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# Status of the Northwestern Atlantic Butterfish Stock - 1982

by

Gordon T. Waring and Emory D. Anderson

☑ Approved for Distribution

☑ Distribution to F/NWC, F/SWC, F/SEC, F/NWR1, & F/NEC (Technical Writer-Editor)

Signature Vaugh Carter

Date Dec 28, 1982

National Marine Fisheries Service
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Summary

The 1981 landings of butterfish (Peprilus triacanthus) off the USA Atlantic coast totalled 5,760 metric tons (mt). The USA landings (4,801 mt) declined slightly from the 1980 historical high of 5,262 mt. The distant-water-fleet (DWF) landings (959 mt) increased marginally over 1980 levels (800 mt). Based on January-November 1982 statistics, projected total landings in 1982 are 6,500 mt.

Length frequencies from 1981 DWF and USA landings indicate, as in previous years, that the DWF landings were comprised of younger age groups than the USA landings. This is due to the smaller mesh utilized by the DWF vessels in the mixed squid/butterfish fishery.

The NMFS autumn survey abundance and biomass indices for 1982 declined markedly from levels of the previous several years, but remained slightly above the 1968-1981 (excluding the high values of the last several years) average. The 1982 year class is less abundant than the three apparently strong year classes in 1979-1981.

Based on the recent performance of the USA fishery and the anticipated implementation of Amendment #3 to the Atlantic Butterfish Fishery Management Plan, total 1983 landings will probably be about 6,000 - 8,000 mt. Although the survey biomass index declined in 1982, the current biomass level should be sufficient to support landings in the above range.

## INTRODUCTION

Butterfish (Peprilus triacanthus) occur along the east coast of North America from Newfoundland to Florida (Hildebrand and Schroeder 1928), and are commercially important between Cape Hatteras and Southern New England. The stock north of Cape Hatteras migrates inshore and northward during the summer and offshore and southward to the edge of the continental shelf in late autumn where over-wintering occurs (Murawski and Waring 1979).

Butterfish were exploited exclusively by United States (USA) fishermen during 1920-1962. Distant-water fleets (DWF), initially from the USSR, began exploiting butterfish in 1963. Total nominal catch (live weight equivalent of landings exclusive of discards, hereafter referred to as landings) peaked at 19,500 metric tons (mt) in 1973, with over 90% taken by the DWF primarily as a by-catch to their squid fishing operations. High levels of non-reported butterfish discard occurred in the DWF directed squid fisheries during the mid-1960's to mid-1970's. Since 1977, the fishery has been prosecuted principally by USA fishermen.

This report describes the current status of the Northwest Atlantic butterfish stock in NAFO (Northwest Atlantic Fisheries Organization) Subareas 5 and 6 based on an examination of research vessel survey and commercial fishery data.

## MANAGEMENT HISTORY

Management of butterfish began during 1974-1976 under the International Commission for the Northwest Atlantic Fisheries (ICNAF) when butterfish was one of many species managed under ICNAF's "other finfish" category. In 1976, ICNAF imposed a separate butterfish total allowable catch (TAC) of 18,000 mt for 1977 (ICNAF 1977). Since March 1977, however, management of butterfish

has been under USA jurisdiction under the provisions of the Magnuson Fishery Conservation and Management Act of 1976 (MFCMA, Public Law 94-265). During February 1977, the National Marine Fisheries Service (NMFS) implemented a Preliminary Management Plan (PMP) for Finfish Caught Incidental to the Trawl Fisheries of the NW Atlantic which included butterfish. Under this PMP, an optimum yield (OY) of 18,000 mt was established for butterfish. This plan remained in effect until November 1979 when the Fishery Management Plan (FMP) for Atlantic Butterfish, prepared by the Mid-Atlantic Fishery Management Council, was implemented.

Under the FMP, management was changed from a calendar year to a fishing year (1 April 1979-31 March 1980) with an OY of 11,000 mt. Domestic annual harvest (DAH) was established at 7,000 mt with a total allowable level of foreign fishing (TALFF) of 4,000 mt. Amendment #1 to the FMP, approved March 1980, and Amendment #2, approved February 1981, extended the FMP through the fishing years 1980-1981 and 1981-1982, respectively. Amendment #3 received initial approval from NMFS in October 1982 and, when implemented, will merge the butterfish plan with both the Atlantic mackerel and squid plans. Under Amendment #3, as approved, the butterfish TALFF will be 6% of the allocated portion of the *Loligo* squid TALFF plus 1% of the allocated *Illex* squid, Atlantic mackerel, silver hake, and red hake TALFF's. Under this Amendment, the 11,000 mt OY will be maintained (Mid-Atlantic Fishery Management Council 1981).

## COMMERCIAL FISHERY

### Landings

Total landings of butterfish in 1981 (5,760 mt) were slightly below the 1980 level of 6,062 mt (Table 1). Landings of butterfish by the DWF increased

from 800 mt in 1980 to 959 mt in 1981. Only 43% (515 mt) of the foreign allocation of 1,200 mt during the fishing year 1 April 1981 - 31 March 1982 from the TALFF of 4,000 mt was caught. The low landings were due in part to by-catch limitations imposed on the DWF squid fisheries. Based on extrapolation of the January-November 1982 statistics, the 1982 DWF landings are expected to be about 500 mt.

USA landings declined 9% from a high of 5,262 mt in 1980 to 4,801 mt in 1981. Based on January-November 1982 statistics, projected USA landings for 1982, however, are estimated to reach a record high of 6,000 mt. Increased USA landings in recent years reflect the strong Japanese market for this species and an increasing interest by USA fishermen to participate in joint venture fisheries.

Strong seasonal differences have existed between DWF and USA butterfish fisheries. DWF landings in 1981 occurred principally during January-March (86%), whereas USA landings were mostly during October-December (61%).

## Length and Age Composition of Commercial Landings

Length frequency data from DWF and USA commercial landings in 1981 are presented in Figure 1. Samples from the DWF fishery were collected during the first and fourth calendar quarters of 1981. USA data encompass the entire year, but were obtained principally from autumn landings when the domestic fishery was at its peak. The DWF length frequencies ranged between 7 and 23 cm (fork length) with modes occurring at 11-12 cm and 15-16 cm, respectively. The USA length frequencies ranged from 12 to 24 cm, and exhibited a pronounced mode at 18 cm. The dissimilarity in modes between the DWF and USA length frequencies results from mesh-size differences between fisheries (Waring and Anderson 1981), culling practices in the USA

fishery, and differences between the location of the two fisheries (DWF offshore, USA inshore).

The USA commercial food fishery length frequency data are compared for 1980, 1981, and 1982 in Figure 2. Size distributions are similar among years; in each year a single pronounced mode ranging between 16 and 18 cm is evident. The mode in 1982 was at 16 cm, compared to 17 and 18 cm, respectively in 1980 and 1981, and also the relative proportion of butterfish $\geq$19 cm was less in 1982 than in 1980 and 1981. This suggests that the 1982 landings may have included a higher proportion of younger fish (e.g. ages 0-1) and/or a lower proportion of older fish (e.g. ages 2-3) than the 1980 and 1981 landings.

The age composition of the 1981 USA and DWF commercial landings was estimated by applying age/length keys derived from samples collected during Northeast Fisheries Center (NEFC) 1981 spring and autumn bottom trawl surveys to the January-June and July-December length frequencies, respectively. In both periods, the DWF landings contained proportionally more younger fish than USA landings (Table 2). Furthermore, both fisheries caught a high proportion of age 3 fish during the January-June period, whereas during July-December, the age composition shifted more towards age 0-1 fish. This shift represents the greater availability of younger age groups later in the year due to recruitment of age 0 fish to the fishery and growth of the age 1 fish.

## SURVEY ABUNDANCE INDICES

In previous studies (Waring and Anderson 1981), indices of relative abundance and biomass (number and weight) were derived from annual NEFC autumn bottom trawl survey (Grosslein 1969) catch-per-tow data collected in offshore (>27 m depth) strata (1-12 and 61-76, Figure 3). In the present report, indices are presented which incorporate survey data from strata 1-12

and 61-76 with that from inshore strata (<27 m, Figure 4) and additional offshore strata (i.e. 13, 14, 19, 20, 23 and 25, Figure 3) from Georges Bank. The larger strata set was considered necessary to account for the relatively larger number of age 0 butterfish sampled in the inshore strata and the increasing number of mainly older butterfish taken in survey catches on Georges Bank in recent years.

The inshore autumn survey time-series began in 1972, but surveys before 1974 did not employ the standard Yankee #36 trawl. Therefore, the 1968-1973 indices based on offshore strata were adjusted to provide a standardized 1968-1982 time series for the entire area (inshore and offshore) from Georges Bank to Cape Hatteras. The mean of the 1974-1982 yearly ratios (in numbers and weight) between the catch-per-tow values from the offshore strata and the combined offshore and inshore strata was calculated. This mean (separate value for numbers and weight) was used to adjust the 1968-1973 survey indices.

Survey catch per tow (numbers) increased from 1977 to a high in 1980 followed by a decline thereafter (Table 3). The 1982 index (108.3) decreased 63% from the 1981 value and was 28% below the 14-year (1968-1981) average (149.7) and 54% below the 5-year (1977-1981) average (233.3). Catch per tow (weight) increased sharply from 1978 to a high in 1980 but then dropped abruptly in 1981 and 1982. The index in 1982 (4.7 kg) was 29% and 46%, respectively, below the 1968-1981 (5.9 kg) and 1977-1981 (8.8 kg) averages. Although the survey indices (numbers and weight) dropped markedly in 1982, they are however, comparable to values observed during 1973-1976 when landings from the international fishery were high (11,200 - 19,500 mt) (Table 1).

The recruitment index (number per tow at age 0) from the 1981 autumn survey (229.9) was virtually the same as the 1980 index (228.5) (Table 4),

representing the third consecutive year of strong recruitment. However, the 1982 index of 81.7 was 64% below the 1981 value and 31% and 56%, respectively, below the 1968-1981 (117.9) and 1977-1981 (184.3) averages. This suggests that the 1982 year class is relatively weak compared to other recent year classes.

The catch-per-tow index (numbers) for age 1 and older butterfish rose sharply in 1980 to a level about 4.5 times higher than the 1968-1979 average. This increase was due to the strong 1979 year class. The index dropped about 38% from 1980 to 1981 but, apart from 1980, was higher than any other index and twice as high as the 1968-1979 average. The 1982 index dropped nearly 60% from the 1981 value, but remained slightly above the 1968-1979 average.

## LENGTH AND AGE COMPOSITION OF SURVEY CATCHES

Length frequency distributions (stratified mean number per tow) of butterfish from NEFC autumn bottom trawl surveys for 1974-1982 (combined inshore-offshore strata) are plotted in Figures 5-7. Age 0 (young-of-year) fish are characterized by a strong mode at 10-14 cm in all years, which corresponds to spring-spawned fish. Additionally, another mode at about 5 cm was observed in 1976 and 1980 which represents summer-spawned age 0 fish. A mode at 15-18 cm is principally reflective of age 1 fish, with some contribution from ages 2 and 3. The 1980-1982 survey length frequencies are similar to the 1980-1982 USA commercial length frequencies (Figure 2) in that both indicate a decline in the relative proportion of larger butterfish in 1982, suggesting the possibility of increased mortality.

Analysis of the NEFC inshore and offshore autumn survey data as a unit was considered necessary to fully evaluate the relative changes in butterfish

recruitment and abundance. Waring and Anderson (1981) documented the size segregation which occurs within the inshore and offshore strata. Butterfish $\leq$10 cm are dominant in the inshore strata (1-23, 45-46; Figure 4) north of Delaware Bay and probably represent summer-spawned fish. In the inshore strata south of Delaware Bay (24-44), the autumn length distributions are similar to those observed in the offshore strata (1-12 and 61-76). In both of these regions, butterfish encompassing the entire size range (2-25 cm) are encountered in survey catches, but fish $\geq$9 cm predominate. In the Georges Bank region, fish $\geq$12 cm are most common in the survey catches. The combined survey data from all of these areas takes into account the overall distributional characteristics and patterns of butterfish.

## DISCUSSION

Based on the 1982 autumn survey data, butterfish abundance and biomass has declined sharply despite indications of strong recruitment in 1980 and 1981. This suggests that (1) the survey overestimated the strength of the 1980 and 1981 year classes, (2) these year classes were reduced by high levels of mortality, and/or (3) the 1982 survey indices represent underestimates of actual butterfish abundance and biomass. Further analysis of the survey data base is in progress to determine whether the 1980 and 1981 year-class indices may represent overestimates. The possibility of high levels of mortality cannot be determined from available information, but if that did happen, it would likely have been from natural causes such as predation by other fish or squid, disease, etc. and not from excessive levels of fishing. The possibility of a reduction in the abundance of age 1 and older butterfish in 1982 is supported, as noted earlier, by the reduced proportion of larger fish in the 1982 DWF and USA landings. In spite of the seemingly ominous drop in stock abundance and biomass in 1982, apart from the

exceptionally high values of the previous several years, the 1982 survey indices are not below the levels observed in most earlier years. The 1982 biomass index of 4.7 kg/tow is slightly above the 1968-1981 (excluding the high 1979 and 1980 values) average of 4.6 kg. The 1982 abundance index of 108.3 fish/tow is also slightly above the 1968-1981 (excluding the high 1979-1981 values) average of 105.3.

Increased interest in the harvesting of butterfish by USA fishermen, as observed in recent years, is expected to continue due to increasing export markets and joint venture opportunities. The USA fishery expects to harvest 7,000 mt (17% above estimated 1982 landings) annually as proposed in Amendment #3 to the Atlantic Butterfish FMP. By-catch and fishing area regulations will probably restrict DWF landings to the 500-1,000 mt level observed the last few years. Thus, total 1983 landings can be expected to range between 6,000 and 8,000 mt. During 1969 - 1976, total landings ranged from 6,500 to 19,500 mt at a time when the survey biomass indices in six of those eight years were below the 1982 level. Although the survey biomass index has declined in 1982, there should be sufficient resource to sustain landings of 6,000 to 8,000 mt in 1983.

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Table 1. Nominal catch (metric tons) of butterfish from Northwest Atlantic Fisheries Organization (NAFO) Subareas 5 and 6 by country, 1963-1982.

| Year | USA | Japan | USSR | Poland | Spain | Italy | Bulgaria | GDR | Romania | Others | Nominal catch | Adjusted[1] nominal catch |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1963 | 4,513 | - | 2,285 | - | - | - | - | - | - | - | 6,798 | 6,798 |
| 1964 | 2,461 | - | 748 | - | - | - | - | - | - | - | 3,209 | 3,209 |
| 1965 | 3,340 | - | 749 | - | - | - | - | - | - | - | 4,089 | 4,089 |
| 1966 | 2,615 | - | 3,865 | - | - | - | - | - | - | - | 6,480 | 6,480 |
| 1967 | 2,452 | 146 | 2,170 | - | - | - | - | - | - | - | 4,768 | 4,768 |
| 1968 | 1,804 | 3,526 | 1,911 | - | - | - | - | - | - | - | 7,241 | 7,241 |
| 1969 | 2,438 | 3,930 | 11,107 | - | - | - | 36 | - | - | - | 17,511 | 17,816 |
| 1970 | 1,869 | 8,624 | 404 | - | - | - | - | - | - | - | 10,897 | 14,319 |
| 1971 | 1,570 | 5,771 | 486 | - | - | - | 26 | - | - | - | 7,853 | 10,483 |
| 1972 | 819 | 3,675 | 1,848 | - | - | - | 114 | 34 | - | - | 6,490 | 13,040 |
| 1973 | 1,557 | 12,172 | 2,334 | 2,804 | - | - | 239 | 196 | 152 | - | 19,454 | 33,236 |
| 1974 | 2,528 | 5,457 | 1,372 | 3,508 | - | - | - | - | - | - | 12,865 | 17,993 |
| 1975 | 2,088 | 3,624 | 789 | 3,754 | - | - | 298 | 1 | - | 612[2] | 11,165 | 14,852 |
| 1976 | 1,528 | 7,884 | 420 | 1,518 | - | - | 4 | 3 | 62 | - | 11,419 | 15,837 |
| 1977 | 1,448 | 1,741 | 419 | 280 | 117 | 107 | - | - | 16 | 525[3] | 4,653 | 4,653 |
| 1978 | 3,676 | 657 | 14 | - | 124 | 355 | - | - | 83 | 93[4] | 5,002 | 5,002 |
| 1979 | 2,707 | 262 | 2 | - | 90 | 138 | - | - | 10 | 343[5] | 3,552 | 3,552 |
| 1980 | 5,262 | 660 | - | 3 | 59 | 65 | - | - | 3 | 10[6] | 6,062 | 6,062 |
| 1981 | 4,801 | 592 | - | - | 255 | 112 | - | - | - | - | 5,760 | 5,760 |
| 1982[7] | 6,000 | 281 | - | - | 127 | 72 | - | - | - | - | 6,480 | 6,480 |

[1] Adjusted to account for non-reported discards of countries not reporting butterfish from directed Loligo fishing operations (Murawski and Waring, 1979).

[2] Ireland

[3] Ireland-415, Cuba-110

[4] Mexico

[5] Mexico

[6] Cuba

[7] Provisional

Table 2. Age composition of the 1981 USA and DWF butterfish landings.

| Period/Fishery | | Percent at age | | | | | |
|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3+ | Total | Tons |
| Jan-Jun | USA | - | 6 | 44 | 50 | 100 | 1,230 |
| | DWF | - | 20 | 51 | 29 | 100 | 827 |
| Jul-Dec | USA | 3 | 23 | 65 | 9 | 100 | 3,571 |
| | DWF | 55 | 27 | 17 | 1 | 100 | 132 |

Table 3. Indices of relative abundance and biomass (stratified mean catch per tow) for butterfish derived from NEFC autumn bottom trawl survey data, 1968-82.

| | (Waring & Anderson 1981)[1] | | Combined offshore (>27 m) and inshore (<27 m) index[2] | |
|---|---|---|---|---|
| Year | Numbers | Weight (kg) | Numbers | Weight (kg) |
| 1968 | 121.1 | 10.4 | 93.6 | 7.7 |
| 1969 | 76.9 | 5.3 | 61.6 | 3.9 |
| 1970 | 48.3 | 3.1 | 39.3 | 2.3 |
| 1971 | 242.2 | 5.5 | 218.6 | 4.3 |
| 1972 | 86.7 | 3.2 | 81.9 | 2.7 |
| 1973 | 178.0 | 8.4 | 148.4 | 6.1 |
| 1974 | 116.3 | 5.1 | 100.2 | 3.8 |
| 1975 | 52.5 | 2.9 | 45.7 | 2.3 |
| 1976 | 160.3 | 6.7 | 139.6 | 5.8 |
| 1977 | 94.7 | 6.9 | 87.0 | 5.2 |
| 1978 | 80.4 | 4.6 | 142.5 | 4.3 |
| 1979 | 453.9 | 17.8 | 309.6 | 12.1 |
| 1980 | 366.5 | 20.6 | 332.9 | 15.2 |
| 1981 | 326.7[3] | 10.8[3] | 294.7 | 7.0 |
| 1982 | 104.5[3] | 5.2[3] | 108.3 | 4.7 |

[1]Strata 1-12, 61-76 (offshore)

[2]Strata 1-12, 61-76, 13, 14, 19, 20, 23, 25 (offshore)
1-46 (inshore)

[3]Not in Waring and Anderson (1981)

Table 4. Indices of relative abundance (stratified mean catch per tow) for butterfish by age group derived from NEFC autumn bottom-trawl survey data, 1968-82[1].

| Year | Age 0 | Age 1 and older |
|---|---|---|
| 1968 | 41.3 | 52.3 |
| 1969 | 39.5 | 21.1 |
| 1970 | 27.1 | 12.2 |
| 1971 | 209.0 | 9.6 |
| 1972 | 73.2 | 8.7 |
| 1973 | 119.1 | 29.3 |
| 1974 | 82.2 | 18.0 |
| 1975 | 26.3 | 19.4 |
| 1976 | 110.6 | 29.0 |
| 1977 | 47.7 | 39.3 |
| 1978 | 127.0 | 15.5 |
| 1979 | 288.7 | 20.9 |
| 1980 | 228.5 | 104.4 |
| 1981 | 229.9 | 64.8 |
| 1982 | 81.7 | 26.6 |

[1]Strata 1-12, 61-76, 13, 14, 19, 20, 23, 25 (offshore)
1-46 (inshore)

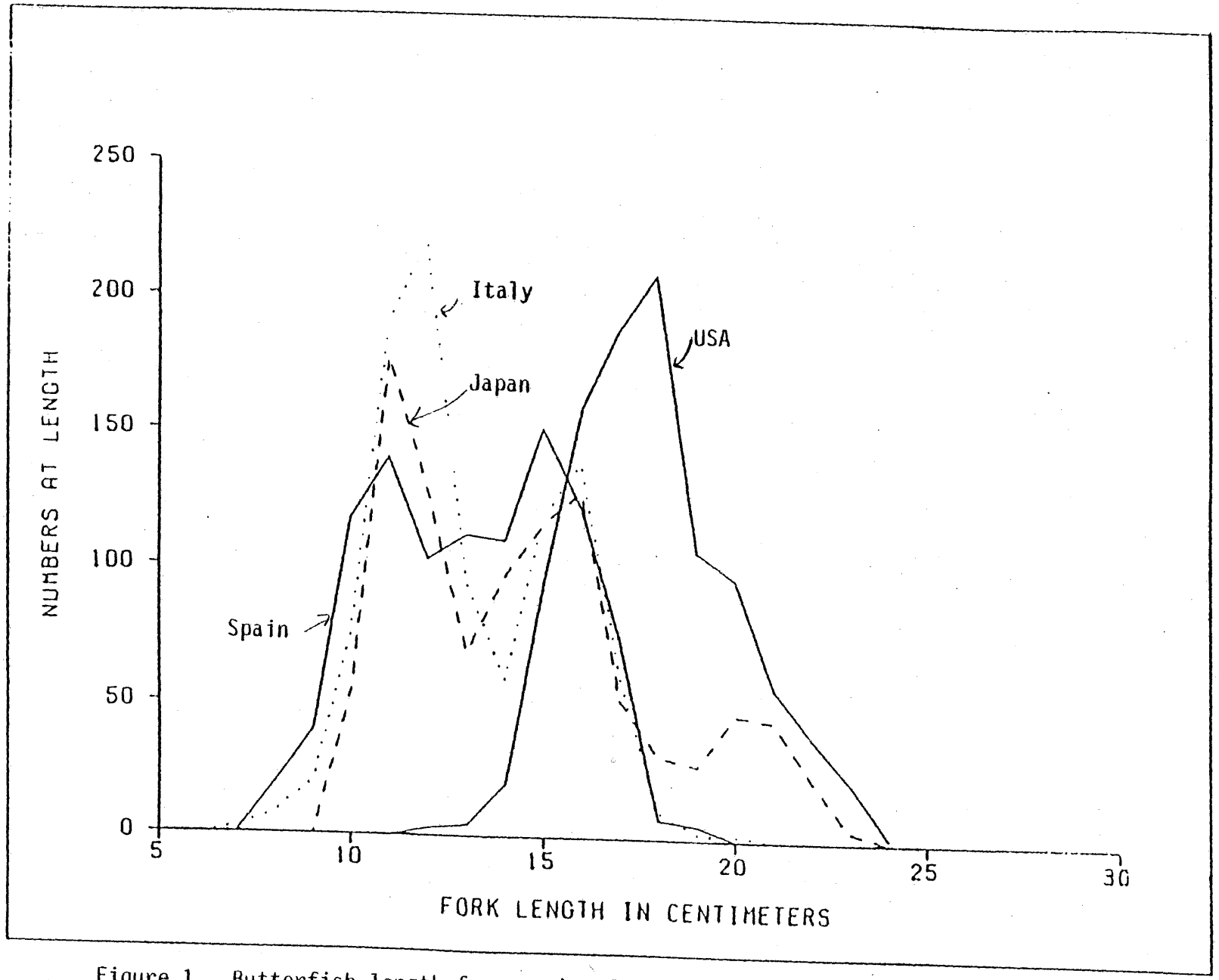



Figure 1. Butterfish length frequencies from sampling of commercial landings by country for 1981.

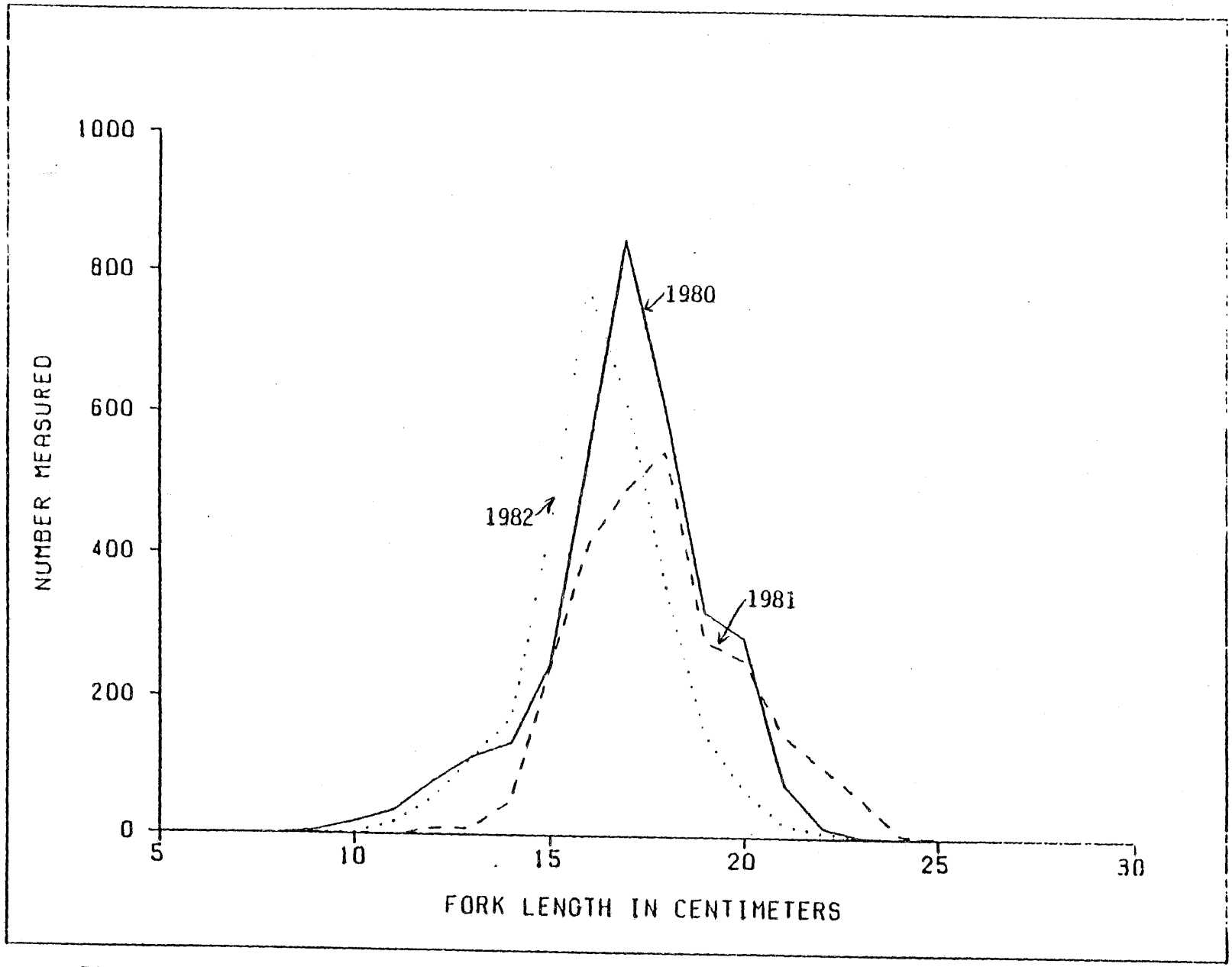



Figure 2. Length frequencies of butterfish in USA landings 1980-1982.

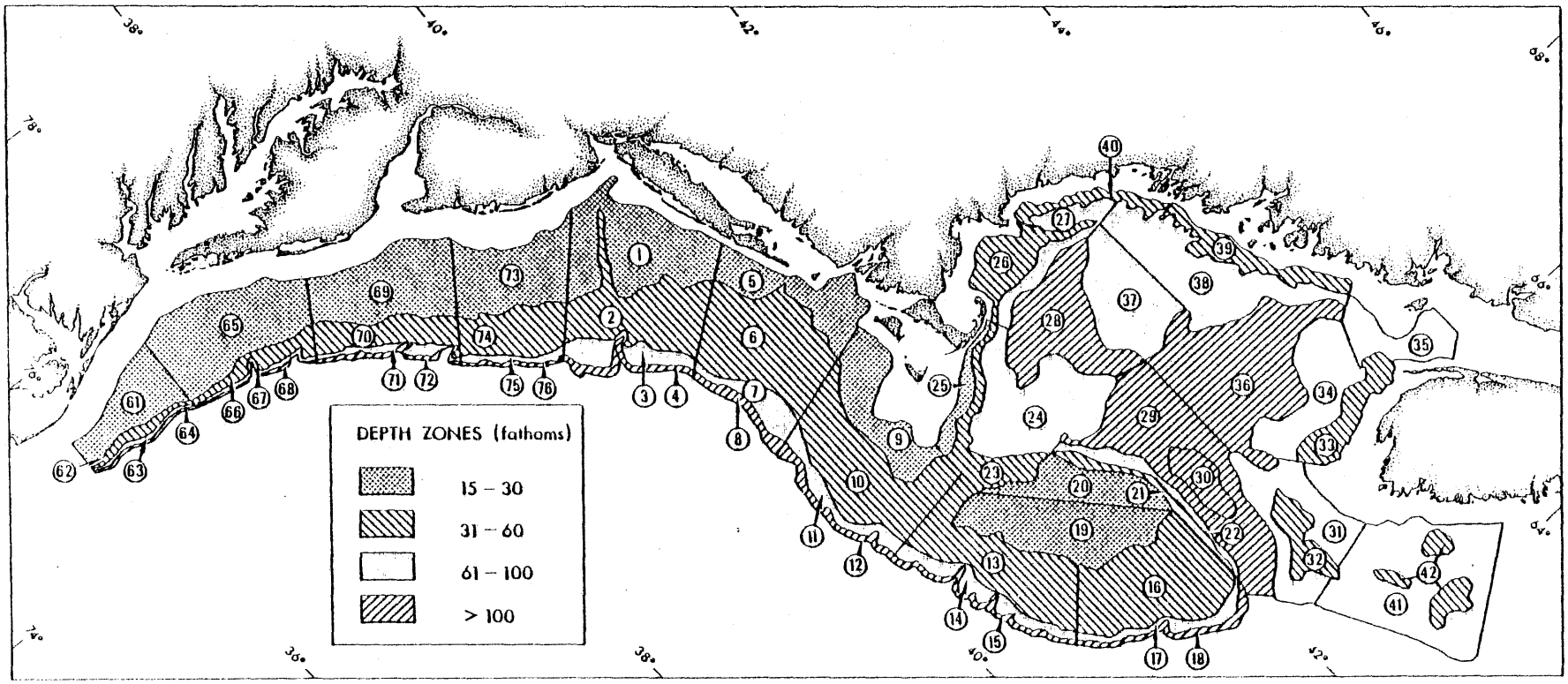
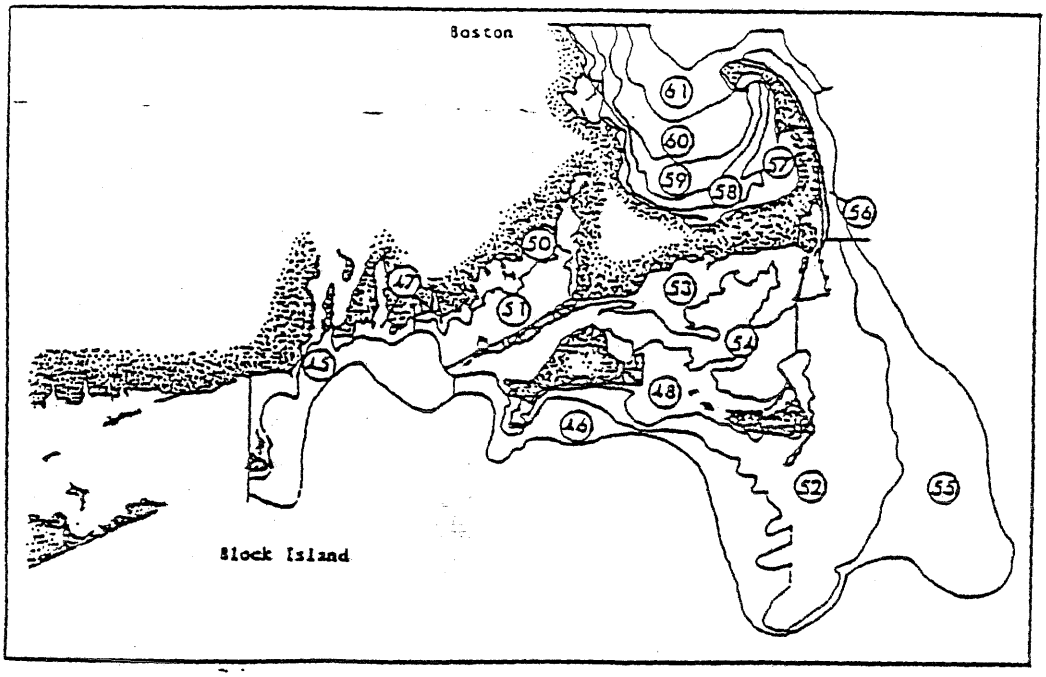



Figure 3. USA offshore bottom trawl survey sampling strata.

COASTAL STRATA

BLOCK ISLAND TO BOSTON




COASTAL STRATA

CAPE HATTERAS TO BLOCK ISLAND

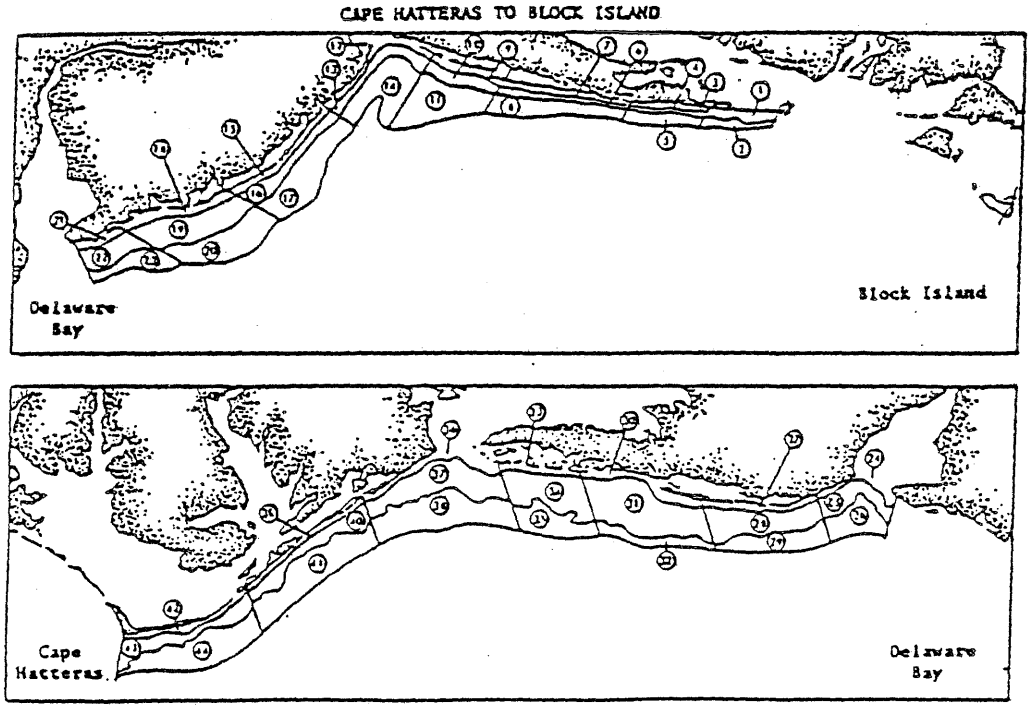



Figure 4. USA inshore bottom trawl survey sampling strata.

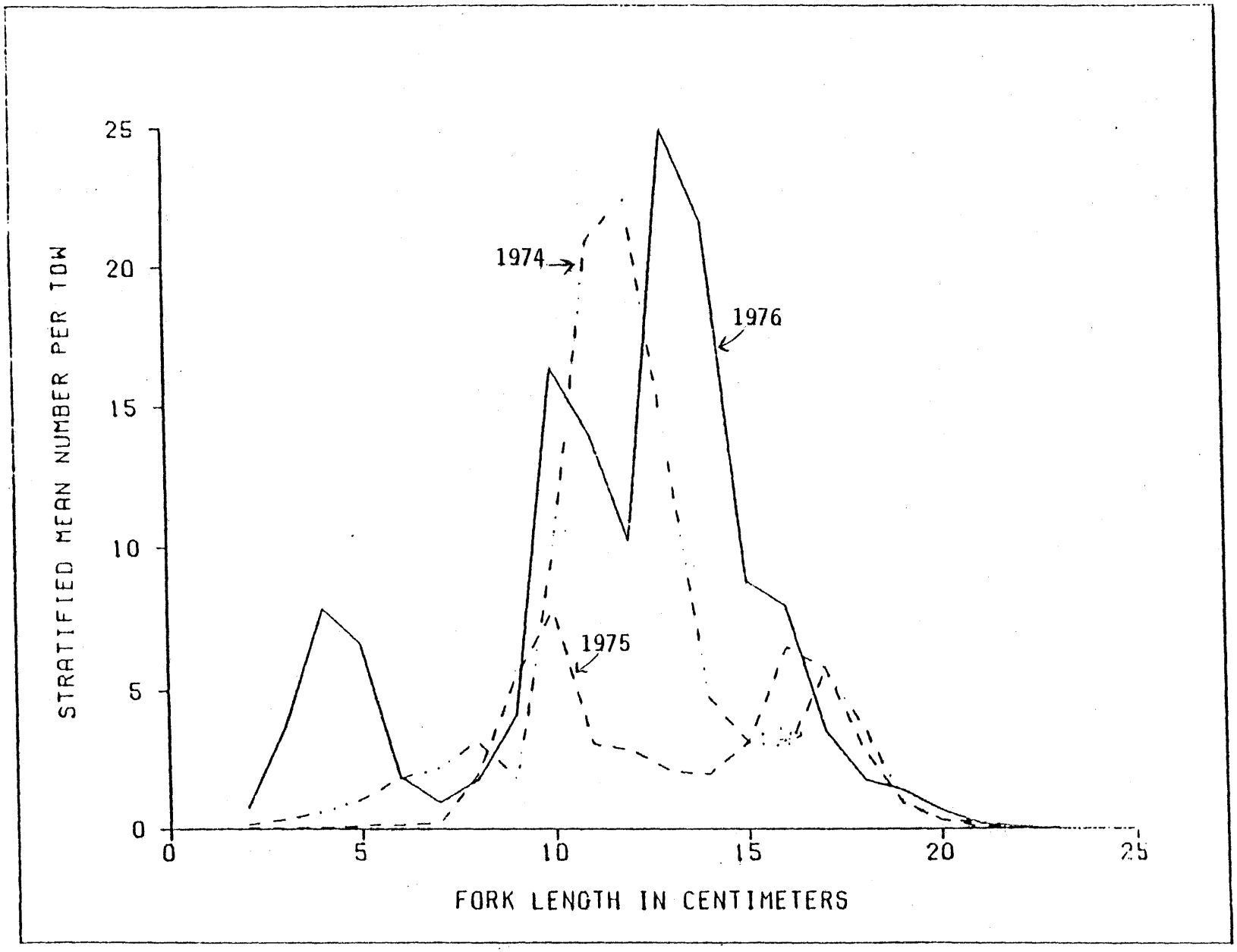



Figure 5. Butterfish length frequency distribution derived from NEFC bottom trawl survey data, 1974-1976.

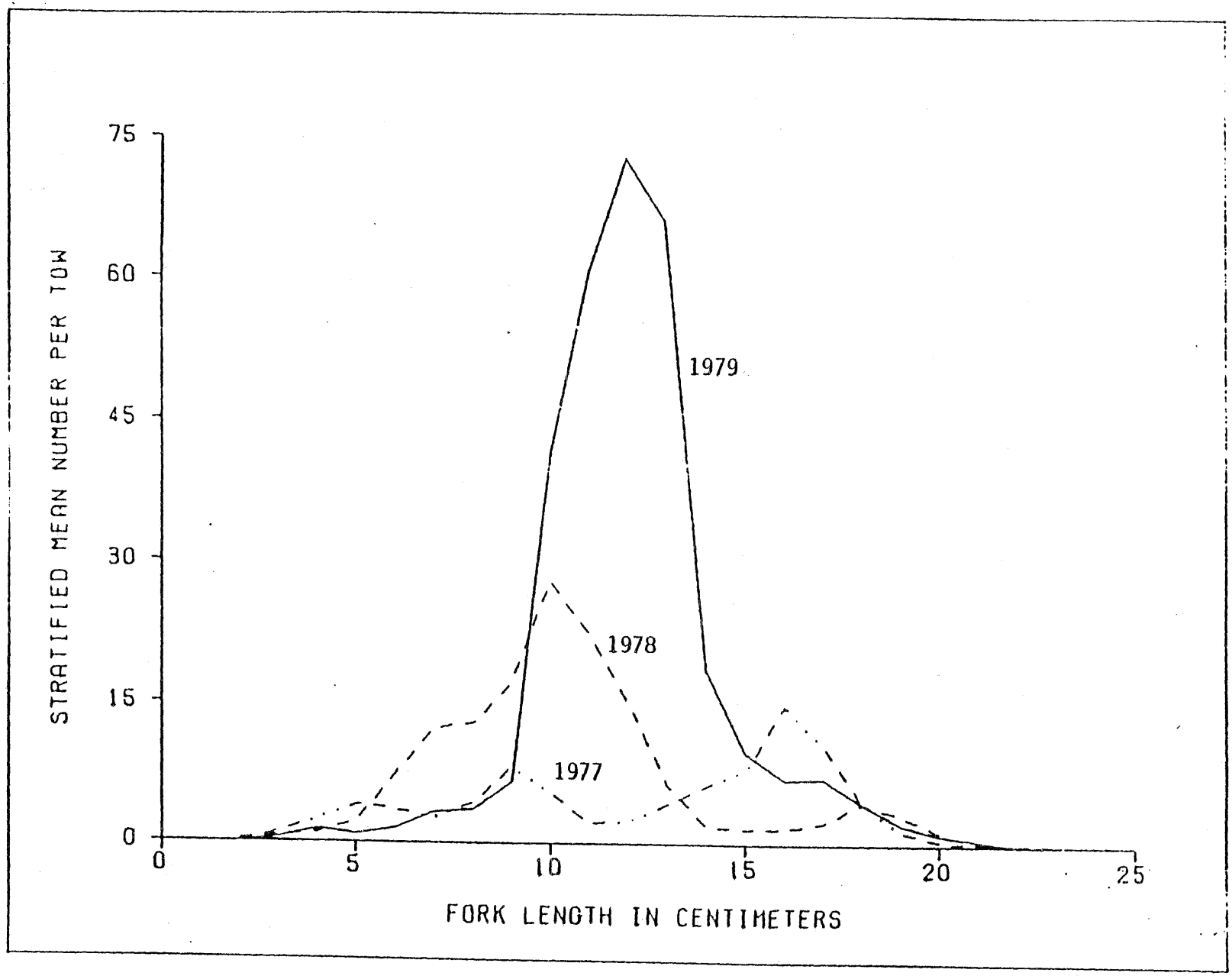



Figure 6. Butterfish length frequency distributions derived from NEFC autumn bottom trawl survey data, 1977-1979.

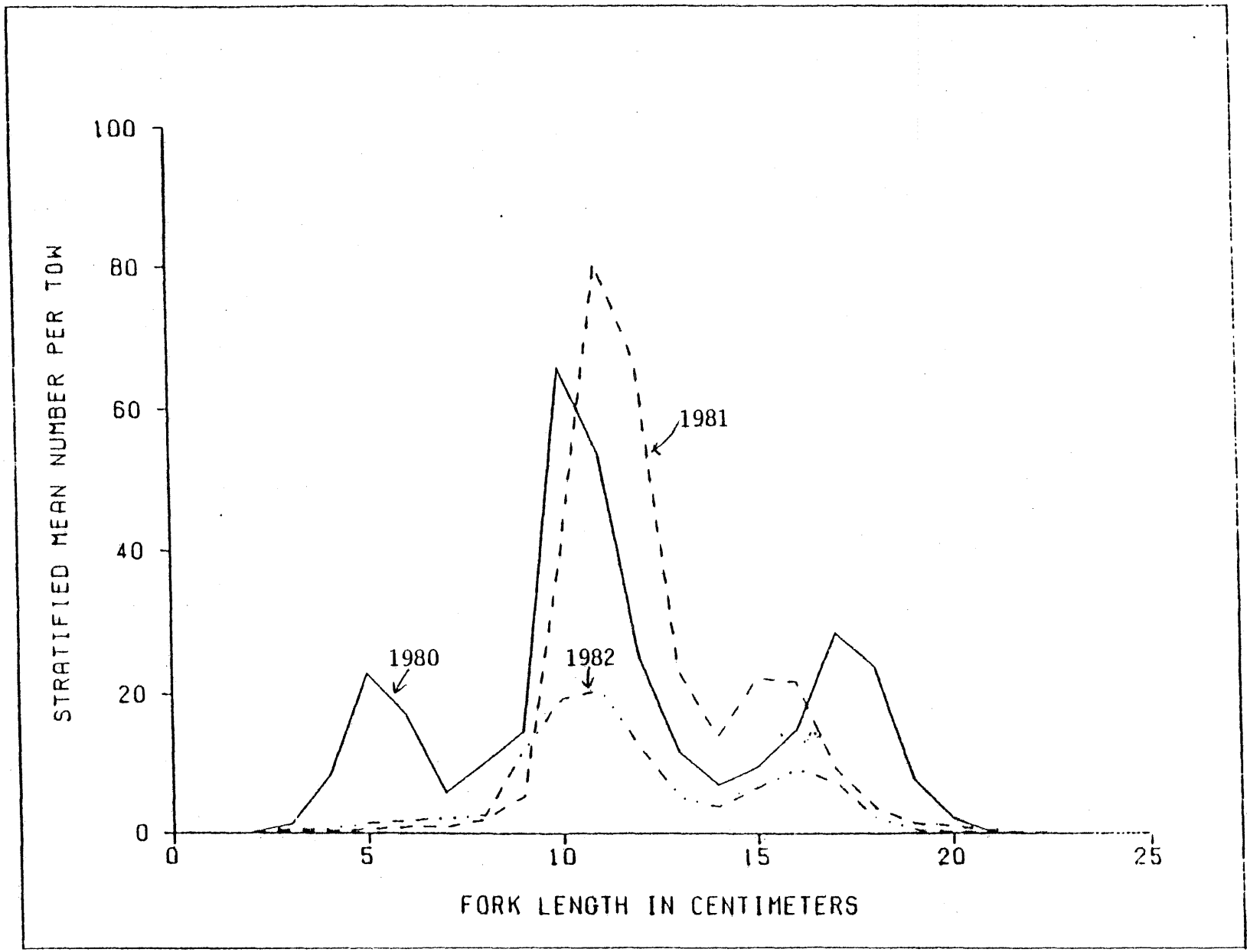



Figure 7. Butterfish length frequency distributions derived from NEFC autumn bottom trawl survey data, 1980-1982.