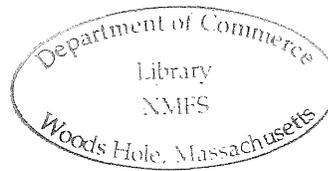


Yellowtail Flounder (Limanda ferruginea):  
Status of the Stocks, March 1980

by

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## INTRODUCTION

This assessment document updates yellowtail flounder fisheries statistics to the year 1979 for Georges Bank ( GB ), Southern New England (SNE), Cape Cod (CC), and Middle Atlantic (MA) grounds. It reviews recent results of Northeast Fisheries Center (NEFC) research vessel bottom trawl surveys. Results of the 1980 State of Rhode Island, Northeast Fisheries Center of the National Marine Fisheries Service, and the fishing industry cooperative yellowtail flounder bottom trawl survey (referred to hereafter as the FREISLAND survey) are also examined herein. Background information on the yellowtail flounder fishery and the methods of using commercial and survey data for assessment purposes are reviewed in earlier documents (Brown and Hennemuth 1971; Sissenwine et. al 1978; and McBride and Sissenwine 1979).

### Fisheries Statistics

Available catch and effort statistics for the Southern New England, Georges Bank, Cape Cod, and Middle Atlantic yellowtail flounder fishing grounds are presented in Tables 1-4, respectively. Total landings will show some increase compared to previous years due in part to the use of a different method to estimated discard. In this document the discard estimate is based on the results of cooperative industry-NEFC mesh selection study (Smolowitz 1978). Indications are that when 5.0 inch mesh is used, approximately 10.7% of yellowtail flounder catch will be discarded assuming a 30 cm culling point. The major portion (70%) of the 1979 New England yellowtail catch was reported to be landed with 5.0-5.1 inch mesh net. This estimate of discard assumes a 1979 population structure similar to that of 1978. In recent years little or no discard has been reported in commercial statistics

obtained from vessel interviews in major yellowtail ports. Persons previously giving estimates now often give no discard estimates. Hence, the problem of estimating discard has become so acute that this measure is deemed vital to the quality of the assessment.

Commercial catch data for 1979 indicate increased food landings from 1978 for SNE, GB, and CC areas. Southern New England landings showed the greatest increase of 152%. Georges Bank and Cape Cod landings increased 22% and 8% respectively, while landings in the Middle Atlantic dropped 80% from the previous year. There are reports of misidentification of areas in the catch statistics such that some of the catch reported in other areas may in fact have been taken from the Southern New England stock. Foreign and industrial yellowtail landings were insignificant in 1979.

Catch per unit effort (CPUE) estimates for 1979 reflect increases for SNE and GB of 11% and 43% respectively while CC indicates a 10% decrease. Whereas, increased CPUE values for SNE and GB signal improved availability of yellowtail in 1979 over the previous three years, they remain less than half the CPUE values for the 1960's years of peak abundance. These figures compare more closely with CPUE values for other periods (i.e., 1950's) when yellowtail abundance was relatively low. These catch per unit effort values would imply that to a large extent increased catch of yellowtail in 1979 simply reflects increased effort.

Comparing the recent CPUE with earlier periods is difficult as fishing regulations which have changed the fishing priorities may influence the values. However, the increases between 1978 and 1979 are likely to reflect real change as regulations were similar in both years.

Commercial catch statistics have been sketchy in recent years due to problems of misreporting or lack of reporting, hence estimates of absolute numbers landed at age should not be interpreted literally. However, there is no reason to suspect that the percent age composition of the catch indicated by the available samples is not accurate. Estimates of historical percent age composition of the commercial catch from SNE, GB, and CC grounds are given in Tables 5. This data indicates a definite shift in age structure of the fished population over the series of years examined. The 1960's were generally characterized by mostly 3 and 4 year olds dominating the catch. Whereas the 1970's reflect a shift toward 2 and 3 year old dominance of the catch in all three areas. The earlier years indicate a wider range of ages that contribute significantly to the catch (i.e., 2-5 year olds, in terms of weight).

Commercial statistics indicate that during the course of 1979, the bulk of the catch shifted from age 3 in quarter 1 (comprising 76% of total landings over SNE, GB, and CC) to age 2 in quarters 2 and 4 (representing 58% of total landings in quarter 3 and 65% in quarter 4). Age 3 yellowtail represent the 1976 year class and age 2 the 1977 year class. This same marked shift toward dependency on newly recruited fish towards the end of the year while the previously dominant year class is apparently fished down is noted in the 1977 and 1978 catch statistics also. This recent phenomenon shows contrast to the 1960's when older age classes (ages 3, 4, and 5) contributed significantly to the commercial catch throughout the year (Tables 6-8). Although the general picture concerning age composition is the same in all areas it should be noted that on Georges Bank the 1976 year class appears weaker relative to the 1977 year class than on Southern New England. This would indicate a poorer population condition.

## NEFC Survey Results

Results of the 1979 NEFC autumn bottom trawl survey indicate little variation from the relatively low catches which have characterized recent years (Tables 9-11). The SNE population size index increased about 2% over the previous year while the GB population index decreased by 38%. The MA index remained about the same. Pre-recruit indices exhibited a general decline from 1978 values: Minus 48% for SNE, minus 69% for GB, and minus 29% for the MA. Thus, the 1978 year class appears weaker than that of 1977 (but similar to 1976) which is contributing largely to the current commercial catch.

Results of summer bottom trawl surveys are given in Table 12. the autumn survey results, the 1979 summer bottom trawl survey indicates marked improvement of the SNE yellowtail flounder stock. The mean catch per tow in weight for SNE area was the highest ever observed. On the other hand, summer survey results for GB and the MA areas were generally comparable to those obtained during autumn. The GB catches, being similar in the summer and autumn surveys, contrast with the SNE differences in summer and fall. The difference may be partially explained by the relatively greater abundance of the 1976 year class fish in SNE, as the 1977 year class may be less vulnerable to the survey gear at this time.

Tables 13-16 summarize information on the age composition of research vessel bottom trawl surveys in summer and autumn for SNE and GB. This data agrees with commercial catch age data in that it generally reflects a wider range (3 or 4 year classes) of ages contributing significantly to the population structure during the 1960's than is evident in more recent years where one or two year classes have made up the bulk of the population. 1979 survey results for SNE do, however, indicate a strengthened condition in the population age structure with both the 1976 and 1977 year classes contributing significantly.

A time series of yellowtail stratified mean number and weight per tow estimates were examined separating the values into four time periods: day (8:00 a.m. - 3:59 p.m.), night (8:00 p.m. - 3:59 a.m.), sunrise (4:00 a.m. - 7:59 a.m.), and sunset (4:00 p.m. - 7:59 p.m.). Mean values over the years indicate that night time catches generally exceed those made by day in number and in weight. This analysis corroborates the results of a previous study by Sissenwine (1978) which found differences in day and night time catches of yellowtail. This analysis lends support to the reliability of the survey indices for predicting trends in relative abundance regardless of catch differentials due to degree of light penetrating, as all time periods reflect similar changes over the years to the standard abundance indices (noting the recent years of decline). This analysis also suggests that catches at sunrise and sunset more closely resemble those of night time in magnitude.

Results of the State of Massachusetts autumn (Sept.-Oct.) 1979 bottom trawl survey indicate a three-fold increase in stratified mean number and weight of yellowtail flounder caught over 1978 values for the overall area sampled (from New Hampshire to Rhode Island, 18 to 87 meters). Personal communication with Dave Pierce, Massachusetts Marine Fisheries, also conveys that this catch largely represents the Cape Cod grounds and that most of the yellowtail were 15-20 cm which would evidence the 1978 year class.

February, 1980, FREISLAND Yellowtail Flounder Survey of the Southern New England Ground

During the first quarter of 1980, the State of Rhode Island in cooperation with the Northeast Fisheries Center and the fishing industry conducted a stratified random bottom trawl survey of the Southern New England yellowtail fishing grounds. This survey was carried out on the F/V FREISLAND (117 GT, 26 meters) of Pt. Judith. It covered the Southern New England area between 15 and 40 fathoms (see Figure 1).

A 12 meter (wing to wing) whiting net was used with 13.3 cm mesh in the wings, 7.6 cm in the cod end and a 1.3 cm cod end liner. Ten cm cookies were used along the footrope instead of rollers and a tickler chain extended from the wings to the doors. The distance between the doors is approximately 91 meters. The FREISLAND made 43 tows of 20 minute duration at randomly selected locations.

The results of this survey are given in Table 17 and Figures 2-8 (including mean catch in numbers and weight per tow by strata, length frequency, and percent age composition of the catch). Results of the FREISLAND survey are difficult to interpret in a relative sense due to differences in gear, time of year, and fishing power from NEFC research surveys, and, since this is the first survey of this type there is no historic data suitable for relative comparison. Nevertheless, the results of the Rhode Island survey are amenable to two types of analysis. Biomass estimates may be calculated by the area swept method or the results may be expressed as catch per day of fishing and compared to historic catch per standard unit effort (CPUE) indices of abundance.

Biomass estimates based on the area swept method depend on the total area randomly surveyed (4,292 square nautical miles), the mean catch per tow during the survey (60.6 kilograms per tow), and the area swept by each tow. The area swept by each tow depends on the linear distance traveled (1 nautical mile) and the path width swept by the net. Typically, the path width swept by the net is assumed to equal the distance between the wings (12 meters), but in this case since tickler chains extend from the wings to the doors, the distance between the doors (91 meters) was also considered. The resultant biomass estimates are 5,285 metric tons (based on distance between the doors) and 39,636 metric tons (based on distance between the wings). The lower value is clearly a minimum biomass estimate, because it assumes that the tickler chains are a hundred percent efficient at herding yellowtail flounder into the net. The higher estimate suffers from two possible biases. First, it ignores the herding effect of the tickler chains resulting in a positive bias. Second, it assumes that all fish in the path of the net between the wings are captured, thus resulting in a negative bias. The degree to which these factors counter balance each other is unknown.

A population size of 5,285 MT obviously would not support the current fishery. A population of 40,000 MT would be similar to that occurring in the early 1960's (Hennemuth and Brown, 1971).

A mean catch rate of 60.6 kilograms per 20 minute tow corresponds to 4.4 metric tons per day fishing (24 hours). This catch rate is similar to commercial catches per standard day of fishing on the Southern New England during 1963-1965 (3.8 tons/standard day of landings, 5.0 tons/standard day including estimated discards). January-February landings per standard day for the same period (1963-

1965) were 3.2 for Southern New England. However, the FREISLAND results are not strictly comparable to commercial abundance indices. The following factors make comparison to commercial indices of abundance difficult:

1. The catch rate during 20 minute tows is likely to be higher than during 1.5 to 2 hour tows typical of commercial operations.
2. The R/V FREISLAND is a much larger vessel than the vessel size used as a standard (26-51 tons) for commercial CPU indices, thus its fishing power is probably higher. Fishing power coefficients for yellowtail flounder by vessels larger than 100 GT are not available. The fishing power coefficient for 71-100 GT vessels based on Lux (1964, ICNAF Res. Bull. 1:5-21) is 1.18. Thus, the FREISLAND catch per day value should be reduced to at least 3.7 for comparative purposes to historic commercial indices of CPUE. The Captain of the FREISLAND indicated that the fishing power of his vessel may in fact be double the fishing power of typical vessels in the Pt. Judith fleet.
3. FREISLAND survey results include catches that would have been discarded during the fishery of the 1960's. This would tend to make the CPUE estimate based on the FREISLAND an overestimate when compared to the 1960's landings data.

Rhode Island survey results are based on a stratified random sampling design.

It is reasonable to assume that the FREISLAND catch rate would have been higher had the Captain been allowed to direct effort at yellowtail flounder. If only catch per tow values of greater than 30 kg are considered (thus excluding 12 tows or 28% of the data), the calculated catch per day would be increased to 5 MT. A histogram of catch frequency by 10 kg interval indicates that it might be

reasonable to assume that areas of abundance providing catches of less than 20 kg/20 minutes would be avoided in a directed fishery.

### Discussion

For the purpose of this discussion, the adjective good will imply the stock condition typical of the 1960's for the Southern New England area and of the early 1970's for the Georges Bank area. During periods of good stock condition, the Southern New England area produced annual yields of 15,000 MT to 25,000 MT. The Georges Bank area produced yields of 10,000-15,000 MT. In both cases, these yields were associated with fishing mortality rates in excess of  $F_{max}$ . The adjective poor implies stock conditions typical of the mid-1970's for the Southern New England area and of the late 1970's for the Georges Bank area. During these poor years stock size was substantially reduced and yields were about 2,000 MT per year for Southern New England and 4,000 MT per year for Georges Bank, again resulting from fishing mortality rates in excess of  $F_{max}$ .

There are several bits of information available pertinent to the current condition of yellowtail flounder resources. These are commercial fisheries statistics, NEFC autumn bottom trawl survey results, NEFC summer bottom trawl survey results, FREISLAND bottom trawl survey results, and Massachusetts inshore bottom trawl surveys.

All sources of information indicate the importance of the 1977 year class. The most recent commercial catch data (3rd quarter 1977) indicates the predominance of this year class. The 1977 year class also dominated NEFC research vessel survey catches and FREISLAND survey catches. McBride and Sissenwine (1979) noted that the 1977 year class was stronger than those of recent years. On the other hand, there is little encouraging evidence concerning the

1978 year class (except from the Massachusetts survey which supports good recruitment prospects for the Cape Cod ground). The 1978 year class does make up a significant percentage of the FREISLAND survey catch (28.7%), but since this year class should be fully recruited to the Rhode Island survey gear, it would appear to be much smaller than the 1977 year class. The 1976 year class contributed significantly to the fishery in 1979 but appears less abundant in Georges Bank relative to the 1977 year class than in Southern New England.

Information on the size of the yellowtail flounder populations is not nearly as consistent as is information on age composition. Unfortunately, commercial indices of abundance (catch per standard day of fishing) are not particularly useful for indicating the current condition of the resource. The restrictive nature of trip limits and the apparent problems of discarding and misreporting make these indices of abundance highly suspect. This situation forces reliance on survey results.

Autumn bottom trawl surveys results indicate only a very modest recovery from the depressed state (or poor conditions) of a few years ago when current optimum yields (OY) were established. On the other hand, the NEFC summer survey of 1979 indicates that the size of the Southern New England yellowtail flounder population might be more comparable to the good years of the 1960's. Summer survey results for Georges Bank on the other hand do not indicate a larger yellowtail population. This discrepancy may be partially accounted for by the lesser strength of the 1976 year class as both areas indicate dominance of the 1977 year class.

FREISLAND survey results are difficult to analyze because there is no time series of data available for comparative purposes. Nevertheless, the evidence is generally supportive of a significant recovery in the Southern New

England yellowtail flounder stock to conditions more typical of the good years of the 1960's. The most conservative interpretation of this data indicates that there has been some recovery from population size on which the current OY was based, a more optimistic interpretation indicates stock sizes comparable to the 1960's. Note, that in spite of OY, catches in the Southern New England area may already be comparable to the 1960's.

The danger of relying on survey results from a single year as a basis for assessing the condition of fish stocks has been noted many times. Our current difficulty in interpreting the available data concerning the condition of yellowtail flounder stocks demonstrates this problem. The inconsistencies between the summer and fall surveys is being investigated. However, the additional input from the FREISLAND survey supports inferences drawn from the summer data.

#### Summary

The available information concerning the condition of the Southern New England yellowtail flounder population is to some degree contradictory and, therefore, difficult to interpret. The most conservative interpretation would indicate virtually no recovery of the stock from the poor condition of the mid 1970's. More realistically, some recovery of the stock has occurred, and optimistically, there is some evidence that the stock is recovered to levels of abundance typical of the 1960's. The Southern New England fishery is heavily dependent on the 1977 year class. During the 1960's, the fishery was supported by a much broader spectrum of age classes (typically 2 through 6). The abundance

of the 1977 year class will result in difficulties for fishing vessels in maintaining a low catch of yellowtail. Conversely, very high catches of yellowtail will not allow for spawning stock recovery.

Much less information is available concerning the condition of the Georges Bank and Mid-Atlantic fishing areas. The available evidence does not indicate significant recovery of these populations. The Cape Cod population appears to be more abundant than in the mid 1970's.

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Table 1. Yellowtail flounder catch statistics for Southern New England (catch in MT x 10<sup>-3</sup>).

Year	Food landings	Discard	Industrial	Foreign	Total	Days fished in 1000's	Catch per day in MT
1935	6.0	2.4			8.4		
1936	6.8	2.7			9.5		
1937	7.6	3.0			10.6		
1938	7.7	3.1			10.8		
1939	9.5	3.8			13.3		
1940	14.2	5.7			19.9		
1941	19.3	7.7			27.0		
1942	28.4	9.9			38.3		
1943	18.0	7.3			25.3	5.75	4.4
1944	10.6	4.8			14.9	4.13	3.6
1945	10.4	4.2			14.6	2.86	5.1
1946	10.8	4.4			15.2	3.64	4.2
1947	12.1	4.9			17.0	4.59	3.7
1948	9.9	4.0			13.9	5.14	2.7
1949	4.7	1.9	0.2		6.8	3.40	2.0
1950	4.7	1.9	0.2		6.8	3.23	2.1
1951	2.8	1.1	0.1		4.0	2.00	2.0
1952	3.0	1.2	0.2		4.4	2.44	1.8
1953	2.0	0.8	0.3		3.1	1.63	1.9
1954	1.5	0.6	0.2		2.3	1.35	1.7
1955	2.2	0.9	0.3		3.4	1.70	2.0
1956	3.5	1.4	0.6		5.5	2.61	2.1
1957	5.5	2.2	0.7		8.4	2.62	3.2
1958	8.9	3.6	0.6		13.1	3.85	3.4
1959	7.7	3.1	0.5		11.3	5.13	2.2
1960	7.8	3.2	0.5		11.5	4.60	2.5
1961	11.6	4.7	0.7		17.0	4.85	3.5
1962	13.1	5.3	0.2		18.6	4.04	4.6
1963	22.0	5.4	0.3	0.2	27.9	5.47	5.1
1964	19.0	9.5	0.5	-	29.0	5.08	5.6
1965	18.9	7.0	1.0	1.4	27.8	6.61	4.2
1966	19.9	5.3	2.7	0.7	23.6	8.42	2.8
1967	10.8	7.7	4.5	2.8	25.8	6.51	4.0
1968	14.3	6.3	3.9	3.5	28.0	6.66	4.2
1969	11.4	2.4	4.2	17.6	35.6	10.78	3.3
1970	13.1	4.7	2.1	2.5	22.4	6.40	3.5
1971	8.2	3.3	0.4	0.3	12.2	3.81	3.2
1972	8.2	1.7	0.3	3.0	13.2	4.71	2.8
1973	7.2	0.1	0.3	0.2	7.8	4.11	1.9
1974	6.4	0.7	<0.1	0.1	7.1	3.74	1.9
1975	3.2	0.2	<0.1	0	3.4	2.43	1.4
1976	1.6	0.2	<0.1	<0.1	1.8	1.50	1.2
1977	2.8	<0.1	<0.1	<0.1	2.9	2.0	1.4
1978*	2.1	0.3	<0.1	-	2.5	1.40	1.8
1979*	5.3	0.1	<0.1	-	5.9	2.9	2.0

\*Preliminary and assuming 10.7% discard

Table 2. Yellowtail flounder catch statistics for Georges Bank  
(catch in MT x 10<sup>-3</sup>).

Year	Food landings	Discard	Industrial	Foreign	Total	Days fished in 1000's	Catch per day in MT
1935	0.3	0.1			0.4		
1936	0.3	0.1			0.4		
1937	0.3	0.1			0.4		
1938	0.3	0.1			0.4		
1939	0.4	0.1			0.5		
1940	0.6	0.2			0.8		
1941	0.9	0.3			1.2		
1942	1.6	0.5			2.1		
1943	1.3	0.4			1.7	0.20	8.6
1944	1.7	0.6			2.2	0.22	10.0
1945	1.4	0.5			1.9	0.28	6.7
1946	0.9	0.3			1.2	0.23	5.2
1947	2.3	0.8			3.1	0.48	6.5
1948	5.7	2.0			7.7	1.12	6.8
1949	7.3	2.5			9.8	2.49	3.9
1950	3.9	1.4			5.3	1.64	3.2
1951	4.3	1.5			5.8	1.61	3.6
1952	3.7	1.3			5.0	1.60	3.1
1953	2.9	1.0			3.9	1.24	3.1
1954	2.9	1.0			3.9	1.38	2.8
1955	2.9	1.0			3.9	1.23	3.2
1956	1.6	0.6			2.1	0.79	2.7
1957	2.3	0.8			3.1	0.82	3.8
1958	4.5	1.6			6.1	1.40	4.4
1959	4.1	1.4			5.5	1.97	2.8
1960	4.4	1.5			5.9	2.02	2.9
1961	4.2	1.5			5.7	1.82	3.1
1962	7.7	2.7			10.3	2.35	4.4
1963	11.0	5.6		0.1	16.7	3.63	4.6
1964	14.9	4.9		-	19.8	3.53	5.6
1965	14.2	4.4		0.8	19.2	4.58	4.1
1966	11.3	2.1		0.3	13.7	5.71	2.4
1967	8.4	5.5		1.4	15.3	4.13	3.7
1968	12.8	3.6		1.8	18.2	4.66	3.9
1969	15.9	2.6		2.4	20.9	6.71	3.1
1970	15.5	5.5		0.3	21.3	6.26	3.4
1971	11.9	3.1		0.5	15.5	6.20	2.5
1972	14.2	1.2		2.2	17.6	8.00	2.2
1973	15.9	0.6		0.3	16.7	6.96	2.4
1974	14.6	1.2		1.0	16.8	8.40	2.0
1975	13.8	1.0		0.1	14.6	8.59	1.7
1976	11.4	0.7		<0.1	12.0	7.50	1.6
1977	9.5	0.2		0	9.7	6.70	1.4
1978*	4.5	<0.1	<0.1	<0.1	4.6	3.33	1.4
1979*	5.5	0.6	-	<0.1	6.1	3.0	2.0

\* Preliminary  
and assuming 10.7% discard

Table 5. Yellowtail flounder catch statistics for Cape Cod ground (catch in MT x 10<sup>-3</sup>).

Year	Food landings	Discard	Industrial	Foreign	Total	Days fished in 1000's	Catch per day in MT
1935	0.4	0.1					
1936	0.4	0.1					
1937	0.5	0.2					
1938	0.5	0.2					
1939	0.6	0.2					
1940	0.9	0.3					
1941	1.3	0.4					
1942	1.5	0.5					
1943	1.3	0.4			1.7	0.53	3.2
1944	1.5	0.5			2.0	1.01	2.0
1945	1.2	0.4			1.6	0.61	2.6
1946	1.2	0.4			1.6	0.62	2.6
1947	1.1	0.3			1.4	0.75	1.9
1948	0.7	0.2			0.9	0.47	1.9
1949	1.2	0.4			1.6	0.68	2.4
1950	1.3	0.4			1.7	0.95	1.8
1951	0.8	0.2			1.0	0.79	1.3
1952	0.8	0.2			1.0	0.76	1.3
1953	0.8	0.2			1.0	0.78	1.3
1954	1.1	0.3			1.4	0.89	1.6
1955	1.3	0.4			1.7	1.00	1.7
1956	1.4	0.4			1.8	1.34	1.3
1957	2.4	0.7			3.1	1.44	2.2
1958	1.6	0.5			2.1	0.92	2.3
1959	1.5	0.5			2.0	0.76	2.6
1960	1.5	0.5			2.0	1.12	1.8
1961	1.8	0.6			2.4	0.91	2.6
1962	1.9	0.6			2.5	1.01	2.5
1963	3.6	1.0			4.6	1.00	4.6
1964	1.8	0.6			2.4	0.71	3.4
1965	1.5	0.5			2.0	0.70	2.8
1966	1.8	0.3			2.1	1.37	1.6
1967	1.5	0.8			2.3	1.69	1.4
1968	1.6	0.6			2.2	0.99	2.3
1969	1.3	0.3			1.6	0.68	2.5
1970	1.2	0.4			1.6	0.53	3.0
1971	1.7	0.7			2.3	0.79	2.9
1972	1.4	0.3			1.6	0.67	2.4
1973	1.7	0.1			1.7	0.89	1.9
1974	2.1	0.2			2.3	1.21	1.9
1975	2.0	0			2.0	1.25	1.6
1976	3.6	0.1			3.7	2.31	1.6
1977	3.5	0			3.5	2.42	1.4
1978*	3.9	0			3.9	1.98	2.0
1979*	4.2	0.4			4.6	2.4	1.8

\*Preliminary and assuming 10.7% discard.

Table 4. Yellowtail flounder catches in ICNAF statistical area 6  
1964-1977, in metric tons.

Year	USA Landings	USA Discards	Foreign Catch	Total
1964	1809	*	0	1809
1965	2117	*	0	2117
1966	2240	*	0	2240
1967	5340	*	0	5340
1968	3272	*	0	3272
1969	3886	*	683	4569
1970	4050	*	118	4168
1971	6867	*	961	7828
1972	8774	*	117	8891
1973	4937	244	197	5382
1974	1906	32	16	1932
1975	655	17	3	653
1976	253	0	0	253
1977	535	25	0	560
1978*	759	0	0	759
1979*	152	16	-	169

\*Preliminary  
and assuming 10.7% discard

Table 5. Commercial Yellowtail Estimated % Landed at Age

	1	2	3	4	5	6	7	8+	Total
<u>Southern New England</u>									
1963-1966		19.0	37.1	27.2	12.3	3.6	.7	.1	373176
1977	.5	27.7	57.2	6.5	2.0	2.5	1.6	2.0	38815
1978	.6	58.0	21.1	16.2	2.3	.8	.5	.4	47083
1979	.2	37.7	52.6	6.5	2.2	.6	.1		132553
<u>Georges Bank</u>									
1963-1966		7.3	42.0	33.1	12.6	3.2	.9	.3	259718
1977		.1	34.4	52.5	8.7	1.8	1.1	1.4	181057
1978		26.8	47.7	18.9	4.3	1.3	.6	.4	74852
1979		59.2	22.3	9.1	4.4	.9	.7	.4	112023
<u>Cape Cod</u>									
1963-1966		4.5	36.7	33.3	20.8	3.3	1.1	.3	22313
1977		18.5	46.6	22.3	4.8	3.7	1.9	2.1	34662
1978		23.9	42.0	27.3	4.0	2.9			45052
1979		75.0	19.8	4.4	.6				97969

Table 6.

COMMERCIALSOUTHERN NEW ENGLAND% at age

	1	2	3	4	5	6	7	8+	Total # Landed
<u>1963-1966</u>									
QTR 1		1.0	27.2	46.9	18.7	5.3	0.9		79882
QTR 2		2.3	52.2	28.7	10.8	4.6	1.3		47946
QTR 3		12.0	43.9	25.2	14.2	4.0	0.6	0.1	103583
QTR 4	0.1	39.9	32.5	17.2	7.8	2.0	0.5		141765
<u>1977</u>									
QTR 1		2.5	79.4	10.3	2.1	1.7	1.5	2.5	17168
QTR 2		3.6	71.8	10.9	4.1	3.1	3.5	3.0	4810
QTR 3		49.4	39.4	—	2.1	6.0	0.6	2.5	6700
QTR 4	1.7	67.4	24.3	2.5	0.8	1.3	1.5	0.5	10137
<u>1978</u>									
QTR 1		33.1	32.0	28.4	3.5	1.4	1.2	0.4	13705
QTR 2		12.3	44.6	30.8	6.3	2.0	2.4	1.6	2765
QTR 3		58.2	16.7	19.0	4.3	0.7	0.2	0.8	9651
QTR 4	1.4	80.1	12.9	5.0	—	0.2			20962
<u>1979</u>									
QTR 1		4.5	81.1	9.3	3.9	1.2			42277
QTR 2									
QTR 3		51.7	43.3	3.7	1.1	0.2			36649
QTR 4	0.6	54.3	36.6	6.2	1.6	0.4	0.3		53627

Table 7.

COMMERCIALGEORGES BANK% at age

	1	2	3	4	5	6	7	8+	Total #/ Landed
<u>1963-1966</u>									
QTR 1		0.3	26.7	38.3	21.7	9.9	2.0	1.1	319505
QTR 2		0.9	45.5	35.2	13.9	3.1	1.1	0.4	805112
QTR 3		6.7	48.3	31.1	11.4	1.7	0.6	0.3	952772
QTR 4		25.1	34.8	30.2	7.2	1.9	0.7		520229
<u>1977</u>									
QTR 1		1.6	62.9	19.6	5.6	3.7	3.5	3.1	152333
QTR 2		3.3	77.1	14.9	2.2	1.1	1.0	0.4	334111
QTR 3	0.0	38.6	51.3	4.0	1.5	0.5	0.3	0.2	881155
QTR 4	0.6	61.0	32.7	2.9	0.5	1.3	0.3	0.8	442923
<u>1978</u>									
QTR 1		3.9	55.1	27.5	7.9	3.0	1.3	1.3	225366
QTR 2									
QTR 3		37.3	44.9	15.0	2.5	0.4			465783
QTR 4		32.0	41.7	16.7	5.3	1.1	3.2	0.0	57381
<u>1979</u>									
QTR 1		17.1	49.3	13.6	12.8	2.6	2.7	1.8	11531
QTR 2		7.9	43.1	29.1	14.7	1.7	1.9	1.6	9632
QTR 3	0.1	62.8	20.2	7.5	2.8	0.6	0.1	0.0	51327
QTR 4	0.4	79.4	12.2	5.1	1.5	0.7	0.7	0.1	39533

Table 8.

Commercial CAPE COD

	<u>% at age</u>								Total #
	1	2	3	4	5	6	7	8+	Landed
<u>1963-1966</u>									
QTR 1			38.8	42.9	12.4	4.5	0.8	0.5	10938
QTR 2		1.0	22.9	26.2	45.0	2.9	1.9		7166
QTR 3									
QTR 4		22.3	54.6	20.2	1.5	0.7	0.5	0.3	4209
<u>1977</u>									
QTR 1		7.5	42.1	34.4	5.6	5.6	3.1	1.6	13529
QTR 2									
QTR 3		7.1	54.6	19.4	10.0	4.1	0.9	3.8	7516
QTR 4		35.8	46.5	11.7	1.2	1.7	1.3	1.7	13617
<u>1978</u>									
QTR 1			64.8	34.2	1.0				11257
QTR 2		3.5	53.5	28.2	9.0	5.7			14270
QTR 3		18.2	24.9	47.6	4.1	5.3			9137
QTR 4		82.8	16.6	0.6					10388
<u>1979</u>									
QTR 1			84.9	13.6	1.5				12843
QTR 2									
QTR 3		100							51181
QTR 4		55.6	25.0	7.6	1.1			0.7	33946

Table 9. Autumn bottom trawl survey results for Southern New England yellowtail flounder

Year of survey	No. per tow Age 1	Total no. per tow	Total weight per tow (kg)	Population size index*
1963	16.3	50.6	16.8	
1964	18.6	60.8	19.1	
1965	11.5	38.7	12.7	
1966	35.5	50.3	9.4	
1967	20.0	57.7	14.1	102.5
1968	10.0	40.2	10.1	119.2
1969	12.8	54.8	14.4	92.6
1970	7.3	39.8	11.0	71.9
1971	6.3	41.7	9.2	53.6
1972	4.3	42.7	10.7	40.0
1973	1.9	7.9	2.3	30.8
1974	1.1	7.3	2.1	20.1
1975	1.7	2.9	0.7	11.9
1976	2.6	10.7	2.9	9.5
1977	1.8	5.01	1.5	10.2
1978	3.5	11.4	3.0	11.0
1979	1.824	9.00	2.57	13.6*
1980				13.9

\*Calculations based on method described by Brown and Hennemuth (1971) using  $M = 0.2$ ,  $F = 0.4$  for 1969-1970 and  $F = 0.3$  for all other years at age 2 and  $F = 1.2$  for 1969-1970 and  $F = 1.0$  for 1971-1974 and  $F = 0.7$  for 1975-1978.

Table 10. Autumn bottom trawl survey results for Georges Bank yellowtail flounder.

Year of survey	No. per tow Age 1	Total no. per tow	Total weight per tow (kg)	Population size index*
1963	11.6	30.1	10.0	-
1964	2.6	23.0	10.6	10.0
1965	1.3	15.0	7.1	10.6
1966	9.8	14.8	3.1	7.1
1967	7.0	19.2	5.9	3.0
1968	10.6	25.6	8.2	5.9
1969	7.6	23.1	7.3	7.3
1970	4.8	13.4	3.9	7.3
1971	5.8	15.2	5.0	3.9
1972	2.4	15.8	5.0	5.0
1973	2.7	14.8	5.1	4.9
1974	3.5	10.0	2.9	5.1
1975	4.1	7.7	1.8	2.9
1976	0.3	2.5	1.2	1.8
1977	0.8	5.4	2.5	1.2
1978	4.2	7.2	2.2	2.5
1979	1.3	3.9	1.4	2.2
1980				1.4

Catch per tow (lbs) is assumed directly related to the size of the fish population. The survey population size index should correspond to the size of the population at the start of the year following the survey.

Table 11. Autumn bottom trawl survey results for the Mid Atlantic area (ICNAF SA 6)

Year	mean number/tow	mean weight (kg)/tow	mean number age 1/tow
1963	28.8	8.9	11.1
1964	16.4	4.9	5.3
1965	49.1	5.8	19.2
1966	48.3	8.9	14.2
1967	55.6	9.3	12.5
1968	81.3	13.5	11.6
1969	45.4	9.9	0.6
1970	45.2	10.3	1.9
1971	27.0	3.8	11.0
1972	38.3	9.9	0.6
1973	8.2	1.9	0.69
1974	0.7	0.2	0.04
1975	0.9	0.1	0.46
1976	0.4	0.06	0.07
1977	1.43	0.2	1.4
1978	1.2	0.2	0.604
1979	1.04	0.2	0.427

Table 12. Summer trawl survey results

Summer	So. New England			Georges Bank			Mid-Atlantic		
	#	kg	Lnth	#	kg	Lnth	#	kg	Lnth
1963	28.17	9.0	31.7	20.68	7.6	33.3	4.01	0.7	25.0
1964	24.54	11.2	35.2	9.75	3.4	31.1	2.17	0.1	34.12
1965	38.48	10.0	31.5	15.55	5.2	32.8	3.33	0.1	19.10
1969	59.45	12.9	29.8	41.97	12.2	30.5	9.35	1.3	24.8
1978	5.41	1.34	29.9	3.59	1.18	29.5	.17	.03	24.6
1979	37.99	14.23	30.4	3.66	1.56	32.0	1.66	0.15	18.5

Indicate incomplete survey for Middle Atlantic.

Table 13.

Southern New EnglandAutumn% Age Composition of NEFC Bottom Trawl Survey Catch

	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8+</u>
1963		32.4	30.1	27.8	8.5	1.1		.2	
1964		30.3	43.3	7.9	11.8	5.4	1.3		
1965		28.1	45.4	16.7	4.7	4.7	.5		
1966		71.2	22.3	3.8	2.2	.4			
1967		29.5	46.5	20.2	2.8	.7	.1	.2	
1968		12.5	25.8	58.2	3.6				
1969		18.3	16.1	55.3	10.2	.1			
1970		9.4	14.1	41.7	27.1	6.4	1.1	.2	
1971		14.9	26.2	15.0	36.5	6.4	.6	.4	
1972		13.1	79.7	6.1	1.1				
1973		13.1	14.5	25.9	19.2	13.8	11.1	2.5	
1974	2.8	13.5	22.4	8.1	30.9	13.1	5.5	2.7	1.0
1975		57.6	15.3	7.2	8.4	8.3		3.2	
1976		25.3	59.9	5.3	.7	1.1	2.9	3.4	1.5
1977		34.2	45.1	16.4	1.1	.9	.8	1.5	
1978		27.9	63.5	3.8	3.3	.4	.1	.7	.3
1979		19.1	49.2	26.7	4.2	.5	.4		

Table 14.

Georges BankAutumn% Age Composition of NEFC Bottom Trawl Survey Catch

	0	1	2	3	4	5	6	7	8+
1963		40.9	21.0	31.8	4.0	1.4	.3	.5	.2
1964		6.1	34.8	26.3	21.4	9.6	1.4	.3	
1965		6.0	32.2	32.4	19.5	8.7	.4	.8	
1966		56.6	18.0	17.4	7.6	.5			
1967		39.7	41.9	12.1	4.5	1.4	.2	.3	
1968		32.9	40.6	20.4	2.7	3.3	.1		
1969		28.3	39.9	22.4	6.4	1.7	.6	.7	
1970		29.8	33.5	20.5	12.7	2.9	.4	.1	
1971		19.5	37.3	26.9	12.1	2.7	1.2	.1	.1
1972		38.5	38.5	18.4	3.0	1.7			
1973		14.0	30.8	28.6	16.5	6.8	2.3	1.0	
1974	10.2	38.1	23.6	12.5	8.7	3.8	2.0	1.1	
1975		45.3	31.5	11.0	7.2	4.2	.4		
1976		10.7	62.7	15.5	3.8	4.0	1.1		2.2
1977		14.9	40.4	29.6	11.3	1.9	1.0	.7	.3
1978	.5	64.0	17.2	10.5	5.4	1.8	.2		.3
1979		30.5	53.7	6.8	3.1	3.5	.9	1.3	.2

Table 15.

Southern New EnglandSummer% Age Composition of NEFC Bottom Trawl Survey Catch

	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8+</u>
1964		2.3	38.0	18.9	25.8	12.3	2.0	.7	
1965		1.9	50.7	44.3	3.1				
1969			23.0	71.1	5.9				
1977		21.9	37.0	30.4	3.6	1.1	4.2	1.3	.6
1978		1.4	88.1	3.8	5.3	.7		.7	
1979		2.7	63.1	32.2	1.8	.3			

Table 16.

<u>Georges Bank</u>		<u>Summer</u>							
		<u>% Age Composition of NEFC Bottom Trawl Survey Catch</u>							
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8+</u>
1964		21.2	39.2	23.6	13.6	2.5			
1965			41.5	41.8	10.7	5.8	.2		
1969		4.8	51.4	32.9	8.7	.4	1.3	.3	.2
1977	1.1	14.9	42.1	16.9	18.5	3.5	3.0		
1978		28.2	34.4	23.4	11.4	2.1	.5		
1979		9.4	55.8	14.6	8.7	7.6	3.8		

Table 17. Rhode Island bottom trawl survey results.

Strata	Strata Area (Square Nautical Miles)	No. of Tows	Mean Catch Per Two Numbers	Weight (kg)
1	441	2	182	64.8
2	1325	11	217	73.9
3	724	7	34	16.2
4	557	6	163	72.1
5	863	11	194	73.7
6	382	3	116	47.1
Total	4292	43	162	60.6

% of catch in numbers by age

Age	1	2	3	4	5	6	7	8
Year-class	79	78	77	76	75	74	73	72
%	0.2	28.7	54.2	15.2	1.3	0.4	--	--

Figure 1. Strata of the FRIISLAND Survey.

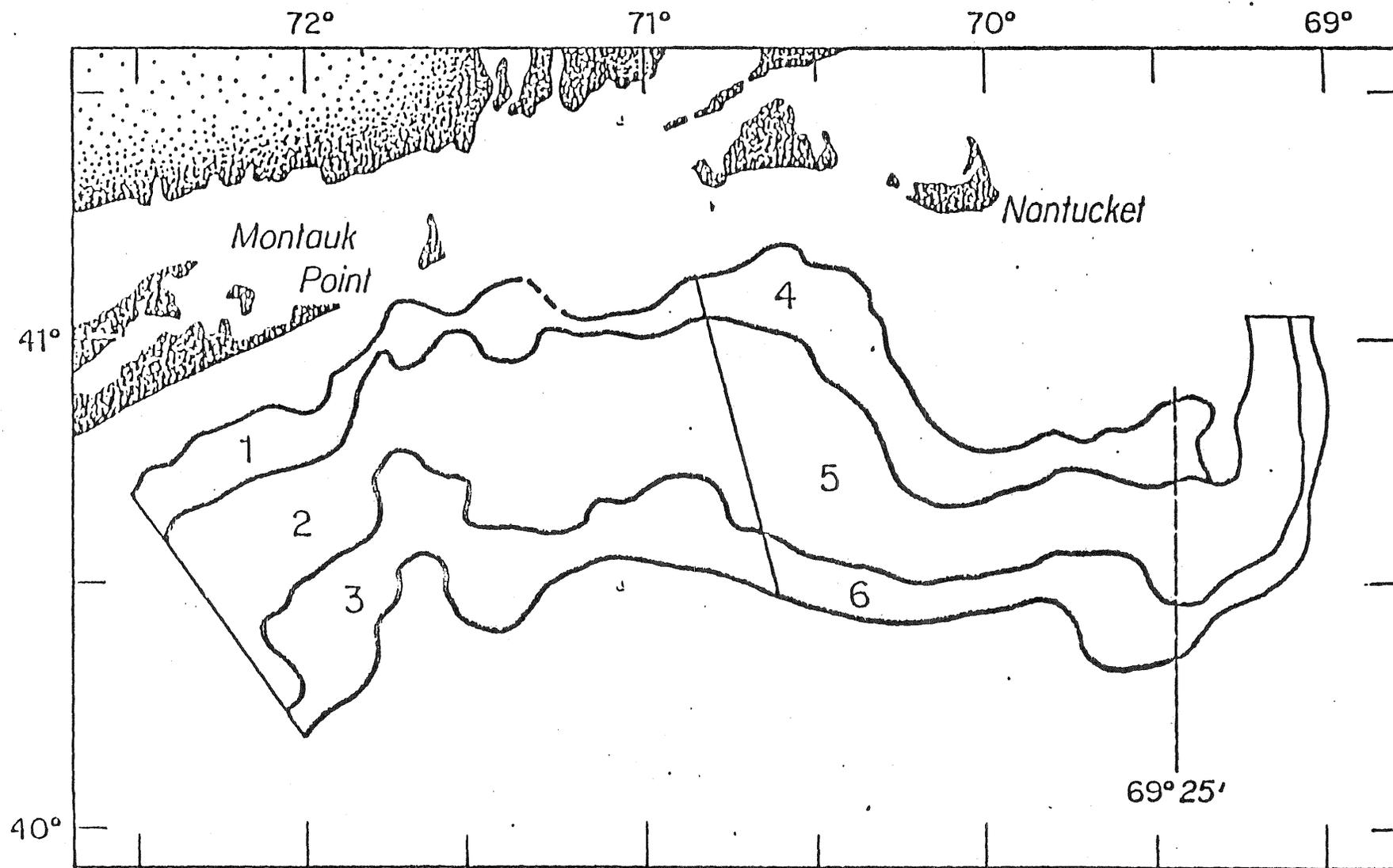


Figure 2. 1980 RHODE ISLAND YELLOWTAIL SURVEY

TOTAL

ALL STRATA

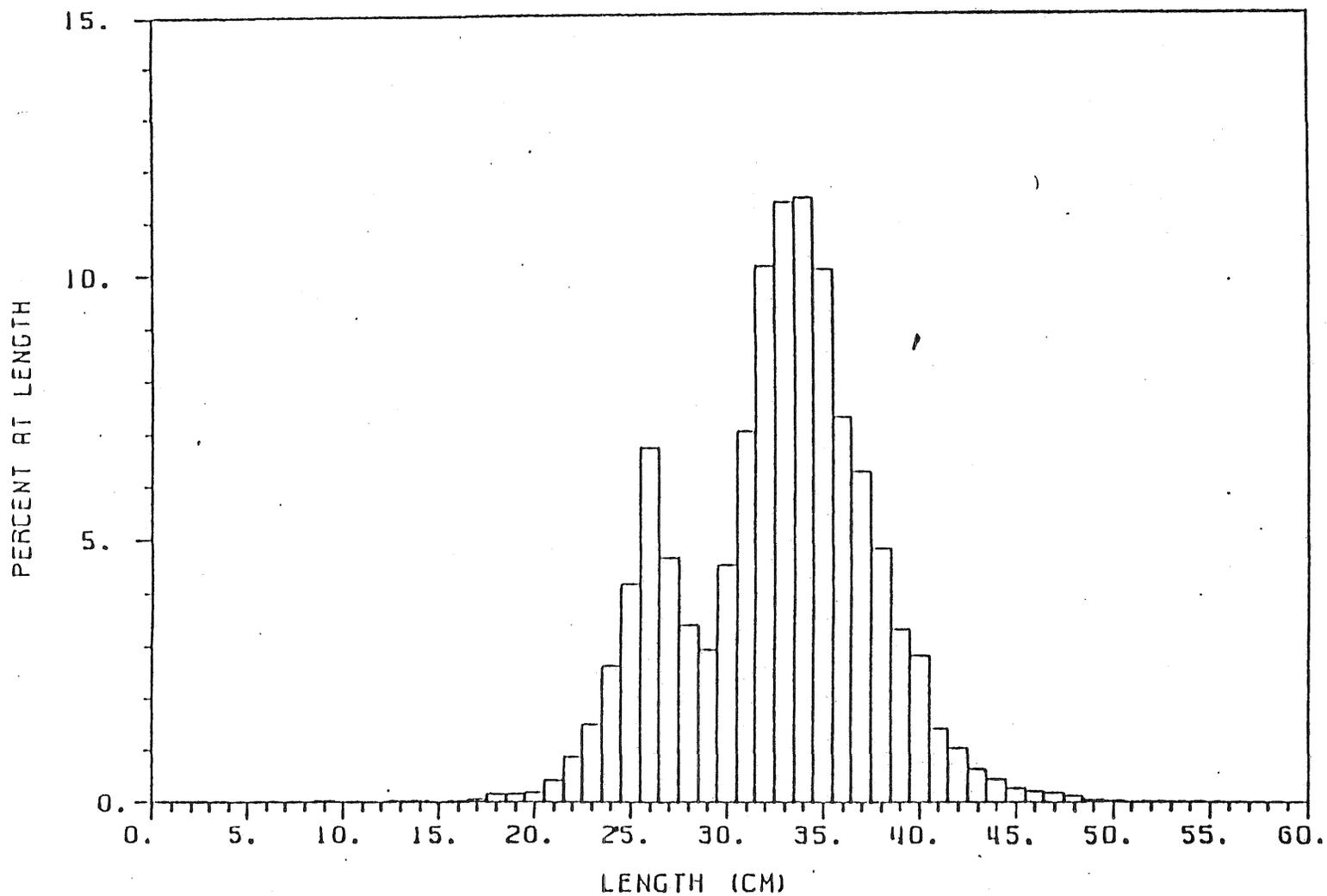


Figure 3.

1980 RHODE ISLAND YELLOWTAIL SURVEY

STRATA

1.

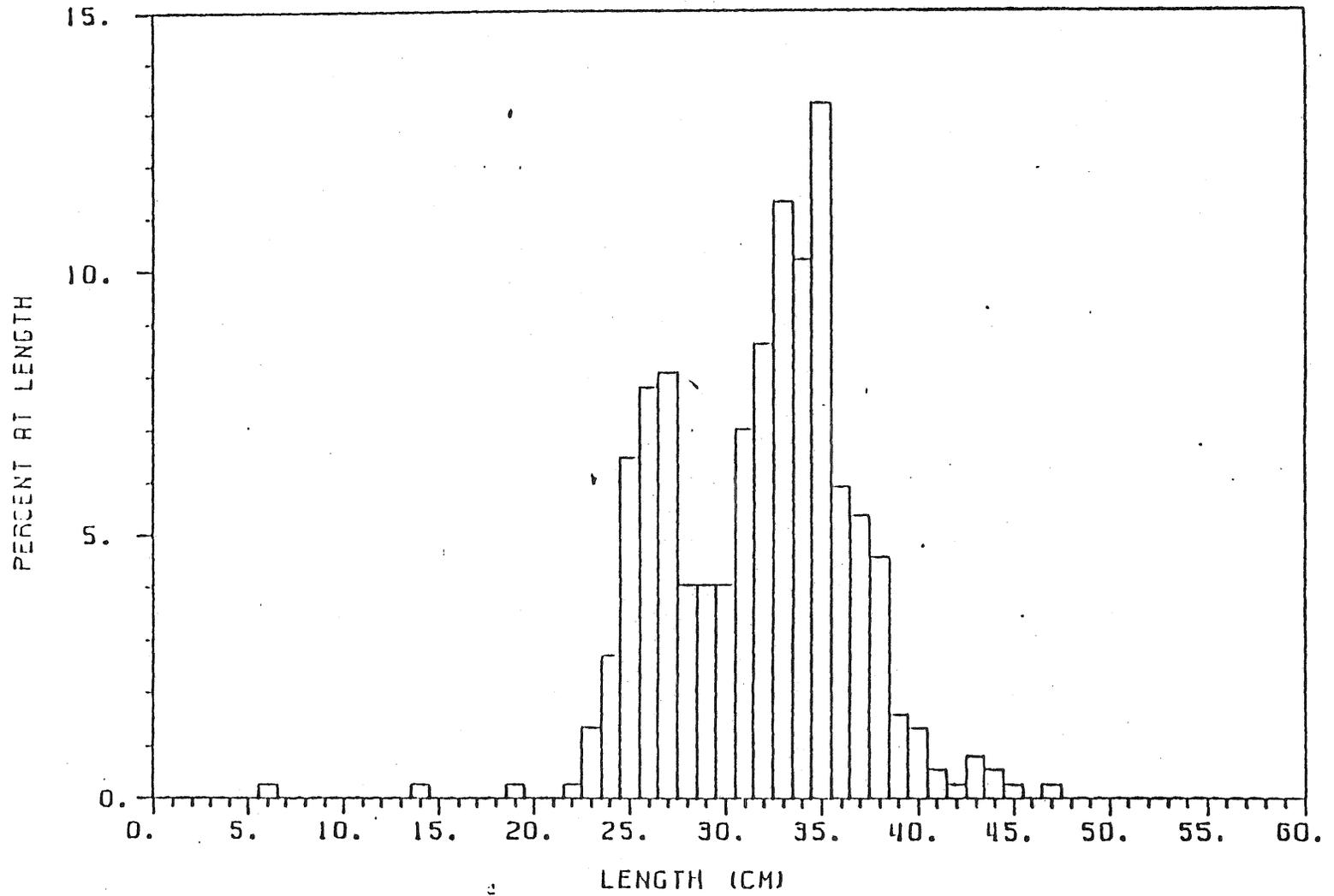


Figure 4. 1980 RHODE ISLAND YELLOWTAIL SURVEY

STRATA 2.

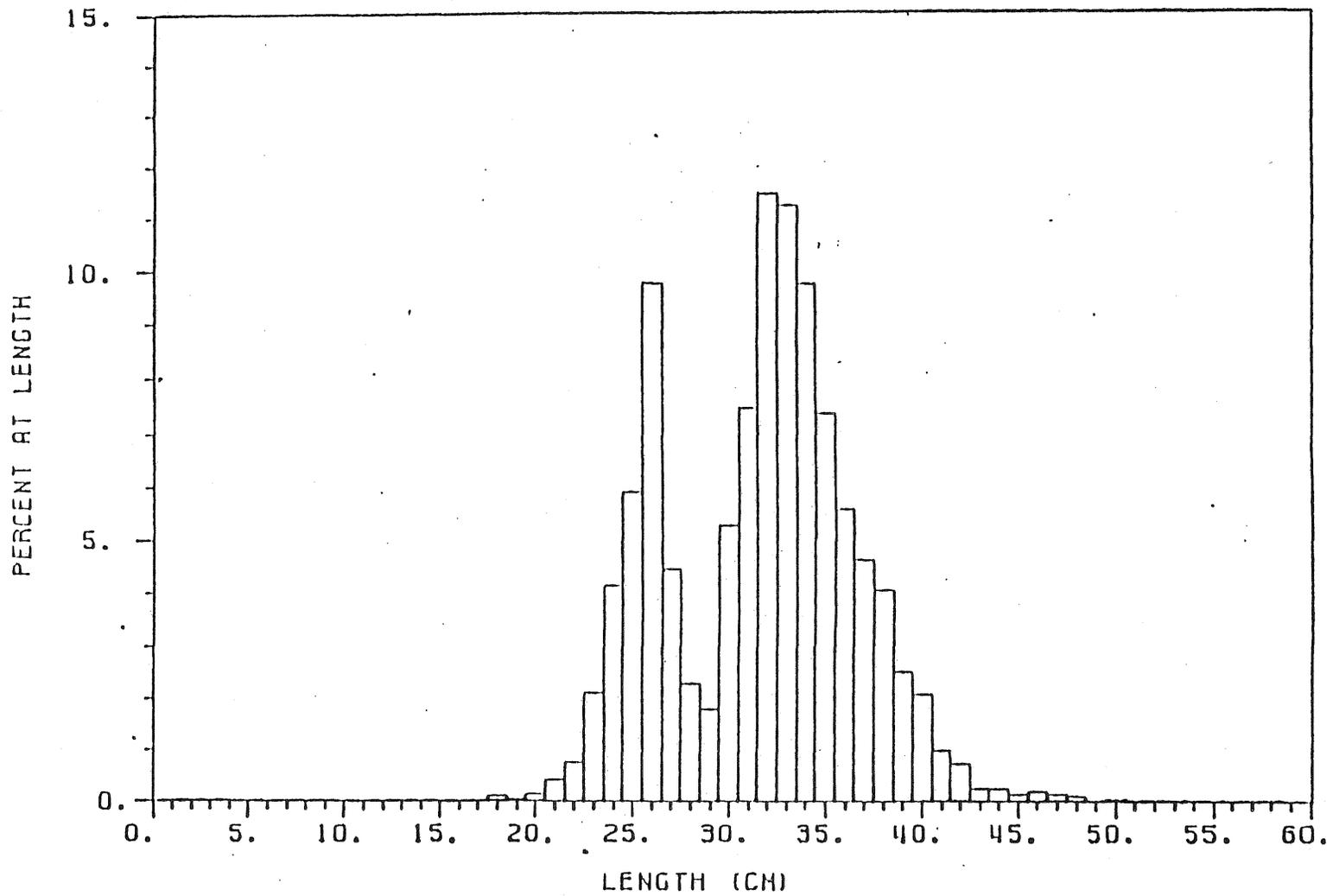


Figure 5. 1980 RHODE ISLAND YELLOWTAIL SURVEY

STRATA 3.

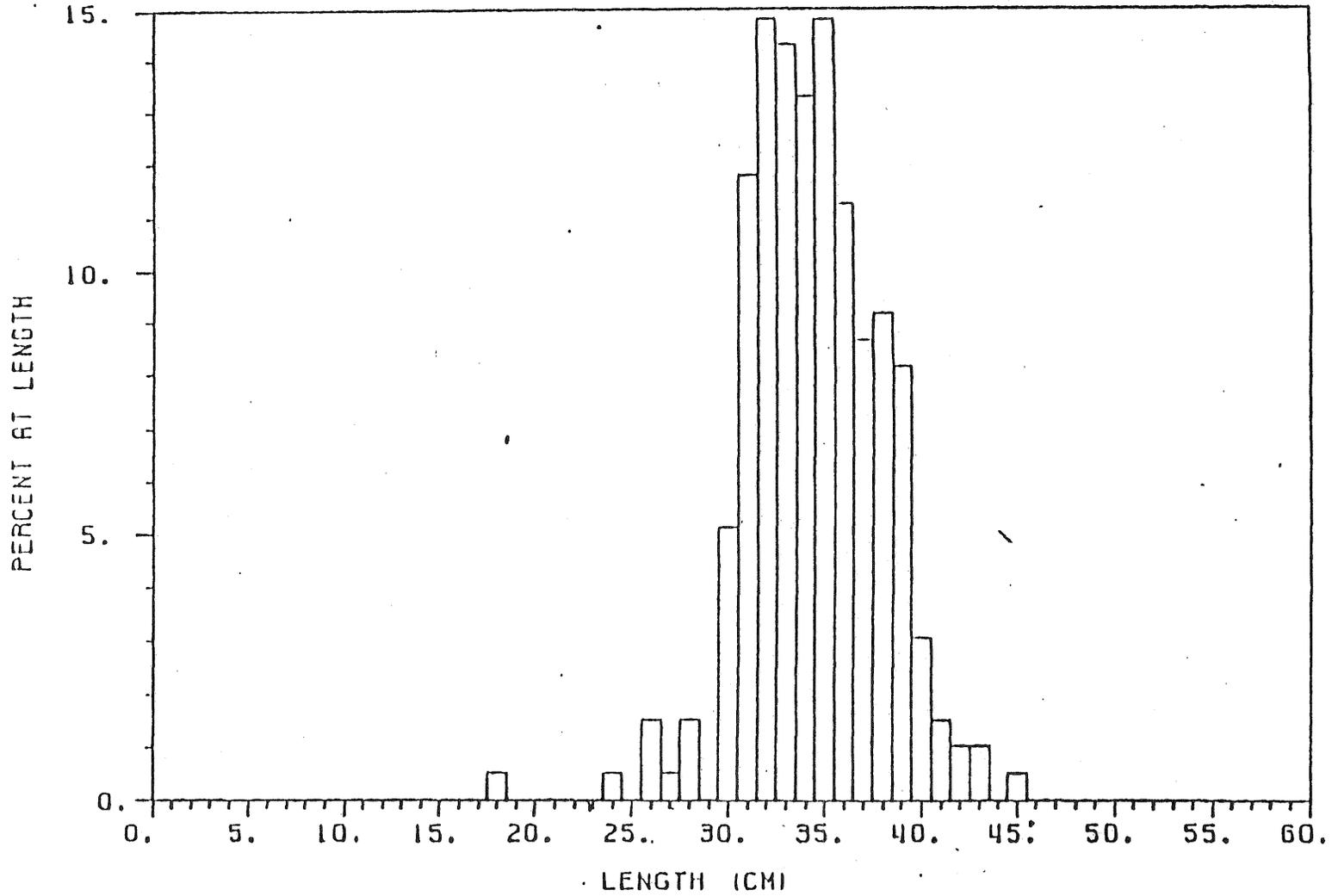


Figure 6. 1980 RHODE ISLAND YELLOWTAIL SURVEY

STRATA 4.

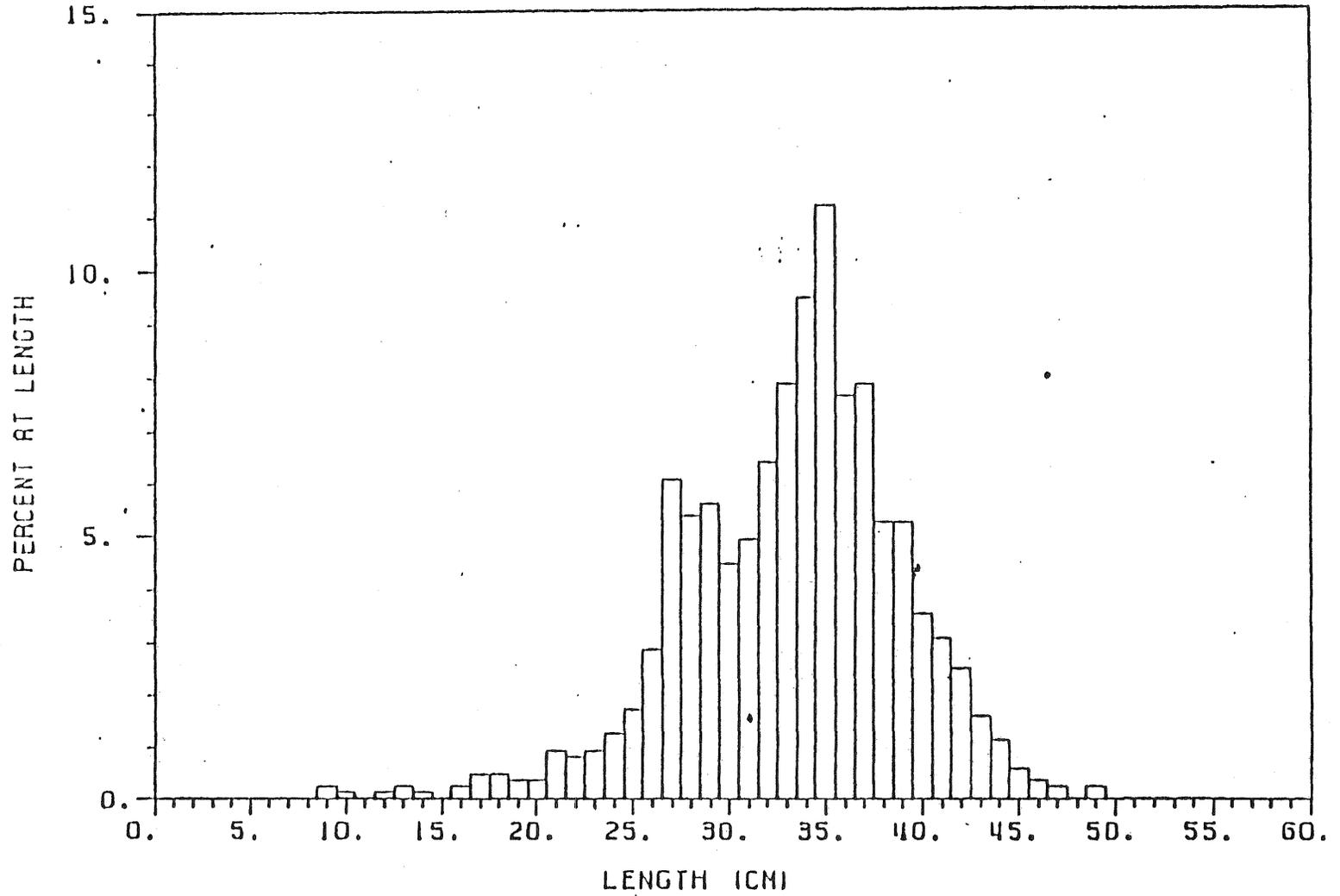


Figure 7. 1980 RHODE ISLAND YELLOWTAIL SURVEY

STRATA 5.

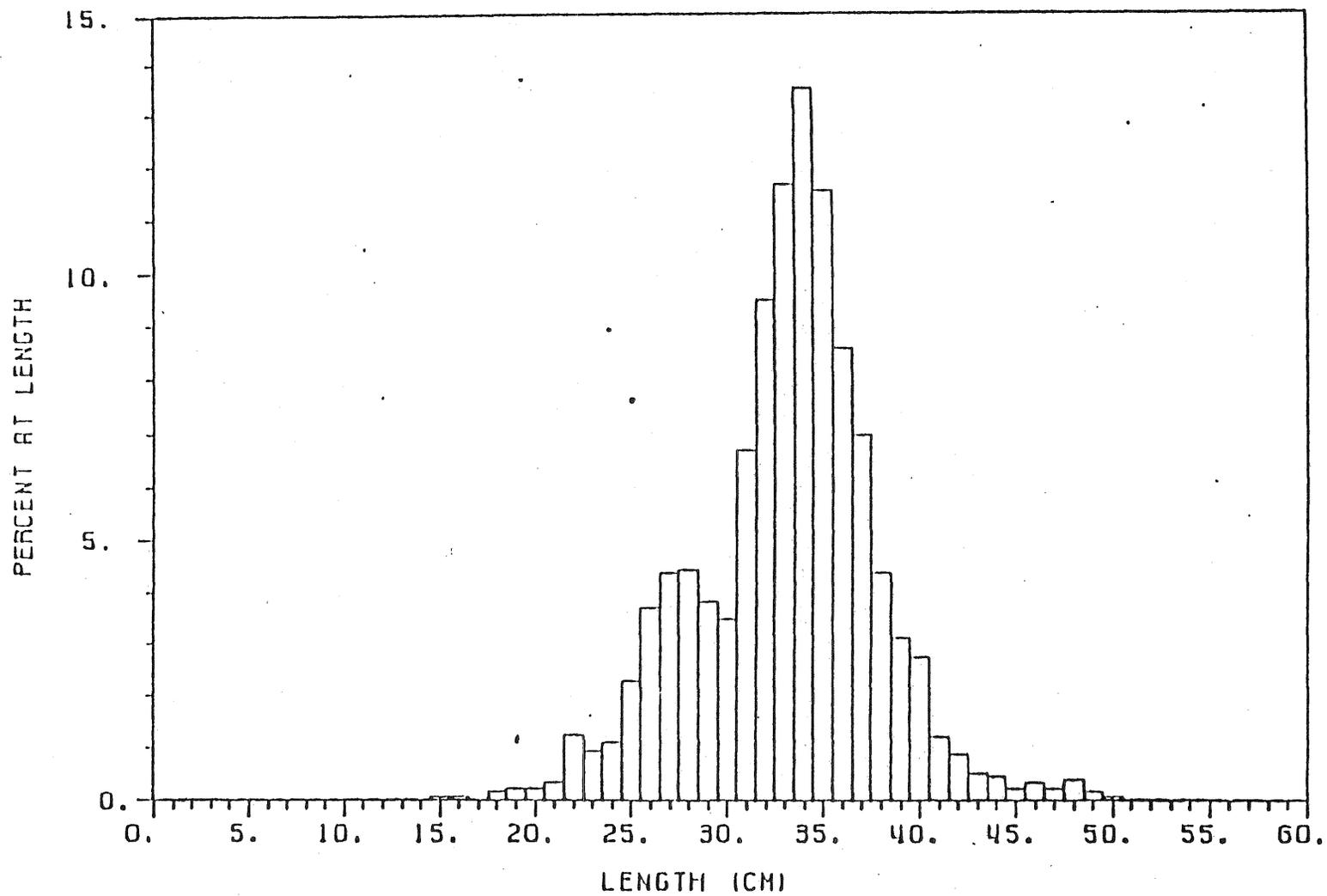


Figure 8. 1980 RHODE ISLAND YELLOWTAIL SURVEY

STRATA 6.

