RESTRICTED

International Commission for the Northwest Atlantic Fisheries

Serial No. 3490
(D.a.74)

ICNAF Summ.Doc. 75/16

ANNUAL MEETING - JUNE 1975

# UNITED STATES RESEARCH REPORT, 1974

The United States landed fish from ICNAF Subareas 4 and 5 and Statistical Area 6. Research was conducted in Subareas 3, 4 and 5 and Statistical Area 6. Table 1 gives a summary of U.S. finfish and sea scallops nominal catches for 1973 and 1974.

Table 1. United States finfish and sea scallops nominal catches for 1973 and 1974 (metric tons, round fresh).

| Species | Year | Subarea 4 | Subarea 5 | Subarea 6 | Total |
|---|---|---|---|---|---|
| Haddock | 1973 | 441 | 3314 | 2 | 3757 |
| | 1974 | 675 | 3034 | -- | 3709 |
| Cod | 1973 | 181 | 22001 | 256 | 22438 |
| | 1974 | 412 | 25290 | 61 | 25763 |
| Redfish | 1973 | 12928 | 11922 | -- | 24850 |
| | 1974 | 9928 | 8690 | -- | 18618 |
| Pollock | 1973 | 571 | 5752 | 1 | 6324 |
| | 1974 | 677 | 7719 | 4 | 8400 |
| Yellowtail | 1973 | 2 | 26139 | 4937 | 31078 |
| | 1974 | 5 | 24160 | 1777 | 25942 |
| Other Flounder | 1973 | 78 | 13185 | 6144 | 19407 |
| | 1974 | 83 | 12640 | 6234 | 18957 |
| Silver Hake | 1973 | -- | 15976 | 4024 | 20000 |
| | 1974 | -- | 9535 | 4686 | 14221 |
| Red Hake | 1973 | 1 | 2940 | 1211 | 4152 |
| | 1974 | -- | 1887 | 822 | 2709 |
| Sea herring | 1973 | -- | 25505 | 526 | 26031 |
| | 1974 | -- | 32392 | 278 | 32670 |
| Mackerel | 1973 | -- | 685 | 716 | 1401 |
| | 1974 | -- | 428[1] | 565 | 993 |
| River herring[2] | 1973 | -- | 1561 | 8735 | 10296 |
| | 1974 | -- | 1589 | 15186 | 16775 |

Table continued next page.

| | | | | | |
|---|---|---|---|---|---|
| Menhaden | 1973 | -- | 30780 | 299760 | 330540 |
| | 1974 | -- | 35219 | 300000 | 335279 |
| Other finfish | 1973 | 162 | 17206 | 37534 | 54902 |
| | 1974 | 876 | 19622 | 51037 | 71555 |
| Total finfish | 1973 | 14364 | 176966 | 363846 | 555176 |
| | 1974 | 12676 | 182265 | 380650 | 575591 |
| Sea scallop | 1973 | -- | 12853 | 6404 | 19864 |
| | 1974 | -- | 9609 | 7810 | 17419 |

[1]Preliminary data.

[2]Alewife and blueback herring.

## Subarea 3

### B. SPECIAL RESEARCH STUDIES

The U.S. Coast Guard conducted oceanographic surveys in support of the International Ice Patrol in Div. 3N, L, and O.

## Subarea 4

### A. STATUS OF THE FISHERIES

#### 1. Haddock

The U.S. nominal catch of haddock from Subarea 4 in 1974 was only 675 tons. Div. 4X landings in 1974 were 670 tons. Landings from Browns Bank, the principal area fished by U.S. vessels in Div. 4X from 1973 (Table 2). Research survey YOY (young of the year) index indicates that abundance will continue low.

Table 2. U.S. haddock statistics, Div. 4X (metric tons, round fresh).

| Year | Division 4X | | Browns Bank | | |
|---|---|---|---|---|---|
| | Landings | YOY Survey[1] Index | Landings | Days fished | Landings/ days fished |
| 1965 | 3,685 | 1.51 | 1,786 | 275 | 6.5 |
| 1966 | 2,473 | 1.32 | 939 | 200 | 4.7 |
| 1967 | 5,014 | 1.10 | 2,059 | 381 | 5.4 |
| 1968 | 3,156 | 1.51 | 2,278 | 506 | 4.5 |
| 1969 | 1,830 | 3.31 | 1,305 | 389 | 3.4 |
| 1970 | 1,744 | 1.03 | 1,576 | 493 | 3.2 |
| 1971 | 751 | 6.08 | 605 | 242 | 2.5 |
| 1972 | 448 | 2.28 | 387 | 117 | 3.3 |
| 1973 | 269 | 1.83 | 268 | 107 | 2.5 |
| 1974 | 670 | 2.90 | 648 | --[2] | --[2] |

[1]Mean catch per haul (linear scale retransformed from $\log_{10}$ scale).

[2]Landings/day not calculated due to 10% trip limitation.

#### 2. Cod

The U.S. fleet landed 412 tons of cod from Subarea 4 in 1974, 231 tons more than in 1973.

3. Redfish

U.S. landings of redfish in 1974 from the Gulf of St. Lawrence (Div. 4R, S, and T) were 1,031 tons. Landings from the Scotian Shelf (Div. 4V, W, and X) by U.S. vessels were 8,897 tons, a decrease from 1972. Commercial landings per day and research survey abundances decreased for the Scotian Shelf in 1974 (Tables 3, 4).

Table 3. U.S. redfish statistics, Div. 4R, S and T (metric tons, round fresh).

| Year | Landings | Days fished | Landings/ days fished |
|---|---|---|---|
| 1965 | 17,099 | 803 | 21.3 |
| 1966 | 12,766 | 608 | 21.0 |
| 1967 | 15,482 | 622 | 24.9 |
| 1968 | 16,437 | 740 | 22.2 |
| 1969 | 12,122 | 689 | 17.6 |
| 1970 | 7,592 | 593 | 12.8 |
| 1971 | 4,706 | 490 | 9.6 |
| 1972 | 1,111 | 104 | 10.7 |
| 1973 | 1,638 | 144 | 11.4 |
| 1974 | 1,031 | 104 | 9.9 |

Table 4. U.S. redfish statistics, Div. 4V, W and X (metric tons, round fresh).

| Year | Landings | Days fished | Landings/ days fished | Survey Wt/tow[1] |
|---|---|---|---|---|
| 1965 | 13,082 | 1,246 | 10.5 | 28.7 |
| 1966 | 16,680 | 1,183 | 14.1 | 20.2 |
| 1967 | 6,407 | 593 | 10.8 | 33.4 |
| 1968 | 4,635 | 297 | 15.8 | 15.3 |
| 1969 | 1,142 | 75 | 15.3 | 42.6 |
| 1970 | 1,949 | 135 | 14.2 | 50.4 |
| 1971 | 6,261 | 404 | 15.5 | 39.7 |
| 1972 | 12,365 | 840 | 14.7 | 25.7 |
| 1973 | 11,290 | 965 | 11.7 | 38.6 |
| 1974 | 8,897 | 780 | 11.4 | 16.1 |

[1]Weight in pounds.

B. SPECIAL RESEARCH STUDIES

Research and environmental studies in Div. 4X are part of a larger program carried out in Subarea 5 and Statistical Area 6. They are reported under Subarea 5.

## Subarea 5

### A. STATUS OF THE FISHERIES

1. Haddock

Haddock landings from Subarea 5 in 1974 were again limited by quota regulations set by the Commission, and U.S. vessels landed 3,034 tons (Table 5)

Table 5 U.S. haddock statistics, Subarea 5 (metric tons round fresh).

| Year | Subarea 5 landings | Div. 5Y landings | Div. 5Zw landings | Div. 5Ze | |
|---|---|---|---|---|---|
| | | | | Landings | Adjusted landings/ standard day fished |
| 1965 | 57,027 | 4,204 | 26 | 52,797 | 5.68 |
| 1966 | 57,497 | 4,579 | 31 | 52,887 | 5.27 |
| 1967 | 39,580 | 4,852 | 37 | 34,691 | 4.02 |
| 1968 | 28,887 | 3,418 | 16 | 25,453 | 3.11 |
| 1969 | 18,858 | 2,402 | 15 | 16,441 | 2.47 |
| 1970 | 9,872 | 1,457 | 15 | 8,400 | 1.82 |
| 1971 | 8,500 | 1,194 | 5 | 7,301 | 1.72 |
| 1972 | 4,771 | 901 | 3 | 3,867 | 1.77 |
| 1973 | 3,314 | 526 | 3 | 2,785 | 2.05 |
| 1974 | 3,034 | 628 | 2 | 2,404 | -- [1] |

[1]Landings/day not calculated due to 10% trip limitation.

The O-group index for haddock continues low (Table 6). Recruitment will continue to be low through at least 1976.

Table 6. U.S. research vessel index of relative year-class abundance of Georges Bank haddock based on autumn catches of O-group fish.

| Year | Index | Year | Index |
|---|---|---|---|
| 1959 | 9.6 | 1967 | 1.0 |
| 1960 | 2.4 | 1968 | 1.0 |
| 1961 | 1.4 | 1969 | 1.1 |
| 1962 | 2.6 | 1970 | 1.0 |
| 1963 | 12.6 | 1971 | 1.4 |
| 1964 | 2.0 | 1972 | 2.0 |
| 1965 | 1.2 | 1973 | 1.8 |
| 1966 | 1.7 | 1974 | 1.3 |

2 Cod

U.S. landings of cod from Subarea 5 in 1974 increased slightly (Table 7). Total catches by all countries in recent years have been high, exceeding or being close to the sustainable yield. U.S. commercial landings per day fished from Georges Bank have increased since 1968; however, this is probably a reflection of change in fishing practices (i.e. a greater directed fishery for cod in the absence of haddock) The research survey index has decreased to the 1966 level.

Table 7. U.S. cod statistics, Subarea 5 (metric tons, round fresh).

| Year | Subarea 5 landings | Div 5Y landings | Subdiv. 5Zw landings | Subdiv. 5Ze | | |
|---|---|---|---|---|---|---|
| | | | | Landings | Landings/ day fished | Survey Wt/tow[1] |
| 1965 | 15,011 | 3,780 | 215 | 11,016 | 0.9 | 15.9 |
| 1966 | 15,343 | 4,008 | 345 | 10,990 | 1.1 | 11.1 |
| 1967 | 18,057 | 5,527 | 684 | 11,846 | 1.0 | 18.5 |
| 1968 | 21,045 | 6,360 | 836 | 13,849 | 1.4 | 11.7 |
| 1969 | 24,175 | 7,823 | 1,143 | 15,209 | 1.7 | 10.9 |
| 1970 | 22,347 | 7,812 | 1,182 | 13,353 | 2.1 | 17.1 |
| 1971 | 23,175 | 7,380 | 796 | 14,999 | 2.0 | 13.4 |
| 1972 | 19,704 | 6,564 | 662 | 12,478 | 2.6 | 31.3 |
| 1973 | 22,001 | 6,063 | 1,092 | 14,846 | 3.4 | 42.0 |
| 1974 | 25,290 | 7,426 | 1,220 | 16,645 | 3.9 | 11.2 |

[1]Weight in pounds.

3. Silver hake

Total U.S. Silver hake findings from Subarea 5 in 1974 decreased (Table 8). Better recruitment in the last two years has prevented further large declines in stock with increased catches, but has not permitted recovery (see Table 9) as indicated by research vessel surveys.

Table 8. U.S. silver hake statistics, Subarea 5 (metric tons, round fresh).

| Year | Subarea 5 landings | Food Fish | | | Industrial & Food Fish | |
|---|---|---|---|---|---|---|
| | | Div. 5Y landings | Div. 5Ze landings | Landings/ day fished | Div. 5Zw landings | Landings/ day fished |
| 1965 | 41,809 | 22,605 | 11,169 | 11.3 | 8,035 | 4.4 |
| 1966 | 40,771 | 21,323 | 16,222 | 12.7 | 3,226 | 1.4 |
| 1967 | 30,986 | 14,390 | 12,692 | 9.3 | 3,904 | 3.4 |
| 1968 | 35,919 | 24,706 | 6,451 | 14.0 | 4,762 | 4.0 |
| 1969 | 20,333 | 14,609 | 1,654 | 4.9 | 4,070 | 4.6 |
| 1970 | 19,379 | 11,384 | 4,238 | 3.7 | 3,757 | 2.2 |
| 1971 | 13,332 | 8,263 | 3,069 | 2.6 | 2,000 | 3.4 |
| 1972 | 8,036 | 5,548 | 879 | 4.3 | 1,609 | -- |
| 1973 | 15,976 | 8,348 | 5,704 | 7.2 | 1,924 | -- |
| 1974 | 9,535 | 4,634 | 2,285 | 1.3 | 2,616 | -- |

Table 9. Silver hake abundance indices (mean catch/tow in pounds) from U.S. autumn survey cruises.

| Year | Div. 5Y (Gulf of Maine) | | Subdiv. 5Ze (Georges Bank) | | Subdiv. 5Zw-Div. 6A (So. New England) | |
|---|---|---|---|---|---|---|
| | Spring | Fall | Spring | Fall | Spring | Fall |
| 1963 | - | 58.31 | - | 7.9 | - | 11.5 |
| 1964 | - | 10.3 | - | 2.8 | - | 12.5 |
| 1965 | - | 17.4 | - | 3.3 | - | 16.8 |
| 1966 | - | 9.4 | - | 3.3 | - | 7.9 |
| 1967 | - | 5.3 | - | 2.3 | - | 9.8 |
| 1968 | .1 | 4.2 | .8 | 5.5 | 16.2 | 10.5 |
| 1969 | .4 | 5.4 | 1.2 | 3.7 | 8.4 | 5.1 |
| 1970 | .7 | 6.6 | 1.6 | 2.8 | 3.7 | 5.7 |
| 1971 | .8 | 6.1 | 1.7 | 2.7 | 8.2 | 10.1 |
| 1972 | 3.8 | 14.3 | 1.1 | 3.0 | 5.1 | 8.8 |
| 1973 | 1.6* | 9.2 | 1.8* | 3.8 | 2.6* | 7.1 |
| 1974 | 1 6* | 8.3 | .7* | 2.4 | 3.7* | 2.7 |

*These spring cruises were made with the Yankee #41 trawl so these values have been adjusted to the normal #36 trawl.

4. Redfish

U.S. landings of redfish from Subarea 5 decreased in 1974 (Table 10).

Table 10. U.S. redfish statistics, Subarea 5 (metric tons, round fresh).

| Year | Total Subarea 5 landings | Div. 5Y (Gulf of Maine) | | |
|---|---|---|---|---|
| | | Landings | Days fished | Landings/ days fished |
| 1965 | 6,986 | 5,045 | 742 | 6.8 |
| 1966 | 7,204 | 4,719 | 429 | 11.0 |
| 1967 | 10,442 | 6,746 | 649 | 10.4 |
| 1968 | 6,576 | 4,060 | 292 | 13.9 |
| 1969 | 12,038 | 9,637 | 824 | 11.7 |
| 1970 | 15,534 | 13,551 | 1,473 | 9.2 |
| 1971 | 16,267 | 12,541 | 1,695 | 7.4 |
| 1972 | 13,161 | 7,150 | 1,132 | 6.3 |
| 1973 | 11,922 | 7,008 | 1,168 | 6.0 |
| 1974 | 8,690 | 5,464 | 1,012 | 5.4 |

The stock is maintaining itself at the lowered level of the past few years (Table 11).

Table 11. Redfish abundance indices from U.S. autumn survey cruises.

| Year | Div. 5Y (Gulf of Maine | | Subdiv. 5Ze (Georges Bank) | |
|---|---|---|---|---|
| | Wt/tow[1] | No/tow | Wt/tow[1] | No/tow |
| 1965 | 30.8 | 62.1 | 2.5 | 4.1 |
| 1966 | 69.9 | 96.8 | 4.4 | 11.4 |
| 1967 | 56.7 | 100.8 | 5.8 | 18.3 |
| 1968 | 95.3 | 154.7 | 7.7 | 11.3 |
| 1969 | 47.0 | 66.5 | 14.4 | 17.6 |
| 1970 | 74.5 | 96.3 | 10.2 | 13.3 |
| 1971 | 56.0 | 50.8 | 4.1 | 6.2 |
| 1972 | 55.0 | 54.8 | 8.5 | 10.8 |
| 1973 | 38.2 | 39.8 | 5.8 | 6.2 |
| 1974 | 58.2 | 51.0 | 4.1 | 6.1 |

[1]Weight in pounds.

5. Yellowtail

The U.S. total catch of yellowtail (including discards) from Subarea 5 in 1974 was about 2,000 tons (Table 12), below that of 1973. Yellowtail landings for food decreased slightly while landings of yellowtail for industrial purposes were negligible.

The Southern New England survey abundance indices remained low (Table 13).

Table 12. U.S. yellowtail statistics, Subarea 5 (metric tons, round fresh).

| Year | Food landings | Landings/ day fished | Estimated discards | Estimated industrial landings | Total catch |
|---|---|---|---|---|---|
| 1965 | 36,218 | 3.1 | 12,893 | 972 | 50,083 |
| 1966 | 28,656 | 2.0 | 8,253 | 2,364 | 39,273 |
| 1967 | 20,819 | 2.2 | 14,407 | 4,587 | 39,813 |
| 1968 | 28,645 | 3.0 | 10,627 | 3,939 | 43,211 |
| 1969 | 28,739 | 2.7 | 5,202 | 4,265 | 38,206 |
| 1970 | 29,825 | 2.5 | 10,689 | 2,095 | 42,608 |
| 1971 | 21,700 | 2.1 | 7,124 | 397 | 29,221 |
| 1972 | 23,886 | 2.1 | 3,100 | 327 | 27,313 |
| 1973 | 24,710 | 2.2 | 1,086 | 343 | 26,139 |
| 1974 | 23,145 | 1.8 | 993 | 22 | 24,160 |

Table 13. Yellowtail abundance indices from U.S. survey cruises.

| Year | S. New England (W. of 69°) No/tow | S. New England (W. of 69°) Wt/tow[1] | Georges Bank (E. of 69°) No/tow | Georges Bank (E. of 69°) Wt/tow[1] |
|---|---|---|---|---|
| 1963 | 50.6 | 32.1 | 30.1 | 22.0 |
| 1964 | 60.8 | 41.9 | 23.0 | 23.4 |
| 1965 | 38.7 | 28.0 | 15.0 | 15.7 |
| 1966 | 50.3 | 20.8 | 14.8 | 6.7 |
| 1967 | 57.7 | 31.0 | 19.2 | 13.0 |
| 1968 | 40.2 | 22.1 | 25.6 | 18.1 |
| 1969 | 54.8 | 31.7 | 23.1 | 16.0 |
| 1970 | 39.8 | 24.7 | 13.4 | 8.6 |
| 1971 | 41.7 | 20.2 | 15.2 | 11.0 |
| 1972 | 73.3 | 44.3 | 14.6 | 10.9 |
| 1973 | 7.9 | 5.0 | 13.1 | 9.5 |
| 1974 | 6.9 | 14.1 | 10.0 | 6.3 |

[1]Weight in pounds.

6. Red hake

Red hake landings by U.S. vessels from Subarea 5 in 1974 declined (Table

The 1974 autumn research vessel survey cruise indicated a decrease in stock abundance for all three subdivisions (Table 15).

Table 14. U.S. red hake statistics, Subarea 5 (metric tons, round fresh).

| Year | Subarea 5 landings | Food Fish: Div. 5Y landings | Food Fish: Subdiv. 5Ze landings | Industrial Fish: Subdiv. 5Zw landings | Industrial Fish: Landings/ day fished |
|---|---|---|---|---|---|
| 1965 | 13,493 | 192 | 385 | 12,916 | 9.1 |
| 1966 | 4,280 | 634 | 845 | 2,801 | 2.3 |
| 1967 | 5,759 | 92 | 169 | 5,498 | 5.6 |
| 1968 | 6,216 | 82 | 161 | 5,973 | 7.0 |
| 1969 | 4,923 | 140 | 225 | 4,558 | 8.2 |
| 1970 | 4,281 | 249 | 100 | 3,932 | 6.3 |
| 1971 | 2,783 | 268 | 111 | 2,404 | 8.4 |
| 1972 | 1,711 | 373 | 160 | 1,178 | -- |
| 1973 | 2,940 | 286 | 77 | 2,577 | -- |
| 1974 | 1,887 | 407 | 81 | 1,399 | -- |

Table 15. Red hake abundance indices (mean pounds/tow) from U.S. autumn survey cruises.

| Year | Div. 5Y (Gulf of Maine) Spring | Fall | Subdiv. 5Ze (Georges Bank) Spring | Fall | Subdiv. 5Zw (So. New England) Spring | Fall |
|---|---|---|---|---|---|---|
| 1963 | - | 10.9 | - | 17.3 | - | 17.8 |
| 1964 | - | 1.5 | - | 5.8 | - | 9.6 |
| 1965 | - | 22.0 | - | 4.6 | - | 12.4 |
| 1966 | - | 1.6 | - | 33.1 | - | 6.4 |
| 1967 | - | 0.9 | - | 1.6 | - | 5.9 |
| 1968 | 2.0 | 0.3 | 0.6 | 3.0 | 4.3 | 9.7 |
| 1969 | 1.0 | 0.0 | 0.9 | 4.0 | 3.6 | 10.6 |
| 1970 | 0.9 | 0.3 | 1.9 | 2.2 | 5.3 | 8.6 |
| 1971 | 1.2 | 2.2 | 3.4 | 4.5 | 11.9 | 7.4 |
| 1972 | 2.9 | 4.1 | 2.4 | 2.6 | 12.2 | 14.6 |
| 1973 | 7.9 | 1.3 | 1.3 | 6.7 | 4.7 | 6.7 |
| 1974 | 4.4 | 1.1 | 0.5 | 3.4 | 3.5 | 1.2 |

7. Sea herring

The U.S. herring catch from Div. 5Y in 1974 increased (Table 16).

The U.S. catch of herring from Div. 5Z and Statistical Area 6 decreased. The U.S. research cruises showed a decrease in abundance indices for the spring, 1974 (Table 17).

Table 16. U.S. sea herring landings from Subarea 5 (metric tons, round fresh).

| Year | Subarea 5 | Div. 5Y | Subdiv. 5Ze | Subdiv. 5Zw | Statistical Area 6 |
|---|---|---|---|---|---|
| 1965 | 34,495 | 33,634 | 861[1] | - | - |
| 1966 | 30,589 | 29,365 | 1,224[1] | - | - |
| 1967 | 31,778 | 31,158 | 620[1] | - | - |
| 1968 | 42,083 | 41,476 | 9 | 598 | - |
| 1969 | 30,780 | 28,687 | 832 | 1,261 | - |
| 1970 | 30,484 | 29,181 | 272 | 1,031 | - |
| 1971 | 33,890 | 31,491 | 1,194 | 1,205 | - |
| 1972 | 40,473 | 38,211 | 11 | 2,251 | - |
| 1973 | 25,675 | 21,601 | 162 | 3,912 | 529 |
| 1974 | 32,392 | 29,356 | 171 | 2,866 | 278 |

[1]Div. 5Z

Table 17. U.S. research cruise indices of herring abundance (mean number/tow).

| Year | Autumn cruises Georges Bank | Spring cruises S. New England | Spring cruises Mid-Atlantic |
|---|---|---|---|
| 1963 | 7.02 | - | - |
| 1964 | 1.13 | - | - |
| 1965 | 6.45 | - | - |
| 1966 | 10.41 | - | - |
| 1967 | 3.26 | - | - |
| 1968 | 1.36 | 120.6 | 17.4 |
| 1969 | 1.14 | 45.8 | 6.4 |
| 1970 | 0.66 | 34.7 | 1.2 |
| 1971 | 0.55 | 4.1 | 3.7 |
| 1972 | 1.06 | 5.7 | 2.6 |
| 1973 | 0.12 | 7.2 | 5.6 |
| 1974 | 0.12 | 2.1 | 1.3 |

8. Industrial Groundfish Fishery

New England landings for industrial purposes from Subarea 5 (predominantly Subdiv. 5Zw) decreased slightly in 1974 (Table 18).

Table 18. New England groundfish landings from Subarea 5 for industrial purposes (metric tons, round fresh).

| Year | Total landings | Species composition (%) for Subdiv. 5Zw | | | | |
|---|---|---|---|---|---|---|
| | | Silver hake | Red Hake | Flounder | Eel pout | Other |
| 1965 | 33,990 | 20.4 | 38.0 | 6.9 | 1.8 | 32.9 |
| 1966 | 27,461 | 9.6 | 10.2 | 18.2 | 25.0 | 37.0 |
| 1967 | 37,400 | 10.2 | 14.7 | 18.5 | 18.9 | 37.7 |
| 1968 | 34,729 | 9.9 | 17.2 | 16.5 | 24.2 | 32.2 |
| 1969 | 26,813 | 9.5 | 17.0 | 21.3 | 20.8 | 31.4 |
| 1970 | 20,696 | 6.3 | 17.9 | 16.7 | 28.3 | 30.8 |
| 1971 | 8,823 | 10.1 | 25.8 | 6.6 | 33.7 | 26.3 |
| 1972 | 5,944 | 2.1 | 17.9 | 10.3 | 35.3 | 35.8 |
| 1973 | 11,854 | 7.4 | 20.8 | 10.4 | 26.2 | 35.2 |
| 1974 | 10,121 | 7.0 | 12.9 | 5.0 | 29.6 | 45.5 |

9. Sea Scallops

U.S. sea scallop landings decreased in 1974 (Table 19). Because of low abundance, the number of U.S. vessels fishing for scallops has declined significantly in recent years.

Table 19. U.S. sea scallop statistics, Subarea 5 (metric tons, weight of adductor muscle only).

| Year | Landings | Days fished | Landings/ day fished |
|---|---|---|---|
| 1965 | 1,509 | 2,156 | 0.7 |
| 1966 | 901 | 1,001 | 0.9 |
| 1967 | 1,309 | 1,870 | 0.7 |
| 1968 | 1,163 | 1,938 | 0.6 |
| 1969 | 1,465 | 2,930 | 0.5 |
| 1970 | 1,553 | 2,588 | 0.6 |
| 1971 | 1,697 | 3,394 | 0.5 |
| 1972 | 1,347 | 2,694 | 0.5 |
| 1973 | 1,543 | 2,572 | 0.6 |
| 1974 | 1,153 | 1,647 | 0.7 |

Annual assessments were made for over twenty stocks of fish in the ICNAF area. New assessments were made for redfish in Division 5Y and for mackerel in Subareas 3-6 inclusive.

Improved information on which to base assessment was obtained for cod in Statistical Area 5 through estimates of growth and mortality rates based on aging the survey collections made annually by research vessels.

Cooperative research with the Mathematics Department of the University of Wisconsin, Milwaukee, Wisconsin, was begun for improving assessment models. Results to date will be reported to ICNAF as a research document for 1975 on "Maximizing Total Yield in a Multispecies Fishery", and "A Graphical Method for Estimating Parameters and Sample Models of Fisheries".

## B. SPECIAL RESEARCH STUDIES

### 1. Environmental Studies

#### a. Hydrographic Studies

Hydrographic studies in the ICNAF area have been conducted primarily by NMFS and the U.S. Coast Guard. A summary of activities in 1974 is presented in Summ. Doc. 75/7. Environmental observations by NMFS consist primarily of weather observations and temperature and salinity profiles recorded during trawl and plankton surveys, and these are listed in Table 20.

Table 20. Trawl and plankton surveys conducted by NEFC in the ICNAF area in 1974.

| Cruise | Dates | Purpose | Biological Stations | | Temp & Sal Profiles | | Area |
|---|---|---|---|---|---|---|---|
| | | | Trawl | Plankton | BT | STD | |
| Alb 74-2 | 11-22 Feb | Larval Herring | - | 71 | 82 | - | Georges Bank |
| Alb 74-4 | 12 Mar - 4 May | Spring Groundfish | 251 | 382 | 335 | 56 | Hatteras to Nova Scotia |
| Alb 74-9 | 13-23 Aug | Zooplankton & Hydrography | - | 64 | 180 | 38 | Georges Bank |
| Alb 74-11 | 20 Sep - 14 Nov | Fall Groundfish | 287 | 308 | 518 | 59 | Hatteras to Nova Scotia |
| Duchess 74-1 | 7-14 Sep | Larval Herring | - | 12 | 20 | - | Western Gulf of Maine |
| Delaware D-74-12 | 8-16 Oct | Larval Herring | - | 90 | 90 | - | Western Gulf of Maine |
| Alb 74-13 | 4-19 Dec | Larval Herring | - | 108 | 154 | 66 | Georges Bank to Gulf of Maine |

#### b. Plankton Studies

Fish eggs and larvae can be separated from invertebrate plankton by isopycnic sedimentation in gradients of colloidal silica. Equipment has been designed to automate this operation. Although at the current stage of development automatic sorting of ichthyoplankton is not feasible for all samples and situations, the system can appreciably reduce sorting time.

#### c. Larval and Juvenile Fish

The U.S. conducted five larval fish cruises, four of which were devoted to herring (Table 1), and U.S. observers also participated in 1974 larval herring cruises by France, Federal Republic of Germany, and Poland. Results of the herring cruises are reported in research documents for the 1975 annual meeting. Studies on distribution of juvenile sea herring caught in U.S. bottom trawl surveys are also reported in a research document.

#### d. Trawl Surveys

Standard spring and fall groundfish surveys were again conducted in 1974 by NEFC in cooperation with the Middle Atlantic Coastal Fishery Center in New Jersey. U.S. observers also participated in surveys conducted by other countries in SA's 5 and 6, as follows:

1) Spring juvenile herring survey (FRG) and hydroacoustic experiments (U.S.S.R.).

2) Joint U.S.-U.S.S.R. fall groundfish surveys by Albatross IV and Belogorsk, and a fall juvenile herring and mackerel survey by Poland on the Wieczno. The results of these surveys are reported in a number of research documents.

e. Other Environmental Studies

The quantitative food habits of 20 species of fish collected from 1969 to 1972 (by Albatross IV) are being analyzed and will be included in an ICNAF document.

A special study on the diets of cod, silver hake, and haddock emphasizes areal, seasonal, and sexual differences in the diet of each species. The food habits in this subarea are compared to those from Georges Bank, Gulf of Maine, Southern New England, and the Middle Atlantic.

Approximately 500 fish of selected species are collected annually as part of an ongoing monitoring survey. This survey will monitor the food habits of 17 indicator species, to observe diet trends over long time periods.

Research projects in the ICNAF area and inshore waters were carried out by the Northeast Fisheries Center and Sandy Hook Fisheries Center in cooperation with bordering states, universities and private institutions. A review of the physical oceanography of Massachusetts Bay was completed in 1974 under contract with the Woods Hole Oceanographic Institution. A three-year program of seasonal sampling of ichthyoplankton was begun at 50 stations in Cape Cod Bay using the standard bongo nets. The first year of intensive study of the oceanography, sedimentation and water quality in the waters off Hudson Canyon in the New York Bight has been completed by several research elements of NOAA.

2. Biological Studies by Species

a. Gadoids and Selected Species

Studies of spawning and fecundity in the Northwest Atlantic were continued with emphasis on haddock, cod, pollock, and yellowtail flounder. Observations on spawning and collections of fecundity samples were obtained off southern New England and southern Georges Bank March 28 to April 11 and northern Georges Bank, Gulf of Maine, Browns Bank and the Scotian Shelf, April 16 to May 5.

Summarized in Table 21 are percentages of haddock, cod, and yellowtail females in a particular maturity category for different geographic areas. The category "spent-recovering" includes those females in which the gonad was either recovering from recent spawning or was preparing to recycle for next year's spawning.

Off southern New England and on Georges Bank, cod were near the end of spawning, and yellowtail were just beginning to spawn. Haddock were half way through spawning; however, the "spent-recovering" category may be too high as will be explained below.

On Browns Bank and off Western Nova Scotia 15 percent of the haddock were spawning, and 41 percent were past spawning; 0 percent of the cod were spawning, and 81 percent were past spawning. For other areas, eastern Nova Scotia, Bay of Fundy, Gulf of Maine, and the Massachusetts Bay area insufficient maturity data were collected except for cod in the Massachusetts Bay area (see Table 21).

Table 21. Percentage of ovarian stages of mature females.

| Area | Dates | Species | Ripening | Spawning | Spent Recovering |
|---|---|---|---|---|---|
| So. New England | Mar 28-Apr 4 | Cod | 6 | 7 | 87 |
| | | Yellowtail | 85 | 1 | 11 |
| So. Georges Bank | Apr 4-8 | Haddock | 31 | 3 | 66* |
| | | Cod | 3 | 3 | 94 |
| | | Yellowtail | 83 | 1 | 16 |
| No. Georges Bank | Apr 18-21 | Haddock | 34 | 9 | 59* |
| | | Cod | 1 | 5 | 94 |
| Mass. Bay Area | Apr 17-19 | Cod | 33 | 8 | 59 |
| Browns Bank & W. Nova Scotia | Apr 22-27 | Haddock | 44 | 15 | 41 |
| | | Cod | 19 | - | 81 |

*Based upon visual examination, not histological study.

The 1974 haddock spawning season was characterized by two events: (1) the almost complete absence of the 1962-63 year class in Georges Bank samples, and (2) the preponderance of 2 and 3-year olds of the 1971-72 year classes, which made up 85 percent of the age composition on Georges Bank and around 40 percent on Browns Bank and western Nova Scotia.

The average size of the 1971 and 1972 year classes on Georges Bank was 41.3 cm and 49.6 cm respectively. Since female haddock on Georges Bank are known to mature at about 42 cm, we would expect some of the smaller females to spawn in 1974. We, however, had considerable difficulty in distinguishing the immature stage from the one that was possibly spent-recovering, thus indicating spawning. Therefore, we think the percentage for Georges Bank females is biased upward. Because of the difficulty of separating these two stages, we preserved a number of samples for future histological determination.

Fecundity estimates for Georges Bank haddock have been completed for 1969, 1971, 1972 and 1973. The 1970 material is expected to be ready early in 1975, and a summary document is planned for ICNAF in 1976. Fecundity material for pollock was collected on the fall groundfish survey and for yellowtail flounder in the spring survey.

The growth and survival of larval haddock in relation to the concentration of their planktonic prey was studied in the aquarium at the Narragansett Laboratory, where it was found that when newly hatched haddock (*Melanogrammus aeglefinus*) larvae were fed zooplankters at nominal rates of 0.5, 1.0, and 3.0/ml at 7 C, they grew at similar rates. After 6 weeks, they averaged 8.7, 10.0, and 11.2 mm in standard length and 810, 1300, and 1728 $\mu g$ in dry weight, and had condition factors of 1.25, 1.22, and 1.32. When fed at 0.1 and 0.01 plankters/ml, all larvae died in 3 and 2 weeks; at 0.5-3.0 plankters/ml, daily instantaneous mortality coefficients were 0.06-0.02 during 6 weeks. Larvae began feeding 2 days after hatching, and the point of no return after they were deprived of food was 6 days after hatching, yolk absorption being completed on day 6 or 7. All larvae deprived of food until 8 and 10 days after hatching, although initiating feeding, did not survive another 4 days. Prey concentration also influenced delayed feeding with greater percentages of larvae able to initiate feeding at higher plankton levels on the point-of-no-return day.

b. Winter flounder (*Pseudopleuronectes americanus*)

Studies of the influence of plankton concentration on survival of winter flounder larvae showed that percentages surviving at 3.0 pl/ml were much greater than at 1.0 pl/ml, and that 0.5 pl/ml is a limiting concentration. Growth appeared to be less affected than survival by plankton concentration. Embryos of summer flounder incubated in the ranges 8-26°C and 0.5-45.0% had best hatching percentages at 14-20 C and 25-30%. Greatest mortalities at all factor combinations occurred

in the blastula stage. Metabolic rates and growth rates from hatching to metamorphosis were determined for scup and summer flounder at respective temperature ranges of 15-21 C and 14-18 C. Digestion rates for summer flounder have been determined at several temperatures.

Studies of the use of hormones to induce ovulation and spermatogenesis in adult species and the use of cryogenetic techniques for storing sperm continued.

c. Deep Sea Red Crab (*Geryon quinquedens*)

A quantitative survey of the deep sea red crab, *Geryon quinquedens*, was conducted along the continental slope of northeastern United States from offshore Maryland to eastern Georges Bank (Subarea 5 and Statistical Area 6). This work was conducted in July, 1974, from aboard the research vessel Albatross IV. Water depths sampled ranged from 125 to 900 fathoms. The geographic and bathymetric distributions and estimates of population size of the red crab were determined by means of in situ photographs of the sea bottom obtained with a sled-mounted photographic system. Additionally, samples of red crabs were collected with a 4.9 meter semi-balloon otter trawl, for the purposes of ascertaining size composition, sex ratios, molting stages, and information pertaining to spawning.

## Statistical Area 6

### A. STATUS OF THE FISHERIES

Please refer to Table 1, Page 1 for finfish and sea scallop landings in Statistical Area 6.

### B. SPECIAL RESEARCH STUDIES

1. Biological Studies by Species

Deep sea red crab (for activities, please see Subarea 5).

2. Miscellaneous Studies - Food Habits of Fish

The quantitative food habits of 42 species of fish collected from this statistical area, 1969 to 1972, by the Albatross IV, are presently being analyzed.

Herring and mackerel collected from this area are included in the competition study (see Subarea 5).

The food habits of cod, silver hake, and haddock were determined, based on the analysis of 1,100 fish from this area.

Some 800 individuals of the major fish species are collected annually as a part of the ongoing food habits monitoring survey.

3. Gear and Selectivity Studies

The new candidate trawl for groundfish surveys, a modified, high-opening Yankee No. 41, designed, tested and measured during 1973, was employed for "interim use" during the Spring Groundfish Survey in ICNAF Subareas 4, 5, and 6. Additional field trials were made to calibrate this trawl against the old standard No. 36; formulation of catch coefficients by species remains to be completed.

Cooperative investigations into the nature of acoustic backscattering from fishes and other objects in sea water were conducted along lines agreed to during ICNAF meetings in January and June 1974. Cooperative cruises were conducted aboard the U.S.S.R. R/V Khronometer in March-April 1974, and the Polish R/V Wieczno in October 1974, and were reported in

included in an ICNAF document.

A preliminary study designed to investigate competition for food between herring and mackerel has been completed. Approximately 500 fish were collected for this research in the spring of 1974 by the research vessels Albatross IV and the Walther Herwig.

The food habits of cod, silver hake, and haddock were determined from the analysis of over 1,400 fish.

Stomach contents of approximately 800 fish are collected annually from this subarea as part of the ongoing fish food habits monitoring survey.

b. Manned Undersea Research

Two major missions were successfully completed in 1974; a mega-benthic crustacean cruise in July with the research submersible Nekton Gamma and a herring spawning and egg bed survey in October and November with SCUBA divers, bottom grab, and remote controlled TV sled. A total of 40 submarine dives were made at 6 submarine canyons on the outer New England Continental Shelf and Georges Bank to assess the distribution, abundance, behavior and general ecology of lobsters, crabs and shrimps. Further definition of the problem of derelict lobster pots was made.

During the fall operation the dive team discovered two herring spawning grounds on Jeffreys Ledge, Gulf of Maine. Detailed bottom samples were taken and photographs made along with bottom grabs to define the areal distribution of the egg beds. Estimates of various parameters pertaining to the dynamics of the egg bed were made by the divers through direct observations and in situ sampling. The success of this fall mission has resulted in a proposed joint international Man-in-the-Sea Program using the underwater laboratory Helgoland to conduct a complete and detailed ecological study on herring spawning and egg bed dynamics.

c. Plankton Sorting Center

The U.S.A.-Poland Cooperative Plankton Sorting and Identification Center opened in Szczecin, Poland in December 1974. An advisory committee of three representatives from Gdynia and Szczecin, and three from the U.S.A. was formed on December 10, 1974. The committee will meet at Szczecin in June 1975 to review progress and to decide on future activities.

d. Age Determination of Silver Hake (*Merluccius bilinearis*)

The lack of agreement between age-length tables prepared by the U.S. and Soviet researchers for silver hake emphasizes the need for standard methods of aging to secure the greatest probability of accurate ICNAF Res. Doc. No. 74/113, Serial No. 3354; Yudanov, I. I., J. B. Suomala, Jr., V. M. Vorobyov and K. A. Smith. Preliminary report of the first joint U.S.A.-U.S.S.R. hydroacoustic experiment in the ICNAF convention area, 11 March-15 April 1974 (6 pages). Additional cooperative work is scheduled for 1975.

Field experiments on means to avoid destructive fishing of lost lobster pots ("ghost pots") were concluded in 1974. This work included observation of trap-related lobster behavior, development of calibrated escape panels, and testing of degradable materials and panels designed to release all entrapped lobsters, crabs, and other animals upon elapse of desired time periods. Analysis and manuscript work are in progress.

A shrimp trawl mesh-selection project was concluded under the State-Federal Management Program. Under this project a trawl-mesh regulation for taking Pandalus borealis shrimp from Gulf of Maine waters was established. The current mesh regulation provides a minimum mesh size of 1 3/4" stretched mesh measured between knots in the trawl body and 1 1/2" in the cod-end as an interim measure. A revised regulation for a minimum of 1 3/4" body and 1 3/4" cod-end was proposed for promulgation as of June 1975.

4. Miscellaneous Studies

a. Food Habits of Fishes

The quantitative food habits of 33 species of fish collected from 1969 to 1972 (by Albatross IV) are presently being analyzed, to be results. Because whole otoliths often exhibit opacity that obscures annuli, U.S. researchers have experimented with thin sections cut transversely in the nucleus area of the otolith. The study is reported in Research Document 75-13.