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Biological Characteristics of Offshore Gulf of Maine Sea Scallop Populations: Size Distributions, Shell Height-Meat Weight Relationships and Relative Fecundity Patterns

by

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SUMMARY

Size-frequency distributions, shell height-meat weight relationships, and relative fecundity relationships for offshore Gulf of Maine sea scallop populations were derived from a NMFS sea scallop research vessel survey conducted during summer 1982. A primary objective of this survey was to obtain data on the biological characteristics of the sea scallop populations supporting the recently developed offshore (Fishery Conservation Zone) commercial fishery off of Jonesport, Maine.

Survey size frequency data indicated that the Jonesport beds were primarily comprised of scallops larger than 82 mm shell height (3.2 in), with about 50% of the resource between 97-107 mm shell height (3.8-4.2 in). The size frequency distribution of the Jonesport scallops was nearly unimodel. Average (mean) shell height of the 2,698 scallops caught was 101 mm (4.0 in); average meat size per scallop was 11.3 grams, equivalent to a meat count of 40 per pound. Scallops as large as 137 mm shell height (5.4 in) and meats as great as 33 grams (14 count) occurred among the samples obtained in the 43 survey tows accomplished on the Jonesport beds.

Apart from the Jonesport region, most other offshore Gulf of Maine areas sampled (56 tows) in the 1982 survey yielded few scallops with two exceptions: on Jeffreys Ledge one tow caught 2,900 scallops (mean shell height = 64 mm; average meat count = 96) and on Fipennies Ledge, two tows caught a total of 1,700 scallops (mean shell height = 33 mm; average meat count = 368).

Shell height-meat weight relationships for Jonesport scallops were statistically different from other offshore Gulf of Maine populations, from inshore Gulf of Maine populations, and from the Georges Bank and Mid-Atlantic scallop resources. Jonesport scallops possess less meat weight per unit shell height than scallops in other areas. Shell height-meat weight relations for other offshore Gulf of Maine populations are similar to those reported for inshore Gulf of Maine scallops. As an entity, the aggregate offshore Gulf of Maine scallop resource exhibits a lower relative growth rate than those observed on Georges Bank and in the Mid-Atlantic, lagging about a year behind these populations in average size at age.

Fecundity, per unit of shell height (or meat weight), for offshore Gulf of Maine scallops is higher than in Mid-Atlantic scallops, but lower than in the Georges Bank populations. Substantial increases in Gulf of Maine scallop ovary weight accompany shell and meat weight growth.

The variability of biological characteristics exhibited by offshore Gulf of Maine sea scallop populations is similar to that observed in other USA sea scallop resources.

INTRODUCTION

In the Gulf of Maine, commercial fisheries for Atlantic sea scallops (Placopecten magellanicus) have been conducted since the latter portion of the nineteenth century (Smith 1891). Until the 1920's, Gulf of Maine sea scallop landings comprised the bulk of the total USA harvest (O'Brien 1961; Lyles 1969). Prior to 1950, USA Gulf of Maine landings were entirely derived from inshore, territorial waters along the Maine coast, principally from beds from Penobscot Bay and eastward (Baird 1956). Landings from this inshore fishery have been reported as cyclical with extremes of high and low yields alternating at approximately ten-year intervals (Dow 1962); fluctuations in inshore landings appear to be correlated with spring and autumn water temperatures lagged six to eight years (Dow 1962, 1977). Dow (1964, 1971) postulated that favorable prespawning and postspawning temperatures resulted in higher year-class strengths of inshore scallops at recruitment to the fishery at age six, at which time individuals average 104 mm (4.1 in) shell height and average 28 grams meat weight (16 meats per pound) (Dow 1969).

Since 1950, scallop catches from offshore Gulf of Maine waters and from Georges Bank have also been landed at Maine ports (Baird 1956; Dow 1962). In some years (1952-1960 and 1980-1982), annual offshore landings have been significantly larger than those from the inshore grounds (Serchuk et al. 1982: Table 8). Although the geographical origin (offshore Gulf of Maine vs Georges Bank) of the offshore landings in Maine during 1952-1960 is uncertain, offshore landings since 1980 have been primarily derived from deepwater areas in the Gulf of Maine. A fishery developed

in 1980 in the Jeffreys Basin, Cashes Ledge, and Fipennies Ledge regions; in 1981-1982, a subsequent offshore Gulf of Maine fishery transpired off Jonesport and Machias Bay.

Although the biological characteristics of inshore Gulf of Maine sea scallops have received some study (Welch 1950; Baird 1953, 1954, 1956; Dow 1956, 1969; Dow and Baird 1960; Haynes 1966; Hidu et al. 1977; Robinson et al. 1981; Schick 1982), little is known about the offshore Gulf of Maine populations. Bottom trawl surveys conducted by the National Marine Fisheries Service (NMFS) and shrimp surveys by the State of Maine have provided some data on the size composition of deepwater Gulf of Maine scallops obtained incidentally in these efforts (Serchuk et al. 1982; Schick, pers. comm.). Shell height-meat weight relationships have also been derived for the offshore population fished in 1980, from commercial samples collected by NMFS and the States of Maine and Massachusetts (Serchuk et al. 1982). However, more detailed studies are lacking. To address this dearth of knowledge, a sea scallop research vessel survey of the offshore Gulf of Maine sea scallop populations was conducted by NMFS during summer 1982. Objectives of this survey were to: (1) obtain biological data on the size composition of the sea scallop populations supporting the offshore Gulf of Maine fishery, particularly those in the Jonesport-Machias Bay region; (2) derive shell height-meat weight relationships and shell size-ovary weight relationships for offshore Gulf of Maine scallops; (3) assess the variability of these relationships compared with those for inshore Gulf of Maine scallops, and those for the Georges Bank and Mid-Atlantic populations; (4) evaluate the size dis-

tribution of the offshore Gulf of Maine resources with respect to prevailing meat count and shell size management standards implemented under the Fishery Management Plan for Atlantic Sea Scallops; and (5) determine the growth rate of the offshore Gulf of Maine scallops. This report reviews the 1982 NMFS survey results relative to objectives 1-4 above. Growth rate analyses (objective 5) are still in progress and will be reported upon in another document.

METHODS

The 1982 NMFS Gulf of Maine sea scallop research vessel survey was conducted during 31 July-5 August using the R/V Albatross IV equipped with a 2.44 m (8 ft) wide commercial sea scallop dredge possessing a 5.1 cm (2 in) ring bag and a 3.8 cm (1.5 in) polypropylene mesh liner. This is the standard sampling gear used in all NMFS Georges Bank and Mid-Atlantic scallop surveys since 1979. Detailed gear specifications are described in Serchuk and Smolowitz (1980).

Sampling stations were determined in a variety of ways: (1) 14 deepwater (≥70 fms) stations in the southwestern Gulf of Maine (Stations 443-456, Appendix Table 1 and Appendix Figure 1) were pre-selected on the basis of spring and autumn 1980-1981 NMFS bottom trawl survey tow locations at which large quantities (24-578 scallops) were obtained; (2) stations in the Jonesport region (Stations 463-504) were selected, at sea, on the basis of information provided by the State of Maine, NMFS port agents, and a commercial sea sampling trip aboard a Jonesport sea scallop vessel delineating the general distribution of scallop beds supporting the Jonesport commercial fishery; and (3) stations in other

offshore areas were randomly selected at the discretion of the Chief Scientist contingent upon suitable bottom topography for dredging and weather and time constraints.

At each station, an attempt was made to tow the survey gear for 15 minutes at 3.5 knots. In some cases, tows had to be abbreviated due to hang-ups on rocks or gear damage. After each tow, all scallops caught were individually measured for shell height; measurements were recorded by 5 mm intervals. At two stations (tows 523 and 531 on Fipennies Ledge and Jeffreys Ledge, respectively), subsampling of the catch was necessary due to the large number of scallops obtained (Appendix Table 1). Following enumeration of the total number of scallops caught, adductor muscle, ovary and shell samples were taken encompassing the entire shell height range of the catch. When catches permitted, a sample consisted of a maximum of 100 adductor muscles (meats) with corresponding top valve shells and excised ovaries per station.

Shell samples were measured to the nearest millimeter for shell height. Adductor muscle and ovary samples were placed in individual plastic bags and frozen. In the laboratory, individual meats and ovaries were weighed to the nearest 0.01 gram.

Linear regressions of the general form, $\ln Y = a + b \ln X$, were fitted to the individual shell height, meat weight and ovary weight data to obtain shell height-meat weight and shell height-ovary weight relationships for each principal region sampled (Jonesport, other offshore Gulf of Maine areas, and all areas combined). Meat weight-shell height and meat weight-ovary weight relationships were similarly computed. Regression and covariance analyses were performed using procedures in Snedecor and Cochran (1967), Neter and Wasserman (1974) and Sokal and Rohlf (1981).

Average meat weight per scallop and corresponding average meat count (number of scallop meats per pound) of scallops collected in each of four areas during the 1982 survey [Jonesport, Fipennies Ledge, Jeffreys Ledge (NNE of New Scantum), and other offshore Gulf of Maine areas combined] were derived by applying the appropriate shell height-meat weight equation to the shell height frequency distributions from these areas. Average meat count was determined by dividing the calculated average meat weight per scallop (g) into 453.6 grams (1 pound).

RESULTS

A total of 98 tows were performed during 1982 Gulf of Maine scallop survey resulting in a total catch of 7,519 scallops (Table 1). Depths sampled ranged from 13-107 fm (23-195 m) (Appendix Table 1, Appendix Figure 1).

In the Jonesport region, 42 tows yielded 2,698 scallops ranging in size from 17-137 mm (0.7-5.4 in) shell height with meats between 0.05 and 33.3 g (9072 - 14 count). Ovary weight samples (600) ranged between 0.09 and 17.8 g and averaged 5.2 g. Sampling depths spanned 36-104 fm (66-191 m); mean depth sampled was 66 fm (121 m). Scallops were obtained in 33 of the 42 tows (79%) with the largest catches (>100 scallops per tow) occurring in depths between 59-84 fm (108-154 m). Individual tow data from the Jonesport sampling are provided in Appendix Table 1; station locations are depicted in Appendix Figure 2.

A total of 56 tows were accomplished in areas other than Jonesport (Table 1). Apart from two tows on Fipennies Ledge which caught a combined total of 1,712 scallops (Tows 522 and 523: Appendix Table 1) and one

tow on Jeffreys Ledge (NNE of New Scantum) which produced 2,876 scallops (Tow 531: Appendix Table 1), most other offshore areas sampled yielded few scallops. Only 233 individuals were collected from 53 tows in other regions. Of this total, 160 scallops (69%) were obtained from the 14 deepwater stations (Tows 443-456) pre-selected for sampling on the basis of prior NMFS bottom trawl survey data.

Size Composition

Shell height frequency distributions of all scallops obtained in the 1982 survey are presented in Table 2, by area. Due to the large catches on Fipennies Ledge and Jeffreys Ledge (NNE of New Scantum), size frequency distributions have been tabulated separately for each of these areas. It should be realized, however, that these data were derived from only three tows (2 on Fipennies Ledge; 1 on Jeffreys Ledge) and that directed sampling of these particular areas was not a specific objective of the 1982 NMFS scallop survey.

In the Jonesport beds, scallops larger than 82 mm shell height (3.2 in) comprised the bulk of the resource (Table 2, Figure 1), constituting 94.1% of the survey catch. Over half (57.6%) of the total number of scallops caught at Jonesport were larger than 97 mm shell height (3.8 in). The mean shell height of all individuals collected was 101 mm (4.0 in) with about 50% of the resource between 97 and 107 mm (3.8-4.2 in). The average calculated meat weight per scallop was 11.3 grams, equivalent to a meat count of 40 per pound. The 1982 survey average shell height, meat weight, and meat count values were virtually identical to those obtained from a sea sampling trip aboard a commercial

Jonesport sea scallop vessel on 26 July 1982 (average shell height = 100 mm; average meat weight per scallop = 10.2 grams; average meat count = 45). Considering the relatively compact and nearly unimodal size frequency distribution of the Jonesport scallop resource (Figure 1), this correspondence is not unexpected.

Small scallops dominated the Fipennies Ledge survey catches. Greater than 75% of the scallops caught were less than 52 mm shell height (2.0 in) with about 50% less than or equal to 22 mm shell height (0.9 in) (Table 2). Prominent size frequency modes at 22 mm and 52 mm (Figure 1) suggest two distinct cohorts, probably the 1980 and 1979 year classes, respectively. The mean shell height of the Fipennies Ledge scallop samples was 33 mm (1.3 in). The average meat weight per scallop was calculated as 1.2 grams, corresponding to an average meat count of 368.

The largest tow of scallops in the 1982 survey (2,876 individuals) was taken in an area NNE of New Scantum (Jeffreys Ledge)at a depth of 32 fm (58 m). Scallops in this tow ranged between 12 and 147 mm shell height (0.5-5.8 in) and averaged 64 mm shell height (2.5 in) (Table 2). The conspicuous height frequency mode between 57-77 mm (Figure 1) suggests that the majority of scallops taken at this location were from a single year class, probably the 1978 cohort. The average calculated meat weight for all scallops taken was 4.7 grams, equivalent to a 96 meat count.

For all other offshore Gulf of Maine areas combined, scallops ranged between 27 and 162 mm (1.1-6.4 in) shell height, with the largest specimens taken in the entire survey (157 mm and 162 mm) occurring in a tow made in Cape Cod Bay (Tow 540; depth = 13 fm). The largest individual scallop

meat (58.9 g, equivalent to 8 count) and ovary (27 g) sampled in the 1982 survey were also taken at this station. As a group, the 233 scallops collected from the 53 tows made in areas other than Jonesport and Fipennies and Jeffreys Ledges averaged 88 mm shell height (3.5 in) and 11.8 grams meat weight. This latter value corresponds to an average meat count of 38 per pound (Table 2).

In toto, the survey size frequency distribution patterns exhibit significant variation among offshore areas in the Gulf of Maine. Characterization of the size composition of the aggregate Gulf of Maine sea scallop resource, however, cannot be reliably deduced from the 1982 survey results since the survey was not performed to synoptically evaluate relative distribution and abundance of the total offshore scallop populations.

Shell Height-Meat Weight Relationships

Summary statistics of the shell height and meat weight data used in deriving shell size-meat weight equations are presented in Table 1. A total of 1,761 samples were obtained: 1,248 samples from 31 sampling stations in the Jonesport area, and 513 samples from 29 sampling stations in all other areas including Fipennies Ledge and Jeffreys Ledge.

Shell height samples ranged between 13 and 157 mm (0.5-6.2 in) and averaged 102 mm (4.0 in) for Jonesport scallops, 77 mm (3.0 in) for scallops from all other areas, and 95 mm (3.7 in) overall. Meat weights ranged from 0.02 to 58.9 g with the smallest and largest individual meats taken from Fipennies Ledge and Cape Cod Bay, respectively. Average meat weight of the Jonesport samples were nearly twice that of the

Fipennies and Jeffreys Ledge samples (Table 1) reflective of the different size composition of scallops among these areas (Table 2).

Regression equations were derived separately for the Jonesport scallops and for all other offshore Gulf of Maine scallop samples combined. The Fipennies and Jeffreys Ledge samples were aggregated with all other offshore samples (apart from Jonesport) to increase the total sample size in the regression analysis and because these samples were collected from only three stations.

Regression parameters and related statistics for the shell height-meat weight relations determined from the 1982 survey data are summarized in Table 3. Also presented are regression statistics derived from previous commercial and research vessel survey sampling (Machias Bay, 1981 Maine DMR samples; Fipennies and Jeffreys Basin, 1980 NMFS, Massachusetts and Maine samples; Penobscot Bay, from Haynes 1966; Boothbay Harbor, 1981 Maine DMR samples). All of these relationships are depicted in Figure 2.

Pairwise comparisons of the four offshore shell height-meat weight equations using covariance analysis indicated that each was statistically different ($P<0.05$) from one another, except for the Jonesport and Machias Bay equations between which no significant difference was detected ($P>0.05$).

Calculated meat weights at various shell heights, using individual offshore and inshore height-weight regressions, reveal little differences among areas for shell heights less than 90 mm (3.5 in) (Table 4). At larger shell sizes, the calculated meat weights of Jonesport-Machias Bay scallops are less than for any of the other offshore or inshore

populations. However, aside from these differences, the predicted weight at height values from the other offshore equations (Fipennies and Jeffreys Basins, 1980; Other Offshore Gulf of Maine areas, 1982) are similar to those for the inshore populations (Penobscot Bay and Boothbay Harbor) implying comparable allometric growth patterns between inshore and offshore beds. The reduced meat weight per unit shell height in the Jonesport-Machias Bay populations may reflect diminished metabolic activity resulting from nutritional limitations in deep water habitats. Depth-associated retardation of growth has been reported for both deepwater Georges Bank and Gulf of Maine scallop populations (Posgay 1979; Gould 1981).

For a given meat weight (or meat count), predicted shell heights [derived from meat weight-shell height regressions (Table 5)] differ only slightly among areas sampled in the Gulf of Maine (Table 6). Between 60 and 20 meat count (7.56-22.68 g meat weight), the most extreme differences in scallop shell height between any of the inshore or offshore populations are less than 13 percent. In absolute terms, these differences are relatively minor, ranging from 7-14 mm shell height (0.3-0.6 in).

Relative Fecundity Relationships

Relative fecundity (weight of ovary to shell height; weight of ovary to meat weight: Baganel 1973, 1978) relationships for Gulf of Maine sea scallops was evaluated from 757 ovary weight samples from 52 different sampling stations in the 1982 survey (Jonesport area: 600 samples from 28 tows; All other areas: 157 samples from 24 tows). In all areas sampled, most female scallops greater than 80 mm shell height (3.1 in) were sexually mature.

Summary statistics of the ovary weight data collected are presented, by area, in Table 1. Average ovary weights were slightly different among areas with the Jeffreys Ledge samples having the smallest mean size and samples from areas other than Jonesport, Fipennies and Jeffreys Ledges having the largest. The range in ovary weights was generally similar among areas.

Regression statistics for the shell height-ovary weight and meat weight-ovary weight equations are presented in Tables 7 and 8, respectively. Covariance analyses indicated a significant statistical difference between the Jonesport equations and those from all other offshore areas combined ($P<0.05$).

Comparison of calculated mean ovary weights, between Jonesport and other offshore Gulf of Maine areas, reveals that Jonesport scallops tend to have a smaller-sized ovary than scallops in other offshore areas at shell heights greater than 80 mm (3.1 in) (Table 9). At these larger shell sizes, calculated Jonesport ovary weights are about 40-50% lower than those for the other offshore populations (Figure 3). In both groups of scallops, however, substantial increases in ovary weight accompany shell growth. Between 80-100 mm shell height (3.1-3.9 in), ovary weight nearly doubles for the Jonesport scallops and increases 2.5-fold in the other offshore populations. Nearly similar proportional increases in ovary size again occur in both groups between 100 and 120 mm shell height (i.e. 1.7X for Jonesport scallops; 2.1X for other offshore Gulf of Maine scallops.

Fecundity, per unit of shell height, for Gulf of Maine scallops is intermediate between that for Georges Bank and that for Mid-Atlantic sea scallops (Figure 3). Calculated ovary weights from both the Jonesport and other offshore Gulf of Maine shell height-ovary weight relationships were larger than corresponding values for Mid-Atlantic scallops (1981 and 1982 Mid-Atlantic equations) but smaller than that for Georges Bank (1982 and 1981 Georges Bank equations).

Relative to meat size growth, ovary weight of Gulf of Maine scallops increases by 50-70% as individuals grow from 60 to 40 count, and further increases by 30-45% from 40 to 30 count (Table 10). These proportional increases in ovary weight are similar to those for Georges Bank and Mid-Atlantic scallops (50% increase from 60-40 count; 35-40% increase from 40 to 30 count: Serchuk et al 1982: p. 42) implying that for all USA scallop resources substantial gains in potential egg deposition may be attained by increasing the average size (age) at which scallops are harvested in the commercial fishery. On an absolute scale, calculated Gulf of Maine ovary weights are intermediate between Mid-Atlantic and Georges Bank ovary weights at any given meat count (Figure 4).

Comparison of Growth Characteristics of Gulf of Maine, Georges Bank and Mid-Atlantic Scallops

The sea scallop shell height and meat weight samples obtained during the 1982 NMFS sea scallop survey in the Gulf of Maine, as well as those collected from the 1982 surveys on Georges Bank and in the Mid-Atlantic, augment the existing sea scallop shell height-meat weight data base series (Serchuk et al. 1982:p. 36). Accordingly, to compare generalized shell height-meat weight characteristics of scallops among

these three regions, the totality of samples within each region were analyzed to derive collective, area-specific shell height-meat weight relationships over all years. A total of 21,293 samples collected during 1977-1982 were included in these analyses: 5,863 samples from Georges Bank (1978-1982); 11,943 samples from the Mid-Atlantic (1977-1982); and 3,487 samples from offshore Gulf of Maine (1980 and 1982) (Table 11). Shell height-meat weight and meat weight-shell height regression statistics for these relationships are expressed in Tables 12 and 13, respectively.

Although each of the regressions were statistically different from one another ($P<0.05$), the differences in predicted values among the three areas were relatively minor. The maximum percentage difference in shell height at various meat counts between 60 and 20 was only 13.5%, with no meaningful differences between Georges Bank and Mid-Atlantic values (Table 14). Offshore Gulf of Maine scallops, however, lag about 10 mm (0.4 in) in shell height behind Georges Bank and Mid-Atlantic scallops at comparable meat counts; that is, for a given meat count, the predicted average shell height of Gulf of Maine scallops is about 10 mm greater than that for the Georges Bank or Mid-Atlantic populations (Table 14).

This 10 mm shell height differential is evident in terms of meat weight at size in Table 15. From 70-160 mm (2.8-6.3 in) shell height, calculated meat weights (and meat counts) of Georges and Mid-Atlantic scallops are not attained by Gulf of Maine scallops until the subsequent 10 mm shell height interval. For example, 40 count size is reached by both Georges Bank and Mid-Atlantic scallops at about 90 mm (3.5 in) shell height while Gulf of Maine scallops do not achieve 40 count until

they average 100 mm (3.9 in) shell height. Given average sea scallop growth rates (Serchuk et al. 1982: Table 20), this differential suggests that meat weight growth of offshore Gulf of Maine scallops may be 1/2-1 year slower than on Georges Bank and in the Mid-Atlantic region.

DISCUSSION

Analyses of size composition data, shell size-meat weight relationships, and relative fecundity relationships from offshore Gulf of Maine scallop populations sampled during the 1982 NMFS sea scallop research vessel survey indicate that these populations exhibit biological characteristics well within the range of variability observed in other USA scallop resources. Although scallops in the Jonesport beds exhibited less meat weight per unit shell height than in either inshore Gulf of Maine or other offshore populations, Jonesport scallops displayed other biotic features (relative fecundity, size at maturation, size composition) regarded as typical for scallops. The average shell height and meat count of scallops in the Jonesport region (101 mm; 40 count) meet the initial year management standards implemented under the Fishery Management Plan for Sea Scallops. Scallops as large as 137 mm shell height (5.4 in) and meats as great as 33.3 grams (14 count) occurred in the Jonesport samples denoting that individuals grow large enough to become 30 count size and lower. The nearly unimodal size frequency composition of the Jonesport resource suggests that the population may be comprised of only 1-2 year classes. The relatively rapid development of the offshore Jonesport scallop fishery during 1981-1982 is further suggestive that recent recruitment in this area stimulated fishery activity. Normally, significant fishery yields from offshore Gulf of

Maine scallop populations tend to be transitory. Elevated yields from the offshore Jeffreys Ledge scallop fishery lasted only two years (1980 and 1981).

Biological attributes of other offshore Gulf of Maine populations (apart from Jonesport) sampled in the 1982 NMFS survey were only slightly different from those observed for inshore Gulf of Maine scallops or scallops on Georges Bank and in the Mid-Atlantic, consistent with previous findings and comparisons (Serchuk et al. 1982: p. 30). Aggregate analyses indicate that the offshore Gulf of Maine populations have a lower relative growth rate than Georges Bank and Mid-Atlantic scallops, but attain large shell sizes and meats weights, nonetheless.

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able 1. Summary information for the 1982 NMFS Gulf of Maine sea scallop research vessel survey conducted 31 July - 5 August 1982.

	Number of Tows	Depth (fm)			Number of Scallops Caught			Shell Height (mm)[1]			Meat Weight (g)[2]			Ovary Weight (g)[3]		
		Mean	Range	Largest Tows	Total	Largest Tow	Smallest Tow	Mean	Largest Scallop	Smallest Scallop	Mean	Largest Scallop	Smallest Scallop	Mean	Largest Scallop	Smallest Scallop
onesport	42	66	36-104	59-84	2698	638	0	101	137	17	11.9	33.3	0.05	5.2	17.8	0.09
ipennies Ledge	2	39	38- 39	38-39	1712	1260	452	33	112	12	6.9	28.1	0.02	7.3	14.5	0.29
NE of New Scantum Jeffrey's Ledge)	1	32	32	32	2876	-	-	64	147	12	6.2	38.2	0.09	4.5	15.1	0.09
ther offshore ulf of Maine Areas	53	65	13-107	73-89	233	43	0	88	162	27	13.2	58.9	0.20	8.4	27.0	0.25
ll Areas	98	64	13-107	32-84	7519	1260	0	71	162	12	11.3	58.9	0.02	5.7	27.0	0.09

Statistics based on all scallops caught.

Statistics based on scallops measured for meat weight: Jonesport (1248); Fipennies Ledge (134); NNE of New Scantum (131); Remaining Gulf of Maine areas (248*).

Statistics based on scallops measured for ovary weight: Jonesport (600); Fipennies Ledge (28); NNE of New Scantum (29); Remaining Gulf of Maine areas (100).

Sample size is greater than that listed for the total number caught due to inclusion of scallops from tows with gear problems

Table 2. Size frequency distributions of Gulf of Maine sea scallops sampled during the 1982 NMFS sea scallop research vessel survey in the Gulf of Maine, 31 July - 5 August 1981.

Shell Height (mm)	Jonesport Area		Fipennies Ledge Area		NNE of New Scantum Area		Other Gulf of Maine Areas	
	Number of Scallops Caught	Cumulative %	Number of Scallops Caught	Cumulative %	Number of Scallops Caught	Cumulative %	Number of Scallops Caught	Cumulative %
7								
12			19	1.1	4	0.1		
17	1	<0.1	435	26.5	40	1.5		
22	6	0.3	464	53.6	64	3.8		
27	10	0.6	184	64.4	68	6.1	4	1.7
32	9	1.0	81	69.1	60	8.2	9	5.6
37	10	1.3	22	70.4	36	9.5	2	6.4
42	3	1.4	28	72.0	60	11.5	6	9.0
47	3	1.6	102	78.0	117	15.6	1	9.4
52	9	1.9	125	85.3	185	22.0	5	11.6
57	6	2.1	101	91.2	221	29.7	7	14.6
62	3	2.2	59	94.6	511	47.5	4	16.3
67	3	2.3	9	95.2	832	76.4	10	20.6
72	8	2.6			414	90.8	6	23.2
77	25	3.6	4	95.4	76	93.5	10	27.5
82	62	5.9	4	95.6	16	94.0	15	33.9
87	234	14.5	2	95.7			22	43.3
92	366	28.1	13	96.5			23	53.2
97	386	42.4	18	97.5			20	61.8
102	501	61.0	20	98.7	4	94.2	34	76.4
107	411	76.2	18	99.8	8	94.4	28	88.4
112	304	87.5	4	100.0	32	95.5	10	92.7
117	159	93.4			28	96.5	7	95.7
122	102	97.1			20	97.2	4	97.4
127	45	98.8			12	97.6	4	99.1
132	25	99.7			24	98.5		
137	7	100.0			24	99.3		
142					16	99.9		
147					4	100.0		
152							1	99.6
157								
162							1	100.0
167								
Total number of Scallops	2698		1712		2876		233	
Mean Shell Height (mm)	100.7		33.2		63.7		87.8	
Mean Meat Weight (g)	11.3[1]		1.2[2]		4.7[2]		11.8[2]	
Average Meat Count	40.2		367.9		95.5		38.4	

[1]Mean meat weight derived by applying the 1982 NMFS Jonesport research survey sea scallop shell height-meat weight equation,

$$\ln \text{Meat Weight (g)} = -10.8680 + 2.8706 \ln \text{Shell Height (mm)} \qquad (N = 1248,\ r = 0.96)$$

to each shell height in the frequency distribution, multiplying by the frequency at each height, summing the products, and dividing by the total number of scallops caught.

[2]Mean meat weight derived, as above, but by using the 1982 NMFS Gulf of Maine (exclusive of Jonesport) research survey sea scallop shell height-meat weight equation,

$$\ln \text{Meat Weight (g)} = -12.3148 + 3.2519 \ln \text{Shell Height (mm)} \qquad (N = 513,\ r = 0.99).$$

[3]Average meat count derived by dividing the calculated mean meat weight into 453.6 grams (1 pound).

Table 3. Regression parameters and statistics for shell height (mm) - meat weight (g) regressions for offshore and inshore Gulf of Maine sea scallops. Regression equations are of the form: ln meat weight (g) = ln a + b (ln shell height$_{(mm)}$).

Area	N	Regression Statistics								Source of Data
		Intercept (ln a)	Slope (b)	ln $\bar{X}$	ln $\bar{Y}$	ln S_x	ln S_y	Correlation Coefficient (r)	Residual Mean Square Error	
Offshore										
Jonesport	1248	-10.8680	2.8706	4.6030	2.3454	0.22925	0.68649	0.959	0.03822	NMFS 1982 sea scallop survey
Machias Bay	1141	-11.4483	3.0010	4.5415	2.1808	0.06402	0.23103	0.832	0.01648	Combined Maine DMR samples (3)
Fipennies and Jeffreys Basin	1726	-13.5356	3.4813	4.4810	2.0642	0.13791	0.51368	0.935	0.03338	Combined NMFS, Mass. and Maine commercial samples (8)
Other Offshore Areas	513	-12.3148	3.2519	4.2187	1.4040	0.53412	1.75047	0.992	0.04754	NMFS 1982 sea scallop survey
Inshore										
Penobscot Bay	1107	-14.3451	3.6640							Haynes 1966
Boothbay Harbor		-10.9500	2.9360							Schick 1981 (Unpublished data)

Table 4. Calculated meat weight (g) at shell height (mm) for sea scallops from offshore and inshore areas in the Gulf of Maine.

Shell Height (mm)	Offshore Calculated Meat Weight (g)				Inshore Calculated Meat Weight (g)	
	[1] Jonesport	[2] Machias Bay	Fipennies[3] & Jeffreys Basin	[4] Other Offshore areas	[5] Penobscot Bay	[6] Boothbay Harbor
40	0.76	0.69	0.50	0.73	0.44	0.89
50	1.44	1.34	1.09	1.50	0.99	1.71
60	2.42	2.31	2.05	2.72	1.93	2.92
70	3.77	3.67	3.51	4.49	3.39	4.59
80	5.53	5.49	5.58	6.92	5.53	6.79
90	7.76	7.81	8.41	10.16	8.52	9.60
100	10.50	10.72	12.14	14.31	12.53	13.08
110	13.81	14.27	16.91	19.51	17.77	17.30
120	17.72	18.52	22.90	25.88	24.44	22.33
130	22.30	23.55	30.26	33.58	32.77	28.25
140	27.59	29.42	39.16	42.73	42.99	35.12
150	33.63	36.18	49.80	53.48	55.36	43.00

[1]Calculated from NMFS 1982 Jonesport research vessel survey shell height-meat weight equation,
ln Meat Weight (g) = -10.8680 + 2.8706 ln Shell Height (mm) (N = 1248, r = 0.96).

[2]Calculated from Maine DMR 1981 samples (3) shell height-meat weight equation,
ln Meat Weight (g) = -11.4483 + 3.0010 ln Shell Height (mm) (N = 1141, r = 0.83).

[3]Calculated from NMFS, Mass., and Maine 1980 commercial samples (8) shell height-meat weight equation,
ln Meat Weight (g) = -13.5356 + 3.4813 ln Shell Height (mm) (N = 1726, r = 0.93).

[4]Calculated from NMFS 1982 research vessel survey shell height-meat weight equation,
ln Meat Weight (g) = -12.3148 + 3.2519 ln Shell Height (mm) (N = 513, r = 0.99).

[5]Calculated from inshore Gulf of Maine (Penobscot Bay) commercial sample shell height-meat weight equation.
ln Meat Weight (g) = -14.3451 + 3.6640 ln Shell Height (mm) (N = 1107, from Haynes, 1966).

[6]Calculated from inshore Gulf of Maine (Boothbay Harbor) commercial sample shell height-meat weight equation,
ln Meat Weight (g) = -10.9500 + 2.9360 ln Shell Height (mm) (from Schick 1981, pers. comm.).

Table 5. Regression parameters and statistics for meat weight (g) - shell height regressions, by area, for Gulf of Maine sea scallops sampled in 1982 USA sea scallop survey in the Gulf of Maine. Regression equations are of the form: ln shell height (mm) = ln a + b (ln meat weight (g)).

Area	N	Regression Statistics							
		Intercept (ln a)	Slope (b)	ln $\bar{X}$	ln $\bar{Y}$	ln S_x	ln S_y	Correlation Coefficient (r)	Residual Mean Square Error
Jonesport	1248	3.8522	0.32013	2.3454	4.6030	0.68649	0.22925	0.959	0.00426
Other offshore Areas	513	3.7937	0.30275	1.4040	4.2187	1.75047	0.53412	0.992	0.00443
All Areas	1761	3.8271	0.32058	2.0712	4.4910	1.18672	0.38823	0.980	0.00599

Table 6. Calculated shell height (mm) at selected meat weight sizes, by area, for sea scallops from the Gulf of Maine.

		Offshore Calculated Shell Height (mm)				Inshore Calculated Shell Height (mm)		
Meat Weight (g)	Meat Count	Jonesport[1]	Machias Bay[2]	Fipennies[3] & Jeffreys Basin	Other Offshore areas[4]	Penobscot Bay[5]	Boothbay Harbor[6]	Largest % Difference in Shell Height Between Two Most Extreme Values
7.56	60	90	89	87	82	87	83	9.8%
8.25	55	93	92	89	84	89	85	10.7
9.07	50	95	95	91	87	92	88	9.2
10.08	45	99	98	94	89	94	92	11.2
11.34	40	102	102	97	93	97	95	9.7
12.96	35	107	106	100	96	101	100	11.5
15.12	30	112	112	104	101	105	105	10.9
18.14	25	119	119	109	107	111	112	11.2
22.68	20	128	128	115	114	118	121	12.3

[1]Calculated from NMFS 1982 Jonesport research vessel scallop survey meat weight-shell height equation,
ln Shell Height (mm) = 3.8522 + 0.32013 ln Meat Weight (g) (N = 1248, r = 0.96).

[2]Calculated by inverse prediction from Maine DMR 1981 samples (3) shell height-meat weight equation,
ln Shell Height (mm) = 3.8148 + 0.33322 ln Meat Weight (g) (N = 1141, r = 0.83).

[3]Calculated from NMFS, Mass., and Maine 1980 commercial samples (8) meat weight-shell height equation,
ln Shell Height (mm) = 3.9630 + 0.25093 ln Meat Weight (g) (N = 1726, r = 0.93).

[4]Calculated from NMFS 1982 research vessel scallop survey meat weight-shell height equation,
ln Shell Height (mm) = 3.7937 + 0.30275 ln Meat Weight (g) (N = 513, r = 0.99).

[5]Calculated by inverse prediction from inshore Gulf of Maine (Penobscot Bay) commercial sample sea scallop shell height-meat weight equation,
ln Shell Height (mm) = 3.9151 + 0.27293 ln Meat Weight (g) (N = 1107, from Haynes 1966).

[6]Calculated by inverse prediction from inshore Gulf of Maine (Boothbay Harbor) commercial sample sea scallop shell height-meat weight equation,
ln Shell Height (mm) = 3.7296 + 0.34060 ln Meat Weight (g) (from Schick 1981, pers. comm.).

Table 7. Regression parameters and statistics for shell height (mm) - ovary weight (g) regressions, by area, for Gulf of Maine sea scallops sampled in 1982 USA sea scallop survey in the Gulf of Maine. Regression equations are of the form: ln ovary weight (g) = ln a + b (ln shell height (mm)).

Area	N	Regression Statistics							
		Intercept (ln a)	Slope (b)	ln $\bar{X}$	ln $\bar{Y}$	ln S_x	ln S_y	Correlation Coefficient (r)	Residual Mean Square Error
Jonesport	600	-12.2669	2.9733	4.6402	1.5298	0.11556	0.50768	0.677	0.13992
Other Offshore Areas	157	-17.1952	4.1550	4.5468	1.6968	0.19694	0.91258	0.897	0.16428
All Areas	757	-12.7797	3.1042	4.6209	1.5645	0.14149	0.61697	0.712	0.18799

Table 8. Regression parameters and statistics for meat weight (g) - ovary weight (g) regressions, by area, for Gulf of Maine sea scallops sampled in 1982 USA sea scallop survey in the Gulf of Maine. Regression equations are of the form: ln ovary weight (g) = ln a + b (ln meat weight (g)).

Area	N	Regression Statistics							
		Intercept (ln a)	Slope (b)	ln $\bar{X}$	ln $\bar{Y}$	ln S_x	ln S_y	Correlation Coefficient (r)	Residual Mean Square Error
Jonesport	600	-0.8642	0.9763	2.4523	1.5298	0.36349	0.50768	0.699	0.13204
Other Offshore Areas	157	-1.5164	1.2804	2.5094	1.6968	0.65851	0.91258	0.924	0.12263
All Areas	757	-1.1989	1.1214	2.4641	1.5645	0.44125	0.61697	0.802	0.13597

Table 9. Calculated ovary weight (g) at shell height (mm), by area, for sea scallops from the Gulf of Maine

Shell Height (mm)	Ovary Weight (g)		
	Jonesport [1]	Other offshore areas [2]	All areas [3]
50	0.53	0.39	0.53
60	0.91	0.83	0.93
70	1.44	1.58	1.50
80	2.14	2.75	2.28
90	3.04	4.49	3.28
100	4.16	6.95	4.55
110	5.52	10.33	6.12
120	7.15	14.83	8.02
130	9.08	20.68	10.28

[1]Calculated from NMFS 1982 Jonesport research vessel scallop survey shell height - ovary weight equation, ln Ovary Weight (g) = -12.2669 + 2.9733 ln Shell Height (mm) (N = 600, r = 0.68).

[2]Calculated from NMFS 1982 research vessel scallop survey shell height - ovary weight equation, ln Ovary Weight (g) =-17.1952 + 4.1550 ln Shell Height (mm) (N = 157, r = 0.90).

[3]Calculated from NMFS 1982 research vessel scallop survey shell height - ovary weight equation, ln Ovary Weight (g) = -12.7797 + 3.1042 ln Shell Height (mm) (N = 757, r = 0.71).

Table 10. Calculated ovary weight (g) at selected meat weight size (g), by area, for sea scallops from the Gulf of Maine.

Meat Weight (g)	Meat Count	Ovary Weight (g)		
		Jonesport [1]	Other offshore areas [2]	All areas [3]
7.56	60	3.04	2.93	2.91
8.25	55	3.31	3.27	3.21
9.07	50	3.63	3.69	3.57
10.08	45	4.02	4.23	4.02
11.34	40	4.51	4.92	4.59
12.96	35	5.14	5.83	5.33
15.12	30	5.97	7.11	6.34
18.14	25	7.14	8.97	7.78
22.68	20	8.88	11.95	9.99

[1]Calculated from NMFS 1982 Jonesport research vessel sea scallop survey meat weight-ovary weight equation, ln Ovary Weight (g) = -0.8642 + 0.9763 ln Meat Weight (g) (N = 600, r = 0.70).

[2]Calculated from NMFS 1982 research vessel scallop survey meat weight-ovary weight equation, ln Ovary Weight (g) = -1.5164 + 1.2804 ln Meat Weight (g) (N = 157, r = 0.92).

[3]Calculated from NMFS 1982 research vessel scallop survey meat weight-ovary weight equation, ln Ovary Weight (g) = -1.1989 + 1.1214 ln Meat Weight (g) (N = 757, r = 0.80).

Table 11. Summary statistics of sea scallop shell height-meat weight data, by area caught, and year.

		Shell Height (mm)							Meat Weight (g)					
Area	Year	n	$\bar{X}$	S.D.	S.E.	C.V.	Min	Max	$\bar{X}$	S.D.	S.E.	C.V.	Min	Max
Georges Bank	1978	316	109.29	14.29	0.80	13.07	80	145	21.51	9.60	0.54	44.62	5.61	52.53
	1979	543	112.20	27.30	1.17	24.33	23	169	27.13	16.78	0.72	61.84	0.21	76.12
	1980	868	77.90	28.67	0.97	36.81	32	163	11.87	13.67	0.46	115.22	0.29	75.13
	1981	1309	102.97	25.92	0.72	25.18	44	168	22.12	16.66	0.46	75.32	0.66	89.53
	1982	2827	91.27	27.50	0.52	30.13	14	169	18.09	17.25	0.32	95.39	0.03	107.39
	All	5863	94.81	28.61	0.37	30.18	14	169	19.09	16.75	0.22	87.74	0.03	107.39
Mid-Atlantic	1977	784	99.71	18.15	0.65	18.20	40	152	15.75	8.96	0.32	56.90	0.62	69.08
	1978	1196	110.26	12.41	0.36	11.25	67	149	22.99	8.99	0.26	39.10	3.31	67.73
	1979	1546	102.21	21.92	0.56	21.44	29	156	21.61	13.80	0.35	63.86	0.08	77.06
	1980	2980	85.72	31.98	0.59	37.30	25	156	17.77	17.10	0.31	96.26	0.14	91.92
	1981	2486	97.28	26.03	0.52	26.75	46	162	21.43	17.85	0.36	83.29	1.07	117.73
	1982	2951	93.43	26.51	0.49	28.38	17	160	16.04	13.69	0.25	85.36	0.04	79.26
	All	11943	95.54	26.89	0.25	28.15	17	162	18.99	15.18	0.14	79.94	0.04	117.73
Gulf of Maine (offshore)	1980	1726	89.15	11.39	0.27	12.78	36	123	8.84	3.98	0.10	44.97	0.40	24.40
	1982	1761	94.47	25.13	0.60	26.60	13	157	11.27	6.30	0.15	55.84	0.02	58.86
	All	3487	91.84	19.75	0.33	21.51	13	157	10.07	5.42	0.09	53.80	0.02	58.86

Table 12. Regression parameters and statistics for shell height (mm) - meat weight (g) regressions for sea scallops from Georges Bank (1978-1982), the Mid-Atlantic (1977-1982), and offshore Gulf of Maine (1980 and 1982). Regression equations are of the form: ln meat weight (g) = ln a + b (ln shell height (mm)).

		Regression Statistics							
Area	N	Intercept (ln a)	Slope (b)	ln $\bar{X}$	ln $\bar{Y}$	ln S_x	ln S_y	Correlation Coefficient (r)	Residual Mean Square Error
Georges Bank (1978-1982)	5863	-11.7656	3.1693	4.5019	2.5024	0.32582	1.05610	0.978	0.04905
Mid-Atlantic (1977-1982)	11943	-12.1628	3.2539	4.5120	2.5189	0.32132	1.06826	0.979	0.04805
Offshore Gulf of Maine (1980 and 1982)	3487	-11.6526	3.0584	4.4861	2.0677	0.29197	0.91739	0.974	0.04422

Table 13. Regression parameters and statistics for meat weight (g) - shell height (mm) regressions for sea scallops from Georges Bank (1978-1982), the Mid-Atlantic (1977-1982), and offshore Gulf of Maine (1980 and 1982). Regression equations are of the form: ln shell height (mm) = ln a + b (ln meat weight (g)).

		Regression Statistics							
Area	N	Intercept (ln a)	Slope (b)	ln $\bar{X}$	ln $\bar{Y}$	ln S_x	ln S_y	Correlation Coefficient (r)	Residual Mean Square Error
Georges Bank (1978-1982)	5863	3.7471	0.30165	2.5024	4.5019	1.05610	0.32582	0.978	0.00467
Mid-Atlantic (1977-1982)	11943	3.7705	0.29439	2.5189	4.5120	1.06826	0.32132	0.979	0.00435
Offshore Gulf of Maine (1980 and 1982)	3487	3.8455	0.30979	2.0677	4.4861	0.91739	0.29127	0.974	0.00448

Table 14. Calculated shell height (mm) at selected meat weight sizes for sea scallops from Georges Bank, the Mid-Atlantic, and offshore Gulf of Maine.

Meat Weight (g)	Meat Count	Calculated Shell Height (mm)			Largest % Difference in Shell Height Between Two Most Extreme Values
		Georges Bank[1]	Mid-Atlantic[2]	Offshore Gulf of Maine[3]	
7.56	60	78	79	88	12.8 %
8.25	55	80	81	90	12.5
9.07	50	82	83	93	13.4
10.08	45	85	86	96	12.9
11.34	40	88	89	99	12.5
12.96	35	92	92	103	12.0
15.12	30	96	97	109	13.5
18.14	25	102	102	115	12.7
22.68	20	109	109	123	12.8

[1] Calculated from NMFS 1978-1982 Georges Bank research survey meat weight-shell height equation, ln Shell Height (mm) = 3.7471 + 0.30165 (ln Meat Weight (g)). (N = 5863, r = 0.978).

[2] Calculated from NMFS 1977-1982 Mid-Atlantic research survey meat weight-shell height equation, ln Shell Height (mm) = 3.7705 + 0.29439 (ln Meat Weight (g)). (N = 11943, r = 0.979).

[3] Calculated from combined 1980 and 1982 offshore Gulf of Maine meat weight-shell height equation, ln Shell Height (mm) = 3.8455 + 0.30979 (ln Meat Weight (g)). (N = 3487, r = 0.974).

Table 15. Calculated meat weight (g) at shell height (mm) and corresponding meat count (number of scallop meats per pound) at shell height (mm) for sea scallops from Georges Bank, the Mid-Atlantic, and offshore Gulf of Maine.

	Calculated Meat Weight (g)			Calculated Meat Count		
Shell Height (mm)	Georges Bank[1]	Mid-Atlantic[2]	Offshore Gulf of Maine[3]	Georges Bank	Mid-Atlantic	Offshore Gulf of Maine
40	0.93	0.85	0.69	488	534	657
50	1.88	1.76	1.37	241	258	331
60	3.36	3.19	2.39	135	142	190
70	5.47	5.27	3.82	83	86	119
80	8.35	8.13	5.75	54	56	79
90	12.13	11.93	8.25	37	38	55
100	16.94	16.81	11.38	27	27	40
110	22.91	22.92	15.23	20	20	30
120	30.19	30.42	19.88	15	15	23
130	38.90	39.48	25.39	12	11	18
140	49.20	50.24	31.85	9	9	14
150	61.23	62.88	39.33	7	7	12
160	75.12	77.58	47.91	6	6	9

[1] Calculated from NMFS 1978-1982 Georges Bank research survey shell height-meat weight equation, ln Meat Weight (g) = -11.7656 + 3.1693 (ln Shell Height (mm)). ($N = 5863$, $r = 0.978$).

[2] Calculated from 1977-1982 NMFS Mid-Atlantic research survey shell height-meat weight equation, ln Meat Weight (g) = -12.1628 + 3.2539 (ln Shell Height (mm)). ($N = 11943$, $r = 0.979$).

[3] Calculated from combined 1980 and 1982 offshore Gulf of Maine shell height-meat weight equation, ln Meat Weight (g) = -11.6526 + 3.0584 (ln Shell Height (mm)). ($N = 3487$, $r = 0.973$).

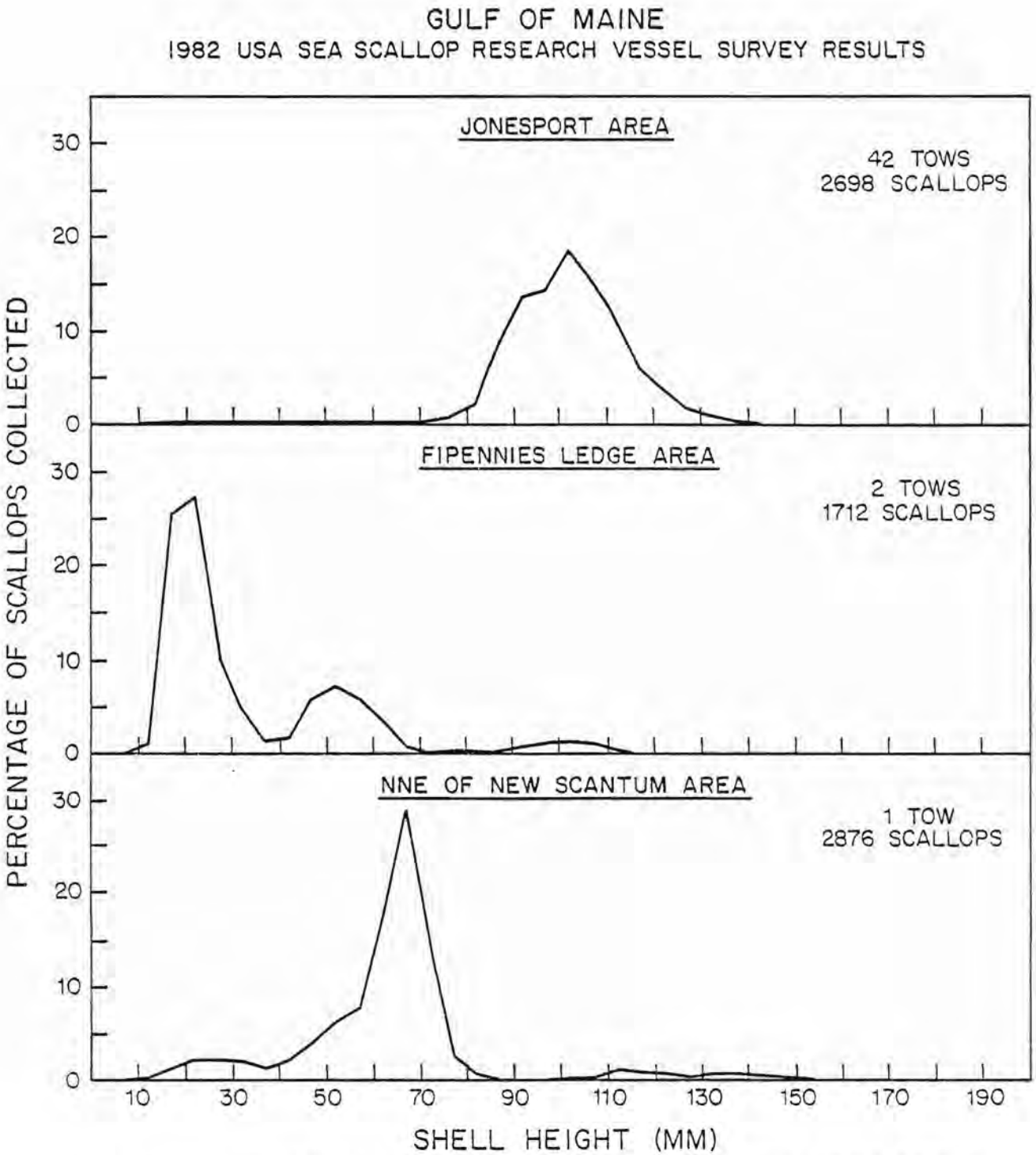


Figure 1. USA 1982 sea scallop research vessel survey shell height frequency distributions of sea scallops from the Gulf of Maine, by area.

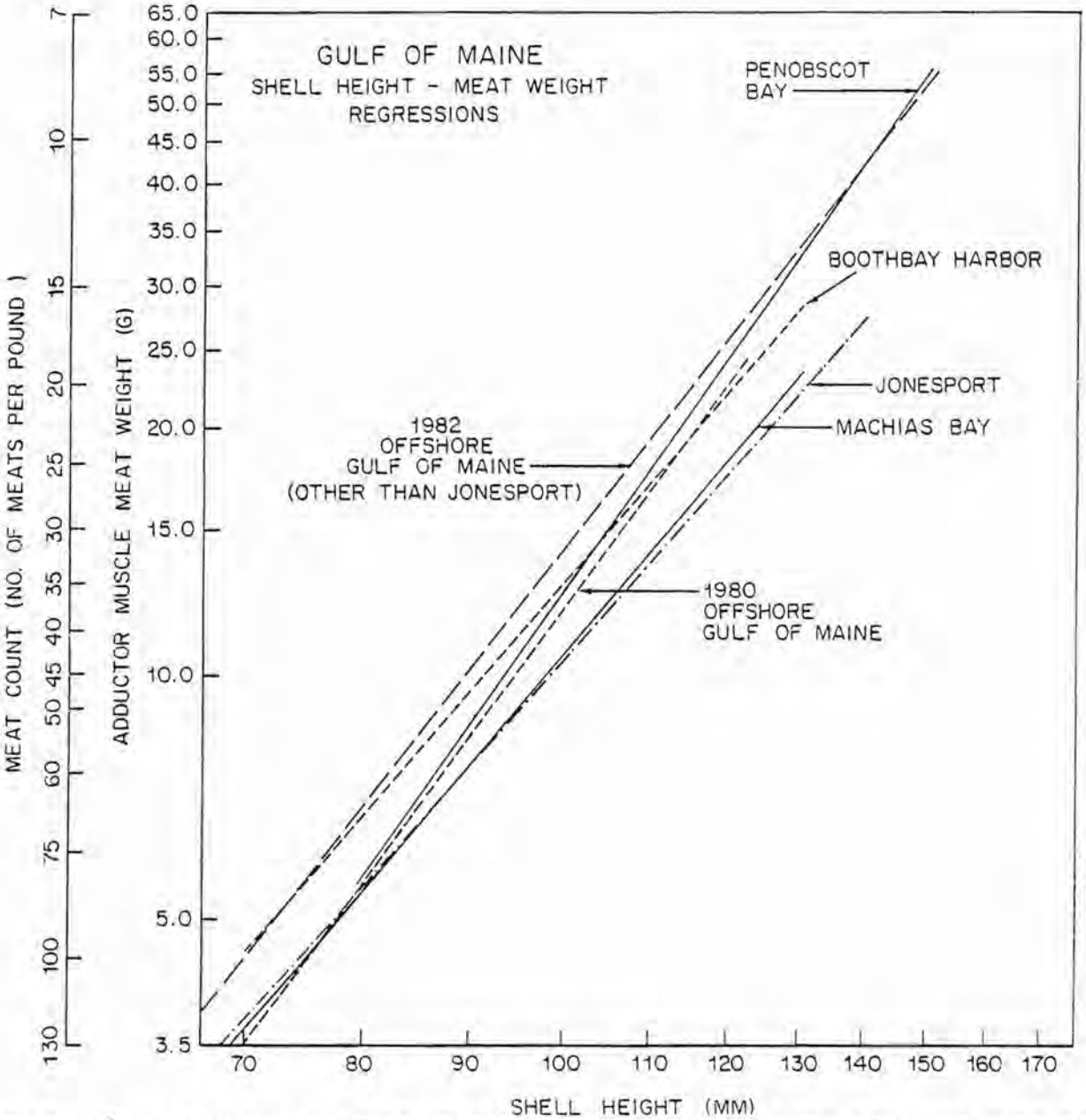


Figure 2. Shell height-meat weight relationships for sea scallops sampled from the Gulf of Maine, by area. The Jonesport and 1982 offshore Gulf of Maine relationships were derived from scallop samples obtained during the 1982 NMFS scallop survey in the Gulf of Maine. The 1980 offshore Gulf of Maine relationship was derived from commercial scallop samples obtained during 1980 by NMFS and the States of Maine and Massachusetts. The Machias Bay and Boothbay Harbor relationships were derived from commercial scallop samples obtained by the State of Maine in 1981. The Penobscot Bay relationship was reported by Haynes (1966).

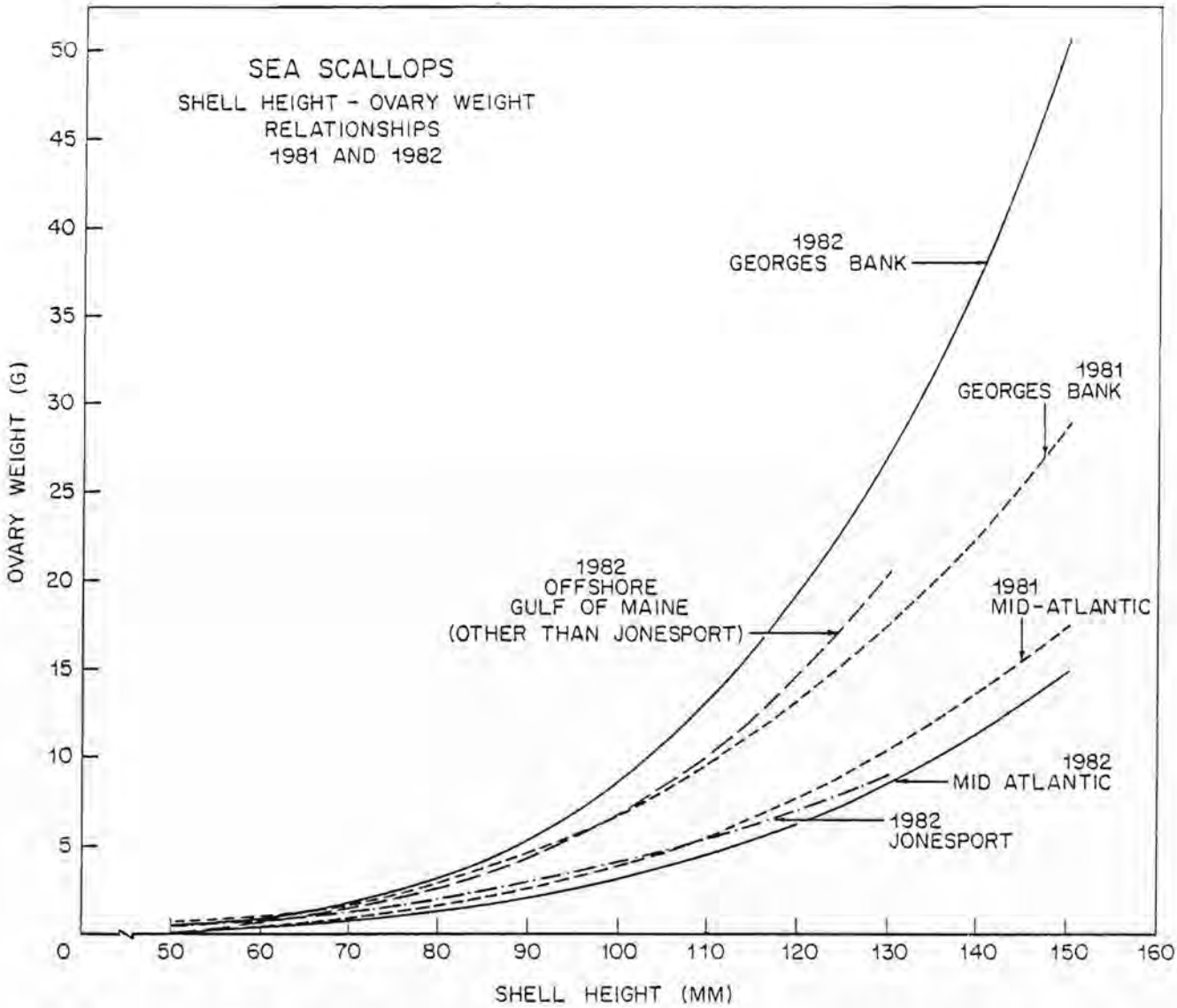


Figure 3. Shell height-ovary weight relationships for sea scallops sampled from Georges Bank, the Middle Atlantic, and the Gulf of Maine during 1981 and 1982 USA sea scallop research vessel surveys.

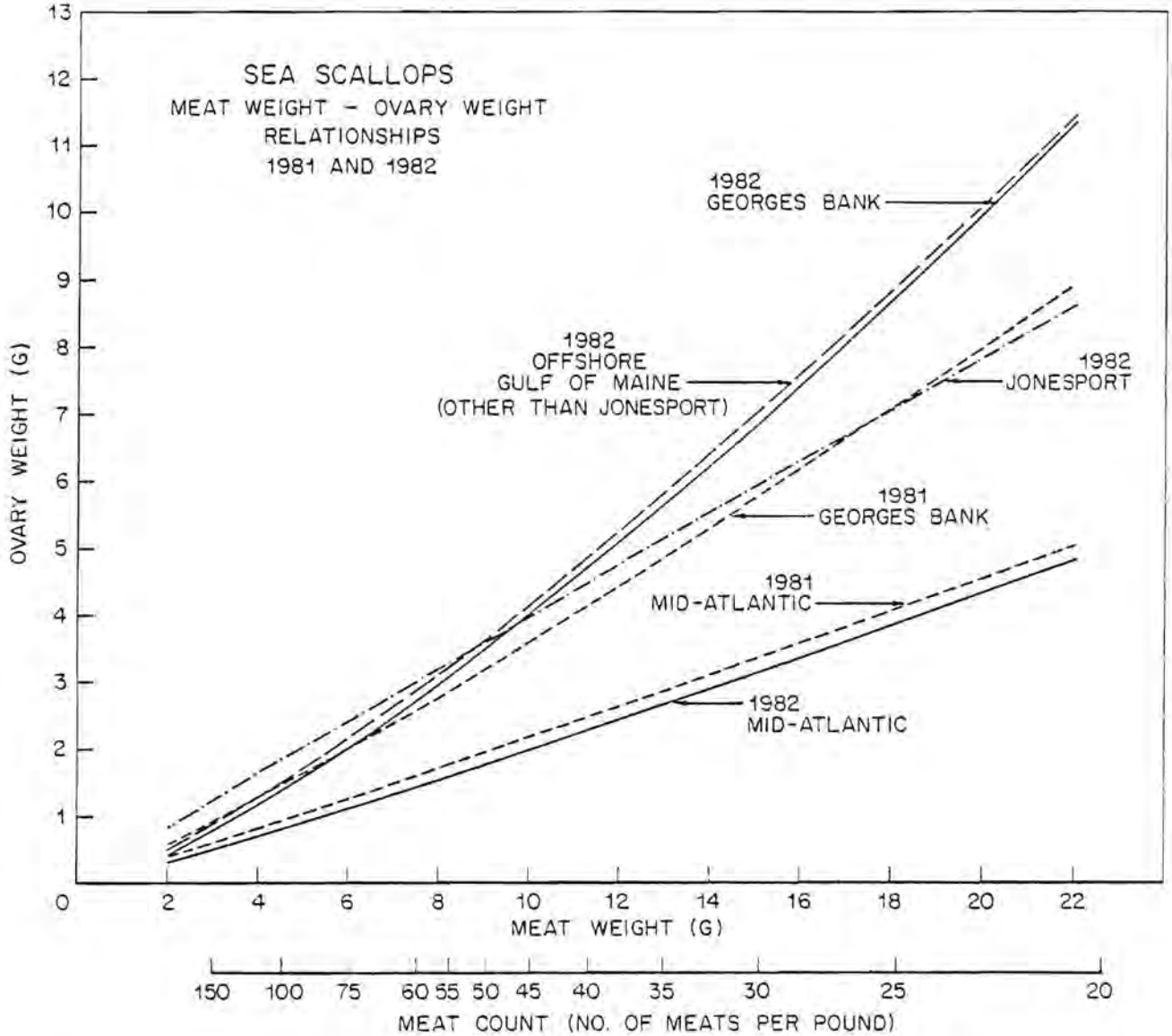


Figure 4. Meat weight-ovary weight relationships for sea scallops sampled from Georges Bank, the Middle Atlantic, and the Gulf of Maine during 1981 and 1982 USA sea scallop research vessel surveys.

APPENDIX

Appendix Table 1. Summary of 1982 NMFS Gulf of Maine sea scallop research vessel survey sampling data, by station (tow).

Station (tow) number	Number of sea scallops caught	Depth (m)	Depth (fm)	Latitude	Longitude	Date
* 443	1	176	96	43°05.6'	68°43.5'	7/31
* 444	7	195	107	43°01.0'	69°21.5'	8/1
* 445	2	147	80	43°15.0'	69°42.5'	7/31
* 446	7	169	92	43°12.5'	69°52.5'	7/31
* 447	13	190	104	43°18.5'	70°02.5'	7/31
* 448	3	154	84	43°23.0'	70°00.0'	7/31
* 449	11	175	96	43°23.0'	69°56.0'	8/1
* 450	7	169	92	43°23.5'	69°55.0'	8/1
* 451	33	134	73	43°26.0'	69°52.0'	8/1
* 452	18	168	92	43°24.5'	69°21.5'	8/1
* 453	43	163	89	43°17.5'	69°18.0'	8/1
* 454	10	165	90	43°17.0'	69°15.0'	8/1
* 455	4	154	84	43°19.0'	69°03.0'	8/1
* 456	1	147	80	43°34.5'	69°08.0'	8/1
457	0	59	32	43°44.0'	69°21.0'	8/1
458	0	48	26	43°44.0'	68°55.0'	8/1
459	0	94	51	43°54.0'	68°38.0'	8/1
460	2	92	50	43°59.5'	68°18.5'	8/1
461	0	84	46	44°10.0'	68°04.0'	8/2
462	0	64	35	44°20.5'	67°41.5'	8/2
Jonesport Area (Tows 463-504)						
463	316	140	77	44°21.0'	67°20.5'	8/2
464	157	117	64	44°21.0'	67°21.5'	8/2
465	1	141	77	44°18.0'	67°25.5'	8/2
466	0	191	104	44°16.5'	67°22.5'	8/2
467	0	184	101	44°16.5'	67°19.0'	8/2
468	2	167	91	44°19.0'	67°20.5'	8/2
469	1	140	77	44°19.5'	67°18.0'	8/2
470	1	108	59	44°21.5'	67°19.0'	8/2
471	13	119	65	44°21.5'	67°14.5'	8/2
472	1	147	80	44°20.0'	67°14.5'	8/2
473	1	132	72	44°22.5'	67°09.5'	8/2
474	0	99	54	44°25.0'	67°04.5'	8/2
475	2	88	48	44°24.0'	67°03.0'	8/2
476	0	115	63	44°23.5'	67°07.5'	8/2
477	2	N/A	N/A	44°22.5'	67°12.5'	8/2
478	159	117	64	44°22.5'	67°16.0'	8/2
479	50	118	65	44°21.0'	67°20.5'	8/2
480	479	131	72	44°21.0'	67°21.0'	8/2
481	84	120	66	44°21.5'	67°18.5'	8/2
482	39	114	62	44°23.0'	67°16.0'	8/3
483	0	105	57	44°22.5'	67°18.5'	8/3
484	0	103	56	44°22.0'	67°19.0'	8/3
485	0	145	79	44°20.5'	67°22.0'	8/3
486	46	142	78	44°21.0'	67°22.5'	8/3
487	2	112	61	44°21.0'	67°21.0'	8/3
488	80	127	69	44°19.5'	67°22.5'	8/3

Appendix Table 1 (continued). Summary of 1982 NMFS Gulf of Maine sea scallop research vessel survey sampling data, by station (tow).

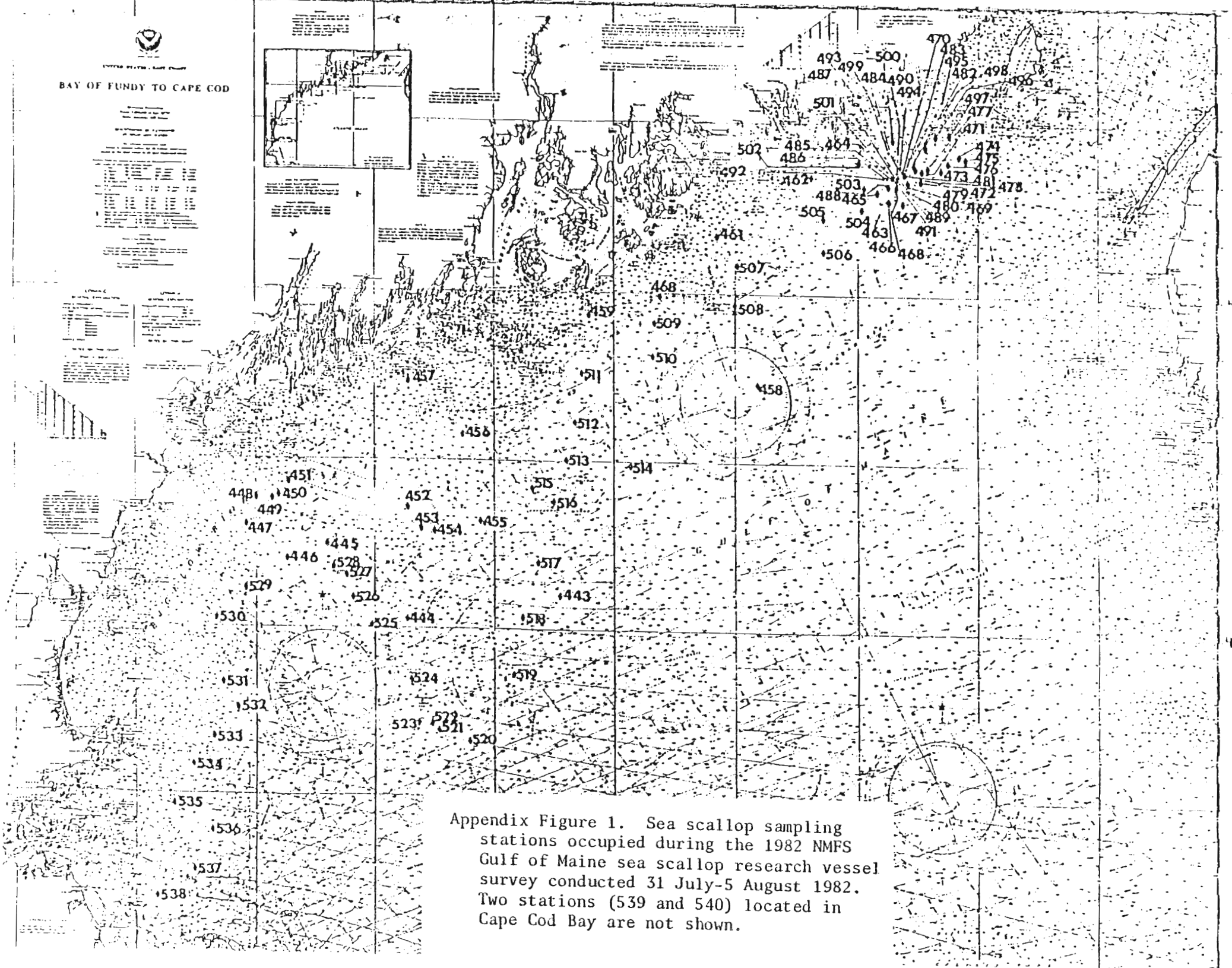
Station (tow) number	Number of sea scallops caught	Depth (m)	Depth (fm)	Latitude	Longitude	Date
489	14	127	69	44°20.5'	67°20.5'	8/3
490	91	121	66	44°21.5'	67°21.5'	8/3
491	638	153	84	44°20.5'	67°21.5'	8/3
492	20	128	70	44°21.5'	67°24.0'	8/3
493	73	90	49	44°23.5'	67°11.0'	8/3
494	168	153	84	44°23.0'	67°19.5'	8/3
495	41	110	60	44°24.5'	67°16.5'	8/3
496	18	89	49	44°28.5'	67°10.5'	8/3
497	165	108	59	44°27.5'	67°08.0'	8/3
498	4	90	49	44°26.0'	67°13.0'	8/3
499	0	86	47	44°25.5'	67°22.0'	8/3
500	8	66	36	44°27.5'	67°21.0'	8/3
501	13	87	48	44°23.0'	67°23.0'	8/3
502	5	90	49	44°24.0'	67°29.5'	8/3
503	0	95	52	44°20.5'	67°29.0'	8/3
504	4	127	69	44°16.5'	67°29.5'	8/3
505	2	109	60	44°14.0'	67°38.5'	8/3
506	21	165	90	44°08.0'	67°41.5'	8/3
507	0	106	58	44°05.5'	67°59.5'	8/4
508	1	154	84	43°58.5'	68°00.0'	8/4
509	0	121	66	43°55.0'	68°20.0'	8/4
510	7	133	73	43°49.0'	68°20.5'	8/4
511	0	120	66	43°46.0'	68°38.0'	8/4
512	0	151	83	43°37.0'	68°40.0'	8/4
513	1	146	80	43°30.5'	68°42.0'	8/4
514	0	108	59	43°26.0'	68°39.5'	8/4
515	0	90	49	43°25.5'	68°50.5'	8/4
516	0	96	52	43°23.0'	68°45.0'	8/4
517	1	170	93	43°12.0'	68°49.0'	8/4
518	5	169	92	43°02.5'	68°53.0'	8/4
519	0	44	24	42°52.0'	68°55.0'	8/4
520	0	166	91	42°40.0'	69°06.0'	8/4
521	0	142	78	42°42.0'	69°14.0'	8/4
522	452	72	39	42°43.4'	69°15.5'	8/4
523	1260	69	38	42°46.5'	69°19.0'	8/4
524	0	125	68	42°51.0'	69°21.0'	8/5
525	1	146	80	43°00.5'	69°29.5'	8/5
526	0	97	53	43°06.5'	69°35.5'	8/5
527	0	83	45	43°09.5'	69°37.0'	8/5
528	5	61	33	43°11.0'	69°40.5'	8/5
529	0	51	28	43°07.0'	70°02.5'	8/5
530	6	170	93	43°02.0'	70°10.0'	8/5
531	2876	58	32	42°51.5'	70°08.5'	8/5
532	0	117	64	42°45.5'	70°04.5'	8/5
533	0	95	52	42°40.5'	70°10.5'	8/5
534	0	72	39	42°35.5'	70°16.0'	8/5
535	0	104	57	42°28.5'	70°20.5'	8/5

Appendix Table 1 (continued). Summary of 1982 NMFS Gulf of Maine sea scallop research vessel survey sampling data, by station (tow).

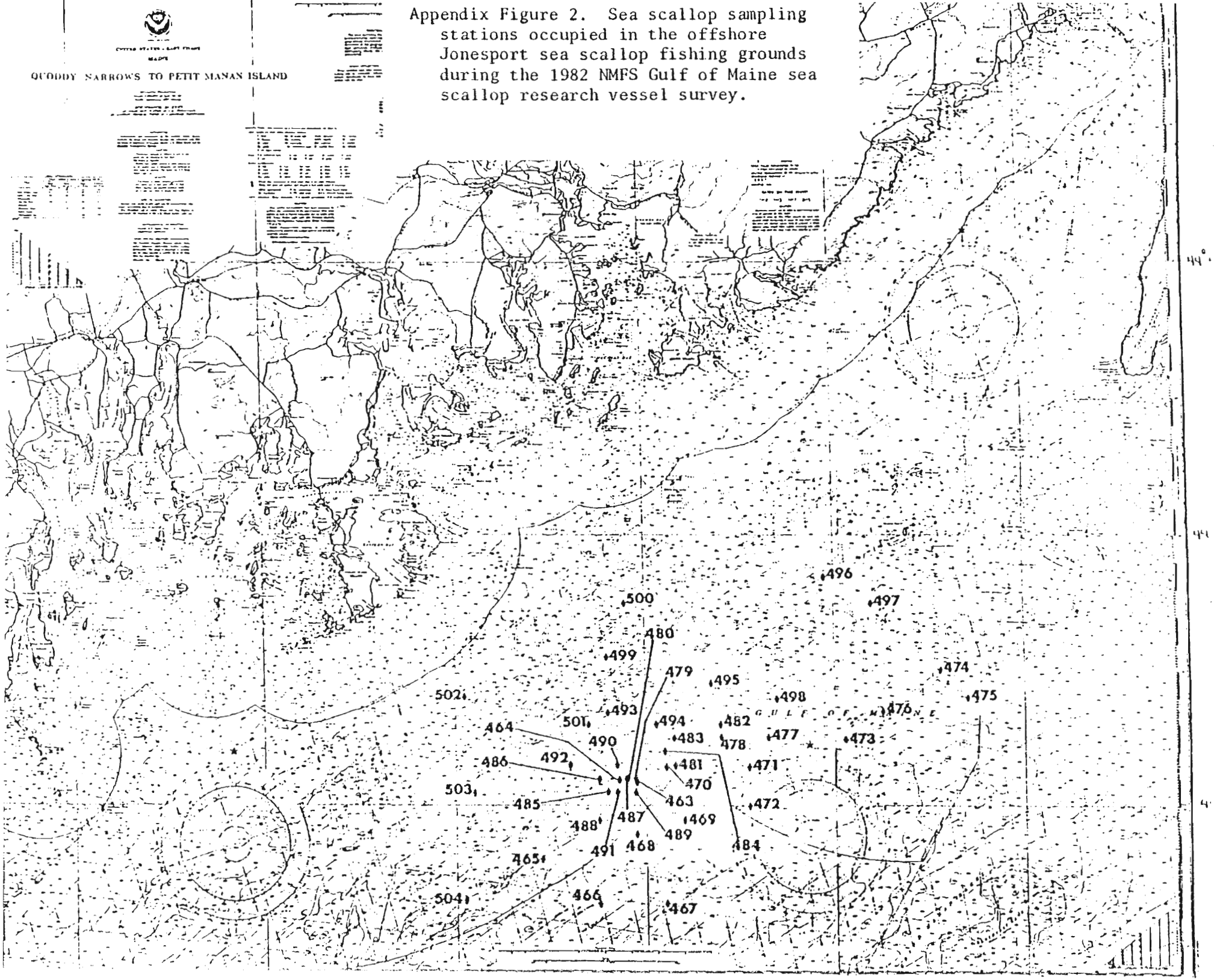
Station (tow) number	Number of sea scallops caught	Depth (m)	Depth (fm)	Latitude	Longitude	Date
536	0	72	39	42°23.5'	70°11.0'	8/5
537	1	29	16	42°16.5'	70°15.5'	8/5
538	0	61	33	42°11.5'	70°25.0'	8/5
539	0	45	25	41°59.0'	70°21.5'	8/5
540	20	23	13	41°54.0'	70°09.5'	8/5

* = Non-random station. Pre-selected on the basis of spring and autumn 1980 and 1981 NMFS offshore bottom trawl survey stations in deep water (≥70 fm) where sea scallop catches were large.

N/A = Not available.



Appendix Figure 1. Sea scallop sampling stations occupied during the 1982 NMFS Gulf of Maine sea scallop research vessel survey conducted 31 July-5 August 1982. Two stations (539 and 540) located in Cape Cod Bay are not shown.



Appendix Figure 2. Sea scallop sampling stations occupied in the offshore Jonesport sea scallop fishing grounds during the 1982 NMFS Gulf of Maine sea scallop research vessel survey.