachusetts ports. Landings per day are for trips by 26-50 ton trawlers, landing 75 percent or more yellowtail.

<sup>2/</sup> Estimated

Research during 1961 <sup>was concentrated on studies of</sup> ~~has consisted primarily of~~ growth rate and age composition ~~studies~~ of fish from the 3 groups. Samples were obtained from 2 sources: (1) commercial vessels using large mesh (about 4-1/2 inch<sup>es</sup>) trawls, and (2) research vessel catches using small mesh gear. Increased sampling with small mesh gear is planned for future studies ~~to~~ in order to provide ~~more~~ additional information on recruitment and discards.

Recovery information for yellowtail tagged in earlier studies have been recorded. These data, along with fishing effort and age compositions, will be used in mortality estimation.

FLUKE ( )

Fluke studies in 1961 consisted ~~of 4 parts, including:~~ (1) studies of time and place of spawning in New England waters, (2) study of abundance and distribution of <sup>O group</sup> ~~O-group~~ fish, (3) stock identification, and (4) preliminary age and growth studies of fish from commercial landings.

Spawning condition of fluke is being followed to determine when and where the ~~New England~~ fish spawn. Information so far collected suggests that spawning occurs in the fall <sup>during the migration from the</sup> ~~between time of departure of fluke from~~ summer inshore grounds <sup>to the</sup> ~~and time of arrival on~~ winter offshore grounds.

A coastal ~~sur~~ water survey in the area from Long Island to Chesapeake Bay using a beach seine and otter trawl to collect young fish provided some information on distribution and nursery grounds of O-group ~~fluke~~ fluke. ~~It~~ <sup>It</sup> appears that Chesapeake Bay is an important nursery ground.

Tagging is being used to identify exploited groups. In a Bureau of Commercial Fisheries study 1,800 fluke were tagged on the offshore winter grounds southeast of Long Island in March and April, <sup>1961.</sup> In a joint Bureau of Commercial Fisheries and New Jersey Conservation Department study 3,400 fluke were tagged in the summer months along the New Jersey coast by New Jersey biologists.

A study of the use of plastic impressions of fluke scales for age and growth assessment is in progress. Although interpretation ~~is difficult~~ of growth zones is difficult, it appears that scales can be used for this work.

WINTER  
BLACKBACK FLOUNDER ( - - )

A biological investigation of the Woods Hole population of <sup>winter</sup> ~~blackback~~ flounder has been undertaken. Sampling trips, using a small otter ~~trap~~ trawl, are being made in local waters at approximately weekly intervals. A study of food habits, with respect to season, time of day, and spawning condition is now underway. Data also are being collected for age, growth, and sex ratio studies. *Information on animal communities, as sampled by the trawl, is being collected at the same time.*

~~ICNAF Industrial Fishery~~

The Industrial Fisheries.

The industrial trawl fishery remains a minor factor in harvesting fish on the New England grounds. The production of meal is negligible, of mink food moderate but slowly increasing, and of cat and dog food, also moderate but with the potential for a sharp increase in the near future. Pending resolution of the difficulties facing the fish flour producers, <sup>their</sup> ~~the~~ production is also low and will remain so at least for the time being. In the past two years, 1960-61, less than 50 million pounds of industrial trawl fish have been landed each year to serve the needs of all of these fisheries.

There is little research being done at this time on these fisheries as specific entities. Routine sampling continues.

2  
20

~~ICNAF REPORT~~

Mesh Selection

Extensive experimentation was carried out in August 1961, (Delaware Cruise 61-12) by the Woods Hole Laboratory personnel on the possibilities of differentially selecting species as well as controlling the sizes retained.

Silver hake selection experiments were also carried out using 2-1/2, 3 and 3-1/2 inch double manila codends. For these experiments the basic net was a 36 Yankee of single manila 2-inch mesh twine. The lower half of the codend was lined with 1-inch cotton twine. The upper portion was covered with an additional loose bag (cover) of 1-inch cotton to retain those fish that escaped. All individuals of all species in both the cover and codend were measured, providing useful escapement data on all species captured in any number.

Silver hake appear to have reasonably sharp selection characteristics (fig. 2). There was some evidence that gilling

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~~Figure 1. --Graph of selection data.~~

---

might account for some of the minor irregularity at the upper end of the selection curve. Unfortunately, there were relatively few fish in the population between 18 and 22 centimeters in length, accounting for the scatter in the data for those lengths.

The differential selection experiments were interesting and revealing although no immediately useful technique was developed that would enable a commercial boat to selectively catch either silver hake or haddock, the two species of principal concern. Different species did behave quite differently in the net. It was possible to differentially select for approximately 70 percent of the silver hake and about 80 percent of the cod and haddock, and in addition, to control in the usual manner, the sizes retained of each of these groups. The variability of species selection was considerable, and further behavioral research will be required before this variability can be reduced to reasonable limits.

2/16/62

GROUND FISH ECOLOGY

←

The program of study of the relationship of environmental conditions to the distribution and abundance of groundfish species was continued. An annual fall survey cruise ( M.V. Delaware 61-19) was conducted which extended from the Bay of Fundy southward to the Hudson Canyon to determine the distribution of groundfish species and the year-class strength of the young-of-the-year haddock (Figure ~~2~~<sup>3</sup>). Sixty-five different species of fish were caught, counted and measured during the cruise.

Preliminary results showed that no haddock were caught south of 41° 00' N. Lat., while haddock were caught at 81 percent of the stations fished north of 41°. Catches for the northern part of the cruise showed that haddock were caught at all depths fished, but the greatest quantity were taken between 60 and 90 fathoms. These data also indicate that the larger size haddock inhabited the deeper waters.

The silver hake (Merluccius bilinearis), white hake (Urophycis tenuis), and the red hake (Urophycis chuss) were also found at all depths fished, but the silver hake were concentrated at depths greater than 90 fathoms, while the white hake were found between 60 and 120 fathoms, and the red hake between 60 and 90 fathoms.

The most frequently caught species on the northern half of the cruise were the silver hake, haddock, redfish, and dabs, while the silver hake, butterfish, scup, and red hake were the most frequently caught species on the southern part of the cruise.

Mesh Assessment

We have continued our studies of the effects on the yield of increasing the size of mesh in codends of trawl nets. These studies involve two different aspects: one is assessing the effectiveness of the current 4-1/2-inch mesh regulation for cod and haddock; the other is how increases in mesh size would effect the yields of other species.

The latter studies have been carried out in conjunction with the mesh assessment working group of ICNAF, and the <sup>initial</sup> results are summarized in Document 20 of the 1961 Annual Meeting of ICNAF. The important redfish, silver hake, and industrial fisheries in sub-area 5 could not be sustained with a mesh as large as 4-1/2 inches; however the dynamics of the species involved are not well enough known to provide a precise estimate of the effects of various mesh sizes. These studies are continuing as further information becomes available.

We have tried, by several methods of analysis, to determine the effects of the current 4-1/2-inch mesh regulation on haddock yield-per-recruit. The results of these analysis have not been defintative. Only one complete year class has passed through the fishery since the regulation has been fully imple- mented, ~~however, and~~ <sup>subsequent</sup> additional data from ~~ensuing~~ year classes are needed for further analysis.

~~United States Research in Convention Area During 1961~~Sea Scallop (Placopecten magellanicus (Gmelin))

The fishery. United States landings of sea scallop meats from Subarea 5 in 1961 were greater than in 1960, the previous record year.

*Table 6. - Trends in the sea scallop fishery.*

| Year | Landings<br>(millions of pounds) | Days fished | Average landings<br>per day (pounds) |
|------|----------------------------------|-------------|--------------------------------------|
| 1952 | 12.1                             | 7,742       | 1,563                                |
| 1953 | 16.3                             | 10,031      | 1,625                                |
| 1954 | 15.5                             | 9,343       | 1,659                                |
| 1955 | 18.3                             | 11,619      | 1,575                                |
| 1956 | 17.5                             | 12,246      | 1,429                                |
| 1957 | 17.3                             | 10,500      | 1,651                                |
| 1958 | 14.4                             | 8,775       | 1,637                                |
| 1959 | 18.7                             | 8,556       | 2,189                                |
| 1960 | 21.9                             | 8,039       | 2,725                                |
| 1961 | 23.6                             | 8,655       | 2,724                                |

Research - One cruise was made to test the effect of various combinations of ring size and ring linkage on the size composition of the catch. Two survey cruises were made to collect data on the abundance of the fishable stock, and strength of the pre-recruit year-classes. Results of the analysis of these data are reported elsewhere in Commission documents.

An experiment was conducted in a large aquarium tank to see if the tag used in previously reported tagging experiments inhibited movement. Results show that tagged animals move about in the same manner as untagged animals, and that the small amount of dispersion of recaptured tagged scallops from the point of release can be regarded as typical of the untagged part of the population as well.

Two meetings were held during the year between Canadian and United States biologists interested in the sea scallop fishery to discuss and compare results of their programs of investigations. The reports of these meetings are to be found in other Commission documents.

~~ICNAP ANNUAL REPORT~~

Benthic Studies  
~~R. L. Wiggley~~

Studies of bottom sediments, macroscopic benthic invertebrates, and food habits of groundfish were continued in 1961. A preliminary examination of bottom sediment samples recently taken from the central and northern sections of the Gulf of Maine indicate that silt and clay are the principal substrate components. However, in some shallow areas, such as Cashes Ledge and Jeffreys Ledge, mixtures of sand and gravel are predominant. Also, in certain deepwater areas near Browns Bank and in moderately shallow water between Browns Bank and the Lurcher Shoal region, sand and shell are the major sediment components.

Although haddock are exceedingly omnivorous feeders and were long considered to be non-selective in their choice of foods, recent information has been obtained which reveals selective feeding, at least in some localities. ~~A quantitative comparison of haddock stomach contents with benthic fauna samples indicates that haddock are discriminating in their selection of food items. Haddock from the northeastern section of Georges Bank appeared to distinct~~ favor crustaceans and, to a lesser extent, echinoderms, <sup>over</sup> but tend ~~to~~ mollusks, annelids, and miscellaneous groups.

Table 7. -- Comparison of haddock diet and available bottom food on northeastern Georges Bank.

(28)

Samples from northeastern Georges Bank

| Group         | Benthic fauna<br>(% weight) | Haddock stomachs<br>(% volume) |
|---------------|-----------------------------|--------------------------------|
| Mollusca      | 38                          | 22                             |
| Echinodermata | 10                          | 13                             |
| Miscellaneous | 34                          | 27                             |
| Annelida      | 10                          | 6                              |
| Crustacea     | 8                           | 32                             |
|               | 100                         | 100                            |

A study of food habits of haddock from one locality throughout a one-year period has shown there are no important differences between males and females in the kinds of animals preyed upon or the quantities of food ingested. A moderately low feeding rate prevailed throughout the year except in June when feeding was intensified remarkably. Differences in diet composition were associated with haddock size and season of the year.

## Environmental Studies

### Bureau of Commercial Fishery Studies

Plankton. Analysis of the zooplankton samples collected in 1953 have been completed and the analysis of the 1955 samples is underway.

Hydrography. Temperature norms for the area bounded by latitude  $39^{\circ}00'N$  and  $45^{\circ}30'N$  and longitude  $64^{\circ}00'W$  and  $72^{\circ}00'W$  are being computed by analysis of bathythermograph and hydrographic data collected between 1940 and 1960.

Woods Hole Oc. Inst.

~~Kenneth Cumming~~

~~ICNAF Report~~

EXPERIMENTAL STUDIES



The program of experimental studies has concentrated on the two major projects of racial stock identification and larval fish biology. The racial characterization of various geographically separate haddock populations has been undertaken using serological techniques. Specific erythrocyte precipitation (agglutination) reactions have been found using haddock sera (isoagglutinins) as well as miscellaneous fish, arthropod and rabbit anti-haddock sera (heteroagglutinins). Preliminary results show that while isoagglutinins are present in haddock their frequency and titre are low, and not useful for racial identification. Heteroagglutinations, on the other hand, show higher titres and a differential haddock cell response in several cases. These tools have not yet been applied on a large scale population analysis.

The work on larval fish biology has focused on a weekly survey of local waters to tabulate the numbers of species and individuals as a function of season. Eggs and larvae from the sampling have been used for laboratory growth and development experiments. Present information implies successful rearing of sculpin from pre-spawning adults through to month old larvae.

*Hydrography*

*Dean F. Bumpus  
Woods Hole Oceanographic  
Institution  
Woods Hole, Massachusetts*

Hydrographic research by the U. S. A. in the Convention area was carried out by three agencies during 1961: the U.S. Coast Guard, the Bureau of Commercial Fisheries and the Woods Hole Oceanographic Institution.

A. The U.S. Coast Guard, as the agency operating the International Ice Patrol, examined the temperature and salinity distribution from the surface to 1500 meters in 4 network surveys in the Grand Bank regions. The first survey, 2-15 April, covered waters over and immediately seaward of the southern and eastern slopes of the Grand Bank from just westward of the tail of the Bank northward to the latitude of Flemish Cap. The second survey, 29 April to 5 May, covered the area immediately seaward of the northeastern slope of the Grand Bank from Flemish Cap northwestward as far as but not including the Bonavista triangle. The third survey, 25 May - 5 June, covered an area similar to the first. The fourth survey, 14-22 June, covered an area similar to the second but included the Bonavista triangle. The post season cruise, 3 to 11 July, occupied the Bonavista triangle and the Labrador - Cape Farewell section to within 6 miles of Cape Farewell.

The season was characterized by an abnormal amount of sea ice on the east coast of Newfoundland and the eastern part of the south coast. Labrador Current water along the eastern slope of the Grand Banks was below normal and south of the latitude of Flemish Cap very nearly absent in early April. This was followed by a steady return toward normal

conditions which were reached about mid-June. The cold subsurface temperatures in the Labrador Current were warmer than normal in early season and also returned to about normal values in June. On the post-season cruise both the Labrador Current off the South Wolf Island and the West Greenland Current off Cape Farewell showed positive anomalies in volume and temperature.

The report in toto will be published in U.S. Coast Guard Bulletin No. 47.

B. The Bureau of Commercial Fisheries Biological Laboratory at Boothbay Harbor undertook a number of temperature surveys at monthly intervals from Gloucester, Massachusetts to off Eastport, Maine. ~~in Section 5~~

C. The Woods Hole Oceanographic Institution together with the Fisheries Research Board of Canada released 23,378

drift bottles in areas 4 and 5 throughout the year with approximately 10% return.

The examination of non-tidal drift at the bottom using Woodhead Sea Bed Drifters was commenced during the year in area 5.

The thirteen lightship stations from Maine to Georgia equipped, at the end of 1955 as observation posts to collect surface temperature and salinity observations daily, bathythermograms daily and bottom water samples weekly, have continued in operation supplemented with surface water temperatures from several shore stations and Texas Towers 2 and 3. Many of the lightships also released drift bottles daily as part of the drift bottle program mentioned above.

*Morone chrysops* (Mitchell)  
Silver Hake (*Morone chrysops*)

The Fishery.

The silver hake fishery in New England ~~has declined~~ <sup>in 1960 due</sup> ~~some-~~ <sup>to the curtailment of the industrial fishery.</sup> In 1961 a drop in landings ~~what in the past several years.~~ This decline is, in part, due to a ~~decrease in availability and possibly abundance as well.~~ Landings ~~are also down due to the relatively small amounts being landed in~~ <sup>for food fish was due apparently to lower availability, and possibly</sup> ~~recent years as industrial fish.~~ <sup>abundance.</sup>

Table 3

Trends in the New England Silver Hake Fishery.  
New England landings of silver hake, 1952-60. In  
millions of pounds, round.

|       | For Food | For Industrial | For Animal Food   | Total |
|-------|----------|----------------|-------------------|-------|
| 1952  | 117      | 9              | 2                 | 128   |
| 1953  | 85       | 16             | 3                 | 104   |
| 1954  | 90       | 21             | 6                 | 117   |
| 1955  | 111      | 23             | 10                | 144   |
| 1956  | 89       | 30             | 11                | 130   |
| 1957  | 117      | 38             | 16                | 171   |
| 1958  | 107      | 23             | 17                | 147   |
| 1959  | 110      | 26             | 20                | 156   |
| 1960* | 103      | 4.6            | 20 <del>(2)</del> | 127.6 |
| 1961  | 87       | 5.0            | 16                | 108.0 |

\* preliminary estimates

Research

In the past year research on silver hake has included studies on ~~their~~ behavior and selection (see section on mesh selection), and on ~~their~~ availability and abundance. <sup>although, in this data base</sup> This data has not been fully analyzed at this time; ~~none the less it demonstrates~~ <sup>a</sup> marked seasonal

1) not available

Regional Director, Region 3, BCF,  
Gloucester, Massachusetts

13 March 1962

Laboratory Director, BCF, Biological Laboratory,  
Woods Hole, Massachusetts

Report "United States Research in the Convention Area during 1962"  
Herbert W. Graham

Enclosed herewith are two (2) copies of subject report; one copy to be  
forwarded to Poulsen and one for your files.

Herbert W. Graham

Enclosures

dcj