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CODEND MESH SELECTIVITY IN THE LONG ISLAND SPRING TRAWL FISHERY FOR SUMMER FLOUNDER AND ASSOCIATED SPECIES

by

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SUMMARY

A study was conducted during May-June 1983 in waters off Long Island at the request of the Mid-Atlantic Fishery Management Council to estimate length selection curves for summer flounder (*Paralichthys dentatus*) and associated species and determine the impact on the catch of all species using a 5½-in stretched mesh codend compared to currently-used small-mesh codends. Four alternate-haul experiments were conducted using four chartered fishing vessels operating in the Montauk and Shinnecock Inlet areas off Long Island. A total of 60 tows of 2-hr duration was made, 30 with control codends with average mesh size ranging from 58 to 65 mm (2.3 to 2.6 in), and 30 with experimental codends with average mesh size ranging from 141 to 148 mm (5.6 to 5.8 in).

Catch per tow of all species averaged 1,080 kg with the control codends and 497 kg with the experimental codends. Summer flounder comprised 10% of the average control catch per tow and 16% of the experimental catch per tow. Species such as skates, searobins, and other usually unmarketable fish comprised 71 and 82% of the control and experimental catch per tow, respectively.

Mean catch per tow in weight of all species decreased 54% between control and experimental codends. The percentage decrease between control and experimental codend catch per tow was greatest for long-finned squid (98%), butterfish (98%), scup (87%), and black sea bass (79%), and smallest for summer flounder (26%).

Selection factors for summer flounder determined from this study ranged from 2.29 to 2.62 and averaged 2.47. These values were consistent with those determined from previous studies. Differences in selection factors between vessels and areas in the present study were discussed relative to various factors including gear, codend material, and size differences in fish between areas.

Length selection curves for other species were derived only for winter flounder. Selection factors ranged from 2.13 to 2.36 and averaged 2.24. These values were in general agreement with those determined for winter flounder and other flounder species (except summer flounder) in earlier studies.

The use of a 5½-in mesh codend appears to be appropriate for summer flounder in conjunction with a 14-in minimum size limit. However, in a mixed species fishery, which appears to be the case much of the time in areas such as off Long Island, the use of a 5½-in mesh codend would result in the escapement of a high percentage of other valuable species.

INTRODUCTION

A draft fishery management plan (FMP) for the summer flounder (*Paralichthys dentatus*) fishery along the Atlantic coast from Massachusetts to North Carolina was completed in 1981 by the State/Federal Summer Flounder Management Program (Scarlett 1981). Management recommendations in the FMP included a 14-in (total length) minimum size limit and a $5\frac{1}{2}$-in minimum stretched codend mesh for trawl gear used in a directed summer flounder fishery. A directed fishery was defined as one in which at least 60% of the catch in weight was comprised of summer flounder.

The $5\frac{1}{2}$-in mesh size was considered appropriate in conjunction with a 14-in size limit based on results of a mesh selection experiment conducted during December 1979 - February 1980 in waters off North Carolina (Gillikin et al. 1981). However, questions were raised concerning the appropriateness of the $5\frac{1}{2}$-in mesh for summer flounder in light of the relatively small number of tows and short tow duration time (generally 30 minutes) in the North Carolina experiment. Accordingly, the Mid-Atlantic Fishery Management Council (MAFMC), at its July 1982 meeting, based on a recommendation by its Summer Flounder Advisory Subpanel, requested that an additional mesh selection study be conducted on summer flounder. Initial objectives were to: (1) supplement the results of the mesh selection study conducted off North Carolina in 1979-80, and (2) demonstrate the efficiency in other areas, such as Long Island and Rhode Island, of a $5\frac{1}{2}$-in mesh codend relative to smaller mesh sizes.

The request was made to the Northeast Fisheries Center (NEFC) to conduct the proposed study. Initially, field work was planned for the above three areas using commercial vessels, with the NEFC being responsible for data analysis and report preparation. Various considerations resulted in the decision to conduct a study only in waters off Long Island. Accordingly, the NEFC contracted with the New York State Department of Environmental Conservation for scientific personnel to perform the field work, and chartered four commercial vessels which were selected following consultation with the Long Island Fishermen's Association.

The objectives of this study were to: (1) estimate the length selection curves for summer flounder and associated species, and (2) determine the impact on the catch of all species using a $5\frac{1}{2}$-in mesh codend compared to currently-used smaller-mesh codends.

METHODS

The study was conducted during May 16 - June 5, 1983 in two separate areas off Long Island employing two commercial fishing vessels in each area. The F/V SEAFARER and the F/V RIANDA S participated in the Montauk area during May 16-21, and the F/V RUTH ANN and the F/V PATRIOT participated in the Shinnecock Inlet area during May 31 - June 5. Specifications of the four vessels are summarized in Table 1. Fishing locations were selected by the respective vessel captains (Figure 1). Personnel from the New York Division of Marine Resources staffed the vessels in the Montauk area; personnel from New York as well as the NEFC Woods Hole Laboratory staffed the vessels in the Shinnecock Inlet area.

The study consisted of four alternate-haul experiments in which each vessel, using its own trawl, made alternating tows with its own codend (which served as the control mesh) and an experimental $5\frac{1}{2}$-in mesh codend. Trawl and codend specifications for each vessel are provided in Table 2. A total of 20 tows was planned for each vessel, 10 with the control codend and 10 with the experimental codend. Four tows were planned for each vessel on each of 5 days, including two with the control and two with the experimental codend. The codend (control or experimental) to be used first by each vessel was selected randomly, with codends alternated during succeeding tows. Trawls and codends were equipped with "zippers" to facilitate switching codends. All tows were made during daylight and were of 2-hr duration.

The experimental codends were provided by the NEFC. Those used at Montauk were constructed by an NEFC net specialist from No. 120 braided nylon webbing, while those at Shinnecock were constructed by a commercial net supplier of doubled 5.5-mm braided polyethylene webbing. The control codends were those in use by the respective vessels at the time the study was conducted. The PATRIOT (Shinnecock) used a codend of about $2\frac{1}{4}$-in stretched mesh, while the other three vessels employed codends of about $2\frac{1}{2}$-in stretched mesh.

The catch from each tow was sorted by species, weighed, and measured. Only fish found in the codend were included so as not to bias the results by including fish which had not been subjected to the selectivity of the codend meshes. Total weight by species was recorded to the nearest 0.1 kg; lengths (fork length where available, total

length otherwise) of individual fish were recorded to the nearest centimeter. Due to the large numbers of unmarketable species in most tows (e.g., skates, sand flounders, searobins, and the like) which were discarded by the fishermen following analysis of the catch, weights and lengths were obtained and recorded only for summer flounder and other commercially-important species (Table 3). An estimated weight was determined for the aggregate remaining species. In cases where species were too numerous for all specimens to be measured in the available time, a random subsample was measured, with the appropriate raising factor applied later to determine the length frequency of the total catch.

Before the first tow when the net was dry and after each tow when the net was still wet, 30 consecutive meshes were measured along the top of each codend in a row running forward from about 3-5 meshes in front of the codline. These measurements were obtained with an ICES longitudinal mesh gauge set at 4 kg pressure and recorded to the nearest millimeter.

RESULTS

The actual number of tows completed during the study was less than planned. Although 20 tows each were completed by the PATRIOT and the RUTH ANN in the Shinnecock area, only four tows were completed by the SEAFARER and 16 tows by the RIANDA S in the Montauk area. However, no damage was incurred by the nets or codends, and weather and sea conditions did not adversely affect operations or catches.

Information concerning time, location, and other relevant parameters for each tow by each vessel is provided in Tables 4 and 5.

Mesh Measurements

The means, standard deviations, and standard errors of the mesh measurements taken from each codend, as well as the 95% confidence limits of the overall mean mesh size for each codend, are given in Table 6. Some mesh measurements were inadvertently not obtained. In the Montauk experiments, dry mesh measurements were not obtained for the control codend used by the RIANDA S. At Shinnecock, dry measurements were not obtained from the PATRIOT for the control codend nor wet measurements after tow 1 using the experimental codend. Also at Shinnecock, wet measurements were not taken from the RUTH ANN after tows 1-3 and 5 with the control codend nor after tows 1 and 3 with the experimental codend.

The overall mean mesh size for the control codends used at Montauk was 64.9 mm (2.56 in) for the SEAFARER and 63.7 mm (2.51 in) for the RIANDA S. The experimental codends averaged 148.0 mm (5.83 in) for the SEAFARER and 145.0 mm (5.71 in) for the RIANDA S. The nylon webbing used in constructing the experimental codends used at Montauk, although sold as $5\frac{1}{2}$-in (140-mm) mesh, was actually slightly larger. For this reason, different experimental codends made of polyethylene mesh, less susceptible to stretching than the nylon, were used for the experiments at Shinnecock.

The control codends used at Shinnecock averaged 58.3 mm (2.30 in) for the PATRIOT and 64.5 mm (2.54 in) for the RUTH ANN. The experimental codends (constructed of polyethylene) averaged 141.9 mm (5.59 in) and 141.0 mm (5.55 in), respectively, for the two vessels.

Analysis of variance indicated significant differences among means of the mesh measurements taken after each tow for both codends (control and experimental) on each of the four vessels. Differences among means were statistically greater in the Montauk area than at Shinnecock as indicated by higher F-values. Tukey's honestly significant difference (HSD) test (Steel and Torrie 1960) indicated, for each codend, those means which differed significantly (Tables 7-10). Examination of the tow-by-tow differences in mesh measurements indicated no consistent pattern or explanation for the differences which could be attributed to shrinking or stretching of meshes during or following particular tows. The most likely explanation for the differences is variability in measurement.

The overall variability in mean mesh size exhibited by each of the control and experimental codends was relatively small based on the 95% confidence limits of the overall mean mesh (Table 6). The confidence intervals had ranges varying from 0.6 to 1.2 mm (0.2-0.5 in). Since the selectivity results presented in this report are based on data combined over tows, the effects due to significant differences in mean mesh size among individual tows are considered to be minimal.

Catches

The catch in weight from each tow is summarized in Tables 11 and 12. Weights were provided for summer flounder, winter flounder, black sea bass, scup, butterfish, long-finned squid, and "others." The above six species represented the bulk of the catch which was retained and landed by the vessels; small amounts of other marketable species taken in some tows were included in the "other" category. There were a few instances when small numbers of one or several of the above six species were included in the "other" category. Since these were typically very small in size and in weight, the failure to include them with their respective species would have had little or no effect on the selectivity analysis. The "other" category for each tow generally included 10-15 miscellaneous species which in most cases were not landed, including skates, sand flounder, searobins, goosefish, smooth dogfish, river herring, and the like. The list of finfish and squid species caught during the study is given in Table 3.

Catch per tow during the study averaged 1,080 kg using the control codends and 497 kg using the experimental codends (Table 13). Catch rates for both control and experimental codends were higher in the Montauk area than in the Shinnecock area, averaging 1,489 kg (control) and 539 kg (experimental) at Montauk and 672 kg (control) and 455 kg (experimental) at Shinnecock. Overall, 70% of the control catch per tow consisted of fish in the "other" category, followed by 16% long-finned squid and 10% summer flounder; 82% of the experimental catch per tow was "other" species, with 15% summer flounder and 1% long-finned squid.

Percentage species composition differed somewhat between the two areas (Table 13). At Montauk, 70% of the control catch per tow was "other" species, followed by 22% long-finned squid and 6% summer flounder. Although the percentage composition of the "other" category in the control catch per tow at Shinnecock (72%) was quite similar to that at Montauk (70%), long-finned squid represented only 3% while summer flounder was 18% of the total in the control catch per tow at Shinnecock. The experimental catch per tow was 88% "other" species and 11% summer flounder at Montauk, and 75% "other" species and 21% summer flounder at Shinnecock.

Mean catch per tow in weight decreased 54% between control and experimental codends for the total study. The percentage decrease varied from 15% for the PATRIOT at Shinnecock to 74% for the RIANDA S at Montauk (Table 14). Total catch per tow decreased 64% between control and experimental codends at Montauk, but only 32% at Shinnecock. This marked difference was due to the larger catches of "other" species and long-finned squid at Montauk. Catch per tow using control codends averaged 1,040 kg of "other" species and 324 kg of long-finned squid at Montauk, but only 483 kg of "other" species and 20 kg of long-finned squid at Shinnecock (Table 13). For the total study, the percentage decrease between control and experimental catch per tow was greatest for long-finned squid (98%), butterfish (98%), scup (87%), and black sea bass (79%), and smallest for summer flounder (26%). For the PATRIOT at Shinnecock, there was actually a 7% increase in the catch in weight of summer flounder between the control and the experimental codends.

Summer Flounder Selectivity

Summer flounder length frequencies were combined for all the control and all the experimental codend tows by each vessel in order to estimate length selection curves and determine 50% retention lengths and selection factors. Combined length frequencies by codend for each vessel are given in Tables 15-18 and plotted in Figures 2-5. For each vessel, the number caught at each length in the experimental codend was expressed as a proportion of the number caught in the control codend. The proportion at each length was adjusted to reflect the difference in catching efficiency of the experimental codend relative to the control codend using the ratio of the experimental vs. control catches above the selection range (Pope et al. 1975).

A selection curve for each vessel was determined by smoothing the adjusted proportions retained at length using 3-point moving averages. Linear interpolation was used to locate the 50% retention length (ℓ_{50}). Variance, standard error, and 95% confidence limits were calculated for the ℓ_{50} using procedures described by Pope et al. (1975). The selection factor was calculated as the ratio between the ℓ_{50} and the mean mesh size.

Selectivity from the experiment conducted by the SEAFARER (Montauk) was based on 170 fish caught with the control codend (65 mm) and 136 fish with the experimental codend (148 mm) (Table 15, Figure 2). The catching efficiency of the experimental codend above the selection range compared to the control codend was 1.09. The ℓ_{50} was determined from the selection curve (Figure 6) to be 37.3 cm (14.7 in), and the selection factor was calculated to be 2.52.

Selectivity from the experiment conducted by the RIANDA S (Montauk) was based on 1,492 fish caught with the control codend (64 mm) and 671 fish with the experimental codend (145 mm) (Table 16, Figure 3). The catching efficiency of the experimental codend above the selection range relative to the control codend was 0.85. The ℓ_{50} was estimated from the selection curve (Figure 7) to be 37.9 cm (14.9 in), and the selection factor was calculated to be 2.62.

Selectivity from the experiment conducted by the PATRIOT (Shinnecock) was based on 1,983 fish caught with the control codend (58 mm) and 1,872 fish with the experimental codend (142 mm) (Table 17, Figure 4). The catching efficiency of the experimental codend above the selection range relative to the control codend was 1.25. The ℓ_{50} from the selection curve (Figure 8) was 32.5 cm (12.8 in), and the selection factor was calculated to be 2.29.

Selectivity from the experiment conducted by the RUTH ANN (Shinnecock) was based on 2,950 fish caught with the control codend (64 mm) and 1,542 fish with the experimental codend (141 mm) (Table 18, Figure 5). The catching efficiency of the experimental codend above the selection range relative to the control codend was 0.98. The ℓ_{50} from the selection curve (Figure 9) was 34.5 cm (13.6 in), and the selection factor was calculated to be 2.45.

Winter Flounder Selectivity

Selectivity for winter flounder was determined in the same manner as described above for summer flounder.

There were insufficient numbers of winter flounder caught during the experiment conducted by the SEAFARER (Montauk) (53 with the control codend and 12 with the experimental codend) to determine selectivity (Table 19, Figure 10).

Selectivity from the experiment conducted by the RIANDA S (Montauk) was based on 149 fish caught with the control codend (64 mm) and 47 fish with the experimental codend (145 mm) (Table 20, Figure 11). The catching efficiency of the experimental codend above the selection range relative to the control codend was 0.92. The ℓ_{50} from the selection curve (Figure 14) was 34.2 mm (13.5 in), and the selection factor was calculated to be 2.36.

Selectivity from the experiment conducted by the PATRIOT (Shinnecock) was based on 980 winter flounder caught with the control codend (58 mm) and 372 with the experimental codend (142 mm) (Table 21, Figure 12). The catching efficiency of the experimental codend above the selection range relative to the control codend was 1.04. The ℓ_{50} from the selection curve (Figure 15) was 30.2 cm (11.9 in), and the selection factor was calculated to be 2.13.

Selectivity from the experiment conducted by the RUTH ANN (Shinnecock) was based on 944 fish caught with the control codend (64 mm) and 308 with the experimental codend (141 mm) (Table 22, Figure 13). The catching efficiency of the experimental codend above the selection range relative to the control codend was 1.10. The ℓ_{50} from the selection curve (Figure 16) was 31.2 cm (12.3 in), and the selection factor was calculated to be 2.22.

Selectivity of Other Species

Length frequencies were summed for the control and for the experimental codend tows by each vessel for black sea bass (Table 23, Figures 17-20), scup (Table 24, Figures 21-24), butterfish (Table 25, Figures 25-28), and long-finned squid (Table 26, Figures 29-32). However, numbers of fish taken by the experimental codends were insufficient to provide a basis for determining selection curves and estimating 50% retention lengths and selection factors.

In almost all cases, the mean length of the combined catch of each species by each vessel exhibited an increase between the control and experimental codends. Such an increase in mean length would be expected going from the 58-65 mm mesh control codends to the 141-148 mm experimental codends. However, the most dramatic difference between the control and experimental catches was in the numbers caught. For the total study, the number of black sea bass decreased 93% between the control and experimental codend catches, scup decreased 90%, butterfish decreased 99%, and long-finned squid decreased 98%. These percentage decreases are slightly higher than those based on changes in mean weight per tow (79, 87, 98, and 98%, respectively, for the four species) (Table 14) since the fish retained by the experimental codends were, in most cases, longer and heavier.

DISCUSSION

The summer flounder selectivity results from the Long Island experiments are summarized in Table 27. The selection factors determined from the four experiments ranged from 2.29 to 2.62 and averaged 2.47. The two highest factors were both obtained from the Montauk experiments (SEAFARER - 2.52, RIANDA S - 2.62), whereas the lowest factors were from the Shinnecock experiments (PATRIOT - 2.29, RUTH ANN - 2.45).

The variability among the four selection factors can be attributed to a variety of factors. The four vessels and trawls used were all different (Tables 1 and 2). It is likely that the particular characteristics of each vessel-trawl combination resulted in different fishing power for each which had an effect on the capture and ultimate retention of summer flounder (as well as the other species).

The experimental codends used in the Montauk experiments were constructed of nylon mesh, whereas those used at Shinnecock were made of polyethylene (Table 2). The higher selection factors from Montauk are consistent with results from other studies which have found that nylon codends give higher selection factors than codends made of polyethylene (Bohl 1967; Pope et al. 1975) due to the greater extensibility of the nylon. Furthermore, the nylon mesh contained only single braided material, whereas the polyethylene mesh was constructed of doubled braided material resulting in larger knots which increases retention.

The control codends used by the four vessels all differed somewhat, either in mesh size or material (Table 2). Codends used by the SEAFARER, RIANDA S, and RUTH ANN all had stretched mesh measurements of about 2½ in, whereas the PATRIOT, whose catch data produced the lowest selection factor, used a codend with about a 2¼-in mesh. In theory, since the selection range of either a 2½-in or a 2¼-in mesh codend should be well below that of a 5½-in mesh codend, the different sized control codends should have had no influence on determining the ℓ_{50} and selection factor of the larger-mesh codend. It is possible, however, that there may have been some effect. In addition, the control codends used by the SEAFARER and RIANDA S were liners inside of 5 1/8-in (130-mm) codends. The effect of the outer larger mesh on the selectivity of the inner 2½-in (64-65-mm) mesh is uncertain, but was probably minimal.

The catching efficiency of the experimental codend above its selection range for summer flounder relative to the control codend was considerably higher for the PATRIOT (1.25) than for the other vessels (0.85 - 1.09). Previous studies (Davis 1934; Beverton and Holt 1957) have suggested that in alternate-haul experiments larger-mesh codends tend to catch more fish than smaller-mesh codends at lengths above the selection range of the larger mesh due to an increase in fishing power of the trawl produced by the larger mesh. This did not appear to happen in the case of the RIANDA S and the RUTH ANN where catching efficiency for summer flounder decreased with the larger mesh.

Mean and modal fish length, not only for summer flounder but for all the other species for which length analysis was done (winter flounder, black sea bass, scup, butterfish, and long-finned squid), was less in catches by both vessels in the Shinnecock area (PATRIOT and RUTH ANN) than in catches by either vessel in the Montauk area (SEAFARER and RIANDA S). This consistent difference in fish size in the catches between the two study areas was due either to the presence of smaller fish (of all species) in the Shinnecock area or to a consistent bias by both trawls in each area towards larger (Montauk) or smaller (Shinnecock) fish. The former reason appears more likely. The experiments at Montauk were conducted two weeks before those at Shinnecock and were done in water which averaged nearly 12 ft shallower than at Shinnecock. Even though the two study sites were only 20-30 miles apart, the slight differences in depth and dates of work could have resulted in the observed differences in length. The species in question were all in the process of their annual inshore and northerly migrations; larger individuals would tend to arrive inshore first, with smaller individuals lagging somewhat behind in deeper water. The smaller size of the summer flounder contributed to the lower values for ℓ_{50} and selection factor determined from the Shinnecock experiments.

An additional factor which may have influenced the selectivity of the various codends for summer flounder was the catch of "other" species. Over 70% of the catch per tow by control codends and 82% of the experimental codend catch per tow in the total study consisted of species in the "other" category such as skates, searobins, sand flounder,

goosefish, and the like. The catch rate of "other" species in control codends was 2.2 times greater at Montauk than at Shinnecock, and in experimental codends 1.4 times greater at Montauk. The greater quantity of "other" species in the codends at Montauk should, in theory, have created the potential for increased clogging of meshes leading to a greater retention of smaller fish. Since the retention of smaller fish was, in fact, less at Montauk than at Shinnecock, it is uncertain what effect, if any, the difference in the catch of "other" species had on summer flounder selectivity.

The selection factors for summer flounder determined from the 1979-80 North Carolina study (Gillikin et al. 1981) ranged from 2.42 to 2.68 and averaged 2.53. In the Long Island study, the average of the four selection factors estimated was 2.47; however, if the low value of 2.29 obtained by the PATRIOT is not considered, the remaining three values also averaged 2.53. Thus, the results of both studies were quite consistent, in spite of some differences in the conduct of the two studies and the quantities of fish caught and included in the analyses.

In the North Carolina study (Gillikin et al. 1981), seven different experimental codends ranging in size (stretched mesh) from 73 mm (2.9 in) to 160 mm (6.3 in) were tested relative to a 38-mm (1.5-in) mesh control codend. The number of tows with each codend varied from 4 to 8, and towing time was generally 30 minutes, although some tows were for 60 minutes. As a result of fewer tows of shorter duration, catch rates of summer flounder averaged 4-5 times

less than in the Long Island study, and fewer numbers of fish were available for estimating length selection curves than in the Long Island study. The difference between the numbers of summer flounder in the two studies from which length selection curves were estimated apparently had little, if any, effect on the determination of selection factors. Concern that the tows of relatively short duration in the North Carolina study (30-60 minutes) would exhibit a different selection pattern and produce higher selection factors than commercial tows of longer duration (2-3 hrs) appears to be unfounded based on the results of the Long Island study. Although longer tows resulting in a greater accumulation of fish in the codend could potentially lead to increased retention of smaller fish and lower selection factors, this should not occur unless gilling in the forward part of the codend became a serious problem and hindered the normal selection process of the codend meshes. This was not apparent in the Long Island study.

The average selection factor of 2.47 determined for summer flounder in this study implies a 50% retention length (ℓ_{50}) of 13.6 in (34.5 cm) for a 5½-in (140-mm) stretched mesh codend. Assuming a selection factor of 2.53 /average from North Carolina study (Gillikin et al., 1981) and average from Long Island study when lowest value is not considered/ implies an ℓ_{50} of 13.9 in (35.3 cm) for a 5½-in codend. This suggests that a 5½-in mesh codend is appropriate for use in conjunction with a 14-in (35.6-cm) minimum size limit for summer flounder. It must be kept in mind, however, that some fish below the 50% retention length are retained and some fish above the 50% retention length are not retained.

The degree to which this may occur can be evaluated by examining the range over which the bulk of the selection process occurs. In the present study, the approximate 25-75% selection range varied from 1.9 to 3.1 cm (0.7 to 1.2 in) for three of the selection curves (Figures 6-8) and was 7.7 cm (3.0 in) for the fourth curve (Figure 9). In three of the curves, the selection was sharpest below the 50% selection length, whereas in one curve it was sharpest above the ℓ_{50}.

In the Long Island study, 43% of the average catch per tow in numbers of summer flounder with the control codends (58-65 mm or 2.3-2.6 in) measured less than 35.5 cm (14.0 in), whereas 26% of the catch per tow with the experimental codends (141-148 mm or 5.6-5.8 in) was less than 35.5 cm. Conversely, 57 and 74% of the catch per tow by control and experimental codends, respectively, consisted of summer flounder longer than 35.5 cm (14.0 in). Average catch per tow of summer flounder decreased 26% in weight and 36% in numbers between control and experimental codends. For the study as a whole, there was a 61% decrease in the retention of summer flounder measuring less than 35.5 cm (14.0 in) between control and experimental codends (on a per-tow basis) and a 17% decrease in the retention of fish above 35.5 cm (14.0 in) in length. For one of the vessels (PATRIOT), however, there was a 25% increase in the retention of fish above 35.5 cm (14.0 in) between the control and experimental codend. As indicated earlier, larger-mesh codends frequently catch more fish than smaller-mesh codends at lengths above the selection range of the larger mesh due to improved fishing power resulting from less drag in the water from the larger mesh.

Length selection curves for species other than summer flounder were derived only for winter flounder. The selection factors determined for winter flounder ranged from 2.13 to 2.36 (Table 27) and averaged 2.24. This value is similar to the selection factor of 2.21 reported for winter flounder by Smolowitz (1983). The variation in the selection factors derived for winter flounder in the current study between areas and vessels followed the same pattern as for summer flounder. This suggests that the gear and area differences described above for summer flounder influenced the selectivity of both species approximately the same.

Selection factors determined for other flounder species are 2.29 and 2.34 for yellowtail flounder (Lux 1968), 2.30 and 2.37 for yellowtail flounder (Smolowitz 1983), and 2.2 (McCracken 1963) and 2.3 (Smolowitz 1983) for American plaice. Factors for these flounders are all consistently lower than those determined for summer flounder in the North Carolina study (Gillikin et al. 1981) and in this study. As suggested by Gillikin et al. (1981), the higher selection factors for summer flounders may be due to their very active nature. As one of the large-mouthed flounders, it feeds heavily on smaller fish and is very active in the pursuit of prey (Bigelow and Schroeder 1953). This apparent higher degree of activity may result in a higher rate of escapement from trawls. An additional, and perhaps more likely, explanation for the higher selection factor for summer flounder is that it has a smaller girth relative to length than most other flounders (Bigelow and Schroeder 1953). This would account for the larger ℓ_{50} for summer flounder than for winter flounder in the present study and result in a larger selection factor.

In addition to demonstrating the selectivity of summer flounder, the results of the Long Island study also illustrated the effect of large-mesh codends on the by-catch of other species caught in association with summer flounder. The use of 141-148-mm (5.6-5.8 in) mesh codends relative to 58-65-mm (2.3-2.6-in) mesh codends resulted in very high escapement of commercially-valuable species at all sizes encountered (including marketable sizes) such as black sea bass, scup, butterfish, and long-finned squid. Percentage loss in terms of weight on a per-tow basis ranged from 79 to 98% for the above species. Percentage loss of "other" species, mostly unmarketable, which would normally be discarded, averaged 47%.

The use of a 5½-in mesh codend appears to be appropriate for summer flounder in conjunction with a 14-in minimum size limit. There is a considerable reduction in the retention of and presumed mortality on undersized summer flounder and other species. In the case of a fishery directed exclusively for summer flounder, the larger-mesh codend also allows the escapement of significant quantities of undesired species and reduces the time and effort required for sorting and discarding. However, in a mixed species fishery, which appears to be the case much of the time in areas such as off Long Island, the use of the larger-mesh codend, although appropriate for the flounders, would result in the considerable loss of other valuable species.

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Table 1. Specifications of vessels participating in the Long Island mesh selection experiments.

Item	SEAFARER	RIANDA S	PATRIOT	RUTH ANN
Type vessel	Wooden stern trawler	Steel stern trawler	Steel stern trawler	Wooden stern trawler
Home port	Montauk, NY	Montauk, NY	Hampton Bays, NY	Hampton Bays, NY
Call sign	WZE 4456	WYQ 7815	WYT 9529	WYC 7845
Length (ft)	48.5	60	78	64
Gross tons	36	65	91	63
Draft (ft)	7	9	10	9.5
Speed (k)	8	8	9	9.5
Engine and drive	8-71 GM 4.5:1	12-71 GM 5:1	12-71 GM 6:1	12-71 GM 4.5:1
Horsepower	320 shp @ 1800 rpm	365 shp @ 1800 rpm	365 shp @ 1800 rpm	360 shp @ 1800 rpm

Table 2. Specifications of trawl gear used by the four vessels participating in the Long Island mesh selection experiments.

Item	SEAFARER	RIANDA S.	PATRIOT	RUTH ANN
Trawl (forward parts)	127-mm mesh face and 102-mm mesh body, 2.5-mm braided polyethylene. 76-mm mesh tail, twisted 30-thread nylon.	127-mm mesh size, 3-mm polyethylene.	203-mm mesh with 76-mm extension, 30-thread nylon.	143-mm mesh; 70-90 combination net.
Control codend	130-mm mesh, 50 meshes around by 50 deep, doubled 4-mm braided polyethylene. Liner of 65-mm average mesh, 100 meshes around by 100 deep, 2.5-mm polyethylene.	130-mm mesh, 50 meshes around by 50 deep, doubled 4-mm braided polyethylene. Liner of 64-mm average mesh, 100 meshes around by 100 deep, #30 nylon.	58-mm average mesh size, 88 meshes around by 100 deep, #120 braided nylon.	64-mm average mesh size, 130 meshes around by 100 deep, #84 nylon.
Experimental codend	146-mm average mesh size, 48 meshes around by 50 deep, #120 braided nylon.		142-mm average mesh size, 60 meshes around by 50 deep, doubled 5.5-mm braided polyethylene.	
Headrope	16.5 m (54 ft) of 3/4-in stainless wire rope.	19.8 m (65 ft) of 1-in poly-dacron.	23.8 m (78 ft) of 1/2-in nylon.	21.3 m (70 ft) of 1/2-in stainless wire rope.
Footrope (sweep)	21.3 m (70 ft) of 1/2-in chain with 5-in rubber cookies.	28.4 m (93 ft) of 5/8-in chain with 5-in rubber cookies.	28.0 m (92 ft) of 1/2-in nylon and 3/8-in chain.	27.4 m (90 ft) of double 1/2-in stainless wire rope.
Floats	13 8-in plastic floats.	50 8-in plastic floats.	12 16-in plastic floats.	7 9-in plastic floats.
Chafing gear	Mat of polyethylene strands covering aft half of underside of codend.			
Doors	Steel V, 1.8 m (6 ft) long by 1.4 m (4.5 ft) wide, weighing 318 kg (700 lb).	Steel V, 2.1 m (7 ft) long by 1.5 m (5 ft) wide, weighing 500 kg (1100 lb).	Steel V, 2.1 m (7 ft) long by 1.5 m (5 ft) wide, weighing 500 kg (1100 lb).	Wooden rectangular, 2.4 m (8 ft) long by 1.2 m (4 ft) wide, weighing 450 kg (990 lb).
Backstraps	3.7 m (12 ft) of 3/8-in chain.	3.7 m (12 ft) of 3/8-in chain.	3.4 m (11 ft) of 1/2-in chain.	3.0 m (10 ft) of 3/8-in double chain.
Bridle wires	18.3 m (60 ft) of 5/16-in wire rope on top; 18.3 m (60 ft) of 1/2-in chain on bottom.	36.6 m (120 ft) of 3/8-in wire rope on top; 27.4 m (90 ft) of 3/8-in wire rope and 9.2 m (30 ft) of 1/2-in wire rope on bottom.	27.4 m (90 ft) of 5/16-in wire rope on top; 27.4 m (90 ft) of 1/2-in chain on bottom.	36.6 m (120 ft) of 5/16-in wire rope on top; 18.3 m (60 ft) of 5/8-in wire rope and 18.3 m (60 ft) of 3/8-in chain on bottom.
Trawl wire	9/16-in wire rope.	5/8-in wire rope.	5/8-in 6x19 wire rope.	9/16-in wire rope.
Ground cables	45.7 m (150 ft) of 5/8-in wire rope with 1 3/4-in rubber cookies.	73.2 m (240 ft) of 3/4-in wire rope.	36.6 m (120 ft) of 5/8-in wire rope and 91.4 m (300 ft) of 3/4-in wire rope.	73.2 m (240 ft) of 5/8-in wire rope with 18.3 m (60 ft) of this rigged with 2-in rubber cookies.

Table 3. Common and scientific names of finfish and squid species caught during the Long Island mesh selection experiments.

Common name	Scientific name
Summer flounder	*Paralichthys dentatus*
Winter flounder	*Pseudopleuronectes americanus*
Sand flounder	*Scophthalmus aquosus*
Fourspot flounder	*Hippoglossus oblongus*
Yellowtail flounder	*Limanda ferruginea*
Scup	*Stenotomus chrysops*
Black sea bass	*Centropristis striata*
Cunner	*Tautogolabrus adspersus*
Tautog	*Tautoga onitis*
Bluefish	*Pomatomus saltatrix*
Striped bass	*Morone saxatilus*
Northern kingfish	*Menticirrhus saxatilus*
Weakfish	*Cynoscion regalis*
Silver hake	*Merluccius bilinearis*
Red hake	*Urophycis chuss*
Pollock	*Pollachius virens*
Atlantic menhaden	*Brevoortia tyrannus*
Atlantic herring	*Clupea harengus*
American shad	*Alosa sapidissima*
Alewife	*Alosa pseudoharengus*
Blueback herring	*Alosa aestivalis*
Butterfish	*Peprilus triacanthus*
Goosefish	*Lophius americanus*
Northern searobin	*Prionotus carolinus*
Striped searobin	*Prionotus evolans*
Sea raven	*Hemitripterus americanus*
Longhorn sculpin	*Myoxocephalus octodecemspinosus*
Bay anchovy	*Anchoa mitchilli*
Striped anchovy	*Anchoa hepsetus*
Sand lance	*Ammodytes americanus*
Conger eel	*Conger oceanicus*
Northern puffer	*Sphoeroides maculatus*
Little skate	*Raja erinacea*
Winter skate	*Raja ocellata*
Smooth dogfish	*Mustelus canis*
Dusky shark	*Carcharhinus obscurus*
Atlantic sturgeon	*Acipenser oxyrhynchus*
Shortnose sturgeon	*Acipenser brevirostrum*
Long-finned squid	*Loligo pealei*

Table 4. Tow data by vessel and codend in the Montauk area during the Long Island mesh selection experiments.

Tow number	Station number	Date	Starting time	Loran C bearing X	Loran C bearing Y	Latitude	Longitude	Average depth (ft)	Tow direction	Wind Direction	Wind Speed (k)	Wave height (ft)	Vessel speed (k)
							SEAFARER - Control						
1	2	5-17-83	0955	26017	43850	41°02'	71°54'	N/A	80°	0°	5	1-2	2.3
2	4	5-17-83	1445	26041	43848	41°01'	71°57'	N/A	N/A	236°	8	1-2	N/A
							SEAFARER - Experimental						
1	1	5-17-83	0720	26060	43848	41°00'	71°59'	48	80°	0°	15	2	2.6
2	3	5-17-83	1220	25994	43854	41°03'	71°52'	N/A	N/A	225°	5	1-2	N/A
							RIANDA S - Control						
1	1	5-17-83	0720	26034	43852	41°02'	71°56'	43	N/A	0°	15	1-2	2.8-2.4
2	3	5-17-83	1240	26052	43847	41°00'	71°59'	56	N/A	225°	5	1-2	3
3	5	5-19-83	0520	25990	43854	41°03'	71°59'	50	N/A	205°	5-10	1	2.8
4	7	5-19-83	1025	26048	43850	41°01'	71°59'	48	N/A	108°	5	1	2.8
5	10	5-23-83	0820	26054	43848	41°01'	71°59'	30	N/A	225°	5	2	2.6
6	12	5-23-83	1315	26060	43848	41°00'	71°60'	36	N/A	225°	5	2	2.5
7	13	5-23-83	0535	26023	43851	41°01'	71°51'	36	N/A	157°	5	2	2.5
8	15	5-24-83	1040	26041	43849	41°01'	71°57'	42	N/A	67°	8	2	2.5
							RIANDA S - Experimental						
1	2	5-17-83	1005	26013	43850	41°02'	71°54'	41	N/A	0°	5	1-2	2.4
2	4	5-17-83	1500	25990	43853	41°03'	71°51'	60	N/A	236°	8	1-2	2.6
3	6	5-19-83	0750	26061	43847	41°02'	71°50'	30	N/A	180°	5	1	2.0
4	8	5-19-83	1255	25989	43857	41°03'	71°51'	63	N/A	157°	5	1	N/A
5	9	5-23-83	0605	26017	43850	41°02'	71°54'	39	N/A	225°	5-10	3	2.1
6	11	5-23-83	1045	26058	43847	41°00'	71°59'	30	N/A	225°	5	2	N/A
7	14	5-24-83	0810	26043	43851	41°01'	71°57'	32	N/A	67°	8	2	2.5
8	16	5-24-83	1305	26048	43850	41°01'	71°58'	41	N/A	67°	8	2	N/A

Table 5. Tow data by vessel and codend in the Shinnecock area during the Long Island mesh selection experiments.

Tow number	Station number	Date	Starting time	Loran C bearing X	Loran C bearing Y	Latitude	Longitude	Average depth (ft)	Tow direction	Wind Direction	Wind Speed (k)	Wave height (ft)	Vessel speed (k)
							PATRIOT - Control						
1	1	5-31-83	0714	26282	43797	40°48'	72°21'	56	93°	180°	5	2	2.4
2	4	5-31-83	1500	26234	43808	40°52'	72°22'	52	279°	N/A	N/A	2	3.1
3	6	6-01-83	0805	26229	43810	40°52'	72°21'	49	77°	SW	5	2	2.8
4	7	6-01-83	1050	26174	43818	40°54'	72°14'	58	261°	SW	5	2	2.9
5	9	6-02-83	0525	26286	43799	40°50'	72°28'	58	87°	NW	10-15	1	2.8
6	12	6-02-83	1320	26233	43806	40°52'	72°22'	56	264°	NW	10	1	2.7
7	14	6-03-83	0754	26221	43810	40°52'	72°20'	48	256°	NW	3-4	1	3.1
8	15	6-03-83	1035	26287	43802	40°50'	72°28'	40	76°	SW	5	1	2.9
9	17	6-05-83	0535	26282	43799	40°50'	72°28'	58	98°	NW	5	3	2.7-3.0
10	20	6-05-83	1315	26229	43802	40°51'	72°21'	60	261°	SW	5	6	2.7
							PATRIOT - Experimental						
1	2	5-31-83	1000	26241	43803	40°51'	72°22'	58	266°	24°	5	2	2.9
2	3	5-31-83	1225	26292	43799	40°491	72°28'	53	80°	210°	5	2	2.8
3	5	6-01-83	0523	26284	43798	40°49'	72°28'	55	70°	320°	8	2	2.8
4	8	6-01-83	1325	26237	43806	40°51'	72°22'	60	N/A	SW	5	2	2.9
5	10	6-02-83	0805	26235	43809	40°52'	72°21'	48	246°	NW	10-15	1	2.9[1]
6	11	6-02-83	1045	26283	43803	40°50'	72°27'	38	67°	NW	10-15	1	2.7
7	13	6-03-83	0516	26288	43802	40°50'	72°30'	48	85°	N/A	0	<1	2.9
8	16	6-03-83	1315	26232	43812	40°52'	72°21'	42	265°	SW	10	1	2.5
9	18	6-05-83	0810	26267	43812	40°51'	72°25'	50	265°	W	5	6	2.8
10	19	6-05-83	1045	26282	43801	40°50'	72°27'	40	89°	WNW	5	6	N/A
							RUTH ANN - Control						
1	2	5-31-83	1005	26237	43802	40°51'	72°22'	66	N/A	5°	5	3	2.8
2	3	5-31-83	1215	26280	43798	40°49'	72°27'	55	N/A	5°	5	3	N/A[2]
3	5	6-01-83	0530	26280	43797	40°49'	72°27'	58	N/A	0°	0	3	2.7-2.8
4	8	6-01-83	1310	26239	43805	40°51'	72°22'	54	N/A	SW	10	6	2.8
5	10	6-02-83	0825	26236	43806	40°51'	72°22'	58	WSW	NW	5-10	2	2.7
6	11	6-02-83	1045	26285	43797	40°49'	72°28'	52	ENE	NW	10	1	2.7
7	13	6-03-83	0520	26290	43797	40°49'	72°28'	56	72°	0°	0	0	2.7
8	16	6-03-83	1320	26250	43807	40°51'	72°23'	54	260°	SW	5	6	2.7
9	18	6-05-83	0820	26226	43806	40°51'	72°20'	58	WSW	0°	0	6-8	2.8
10	19	6-05-83	1110	26279	43796	40°49'	72°27'	64	ENE	0°	0	6-8	2.7
							RUTH ANN - Experimental						
1	1	5-31-83	0730	26283	43797	40°49'	72°27'	56	N/A	0°	0	4	2.8
2	4	5-31-83	1455	26235	43808	40°52'	72°21'	50	N/A	5°	5	N/A	2.7
3	6	6-01-83	0805	26227	43808	40°52'	72°20'	54	N/A	0°	0	3	2.7-2.8
4	7	6-01-83	1030	26182	43820	40°54'	72°15'	52	N/A	SW	5	6	N/A
5	9	6-02-83	0533	26281	43798	40°49'	72°27'	55	72°	NW	5-10	1	N/A
6	12	6-02-83	1315	26240	43807	40°51'	72°22'	56	WSW	315°	15	1-2	2.7
7	14	6-03-83	0805	26233	43806	40°51'	72°21'	54	280°	0°	0	0	2.7
8	15	6-03-83	1045	26287	43798	40°49'	72°28'	59	N/A	0°	0	0	2.7
9	17	6-05-83	0535	26280	43796	40°49'	72°27'	65	N/A	NW	5	6-8	2.7
10	20	6-05-83	1245	26227	43802	40°51'	72°21'	67	WSW	SW	<1	6-8	2.8

[1]Reduced to 1500 RPM at 0850.

[2]1250 RPM.

Table 6. Mesh measurement statistics for each codend used in the Long Island mesh selection experiments. All measurements are expressed in mm.

Parameter[1]	Tow number											
	Dry	1	2	3	4	5	6	7	8	9	10	Overall
SEAFARER - Control												
n	30	30	30	-	-	-	-	-	-	-	-	90
$\bar{x}$	64.5	65.7	64.6	-	-	-	-	-	-	-	-	64.9
s	1.78	1.53	1.36	-	-	-	-	-	-	-	-	1.65
$s_{\bar{x}}$	0.32	0.28	0.25	-	-	-	-	-	-	-	-	0.17
95% C.I. = 64.6 - 65.2 mm												
SEAFARER - Experimental												
n	30	30	30	-	-	-	-	-	-	-	-	90
$\bar{x}$	148.3	149.0	146.9	-	-	-	-	-	-	-	-	148.0
s	2.37	3.09	2.51	-	-	-	-	-	-	-	-	2.78
$s_{\bar{x}}$	0.43	0.56	0.46	-	-	-	-	-	-	-	-	0.29
95% C.I. = 147.5 - 148.7 mm												
RIANDA S - Control												
n	-	30	30	30	30	30	30	30	30	-	-	240
$\bar{x}$	-	62.1	62.4	62.5	63.8	64.3	64.2	65.4	65.1	-	-	63.7
s	-	2.23	1.71	1.38	1.92	1.70	2.03	2.13	2.32	-	-	2.26
$s_{\bar{x}}$	-	0.41	0.31	0.25	0.35	0.31	0.37	0.39	0.42	-	-	0.15
95% C.I. = 63.4 - 64.0 mm												
RIANDA S - Experimental												
n	-	30	30	30	30	30	30	30	30	-	-	240
$\bar{x}$	-	147.2	145.0	145.1	144.2	145.6	144.4	144.3	144.3	-	-	145.0
s	-	2.11	2.45	2.22	2.45	2.51	2.44	2.64	2.21	-	-	2.54
$s_{\bar{x}}$	-	0.39	0.45	0.40	0.45	0.46	0.45	0.48	0.40	-	-	0.16
95% C.I. = 144.7 - 145.3 mm												
PATRIOT - Control												
n	-	30	30	30	30	30	30	30	30	30	30	300
$\bar{x}$	-	55.0	55.7	58.9	54.5	58.6	56.7	60.5	59.3	57.2	64.6	58.3
s	-	2.02	2.06	5.89	2.08	5.84	2.17	5.39	11.22	1.97	6.70	5.32
$s_{\bar{x}}$	-	0.37	0.48	1.08	0.38	1.07	0.40	0.98	2.05	0.36	1.22	0.31
95% C.I. = 57.7 - 58.9 mm												
PATRIOT - Experimental												
n	30	-	30	30	30	30	30	30	30	30	30	300
$\bar{x}$	145.7	-	141.7	137.6	141.8	139.0	142.3	144.7	142.3	140.4	143.9	141.9
s	4.71	-	4.37	4.77	3.52	3.96	4.44	4.65	4.32	4.68	4.76	4.96
$s_{\bar{x}}$	0.86	-	0.80	0.87	0.64	0.72	0.81	0.85	0.79	0.85	0.87	0.29
95% C.I. = 141.4 - 142.5 mm												
RUTH ANN - Control												
n	30	-	-	-	30	-	30	30	30	30	30	210
$\bar{x}$	60.4	-	-	-	61.0	-	65.5	66.1	64.4	65.2	68.7	64.5
s	5.22	-	-	-	2.85	-	2.90	2.23	3.01	2.83	2.11	4.12
$s_{\bar{x}}$	0.95	-	-	-	0.52	-	0.53	0.41	0.55	0.52	0.38	0.28
95% C.I. = 64.2 - 65.1 mm												
RUTH ANN - Experimental												
n	30	-	30	-	30	30	30	30	30	30	30	270
$\bar{x}$	142.3	-	139.0	-	140.1	144.6	141.2	139.8	138.6	139.3	144.5	141.0
s	4.58	-	4.18	-	3.57	4.01	3.90	3.45	2.90	4.10	3.09	4.32
$s_{\bar{x}}$	0.84	-	0.76	-	0.65	0.73	0.71	0.63	0.53	0.75	0.56	0.26
95% C.I. = 140.5 - 141.5 mm												

[1] n = number of meshes measured, $\bar{x}$ = mean size (mm), s_x = standard deviation, and $s_{\bar{x}}$ = standard error of mean.

Table 7. Differences among mean mesh measurements (mm) for each codend used by the SEAFARER in the Montauk area during the Long Island mesh selection experiments.

a. Control codend.

Tow number	$\bar{x}$	Tow number: Dry	1	2
		64.5	65.7	64.6
Dry	64.5	-	1.2*	0.1
1	65.7	-	-	1.1*
2	64.6	-	-	-

*Significant difference between means (HSD = 0.98) at the 95% level.

b. Experimental codend.

Tow number	$\bar{x}$	Tow number: Dry	1	2
		148.3	149.0	146.9
Dry	148.3	-	0.7	1.4
1	149.0	-	-	2.1*
2	146.9	-	-	-

*Significant difference between means (HSD = 1.65) at the 95% level.

Table 8. Differences among mean mesh measurements (mm) for each codend used by the RIANDA S. in the Montauk area during the Long Island mesh selection experiments.

a. Control codend.

Tow number	$\bar{x}$	Tow number 1	2	3	4	5	6	7	8
		62.1	62.4	62.5	63.8	64.3	64.2	65.4	65.1
1	62.1	-	0.3	0.4	1.7*	2.2*	2.1*	3.3*	3.0*
2	62.4	-	-	0.1	1.4	1.9*	1.8*	3.0*	2.7*
3	62.5	-	-	-	1.3	1.8*	1.7*	2.9*	2.6*
4	63.8	-	-	-	-	0.5	0.4	1.6*	1.3
5	64.3	-	-	-	-	-	0.1	1.1	0.8
6	64.2	-	-	-	-	-	-	1.2	0.9
7	65.4	-	-	-	-	-	-	-	0.3
8	65.1	-	-	-	-	-	-	-	-

*Significant difference between means (HSD = 1.53 mm) at the 95% level.

b. Experimental codend.

Tow number	$\bar{x}$	Tow number 1	2	3	4	5	6	7	8
		147.2	145.0	145.1	144.2	145.6	144.6	144.3	144.3
1	147.2	-	2.2*	2.1*	3.0*	1.6	2.8*	2.9*	2.9*
2	145.0	-	-	0.1*	0.8	0.6	0.6	0.7	0.7
3	145.1	-	-	-	0.9	0.5	0.7	0.8	0.8
4	144.2	-	-	-	-	1.4	0.2	0.1	0.1
5	145.6	-	-	-	-	-	1.2	1.3	1.3
6	144.4	-	-	-	-	-	-	0.1	0.1
7	144.3	-	-	-	-	-	-	-	0.0
8	144.3	-	-	-	-	-	-	-	-

*Significant difference between means (HSD = 1.87 mm) at the 95% level.

Table 9. Differences among mean mesh measurements (mm) for each codend used by the PATRIOT in the Shinnecock area during the Long Island mesh selection experiments.

a. Control codend.

Tow number	$\bar{x}$	Tow number: Dry	1	2	3	4	5	6	7	8	9	10
		-	55.0	55.7	58.6	54.5	58.6	56.7	60.5	61.4	57.2	64.6
Dry	-	-	-	-	-	-	-	-	-	-	-	-
1	55.0	-	-	0.7	3.6*	1.5	3.6*	1.7	5.5*	6.4*	2.2	9.6*
2	55.7	-	-	-	2.9	1.2	2.9	1.0	4.8*	5.7*	0.5	8.9*
3	59.6	-	-	-	-	4.1*	0	1.9	1.9	2.8	1.4	6.0*
4	54.5	-	-	-	-	-	4.1*	2.2	6.0*	6.9*	2.7	10.1*
5	58.6	-	-	-	-	-	-	1.9	1.9	2.8	1.4	6.0*
6	56.7	-	-	-	-	-	-	-	3.8*	4.7*	0.5	7.9*
7	60.5	-	-	-	-	-	-	-	-	0.9	3.3	4.1*
8	61.4	-	-	-	-	-	-	-	-	-	4.2*	3.2
9	57.2	-	-	-	-	-	-	-	-	-	-	7.4*
10	64.6	-	-	-	-	-	-	-	-	-	-	-

*Significant differences between means (HSD = 3.60 mm) at the 95% level.

b. Experimental codend.

Tow number	$\bar{x}$	Tow number: Dry	1	2	3	4	5	6	7	8	9	10
		145.7	-	141.7	137.6	141.8	139.0	142.3	144.7	142.3	140.4	143.9
Dry	145.7	-	-	4.0*	8.1*	3.9*	6.7*	3.4	1.0	3.4	5.3*	1.8
1	-	-	-	-	-	-	-	-	-	-	-	-
2	141.7	-	-	-	4.1*	0.1	2.7	0.6	3.0	0.6	1.3	2.2
3	137.6	-	-	-	-	4.2*	1.4	4.7*	7.1*	4.7*	2.8	6.3*
4	141.8	-	-	-	-	-	2.8	0.5	2.9	0.5	1.4	2.1
5	139.0	-	-	-	-	-	-	3.3	5.7*	3.3	1.4	4.9*
6	142.3	-	-	-	-	-	-	-	2.4	0	1.9	1.6
7	144.7	-	-	-	-	-	-	-	-	2.4	4.3*	0.8
8	142.3	-	-	-	-	-	-	-	-	-	1.9	1.6
9	140.4	-	-	-	-	-	-	-	-	-	-	3.5
10	143.9	-	-	-	-	-	-	-	-	-	-	-

*Significant differences between means (HSD = 3.62 mm) at the 95% level.

Table 10. Differences among mean mesh measurements (mm) for each codend used by the RUTH ANN in the Shinnecock area during the Long Island mesh selection experiments.

a. Control codend.

Tow number	$\bar{x}$	Tow number: Dry 60.4	1 -	2 -	3 -	4 61.0	5 -	6 65.5	7 66.1	8 64.4	9 65.2	10 68.7
Dry	60.4	-	-	-	-	0.6	-	5.1*	5.7*	4.0*	4.8*	8.3*
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
4	61.0	-	-	-	-	-	-	4.5*	5.1	3.4*	4.2*	7.7*
5	-	-	-	-	-	-	-	-	-	-	-	-
6	65.5	-	-	-	-	-	-	-	0.6	1.1	0.3	3.2*
7	66.1	-	-	-	-	-	-	-	-	1.7	0.9	2.6*
8	64.4	-	-	-	-	-	-	-	-	-	0.8	4.3*
9	65.2	-	-	-	-	-	-	-	-	-	-	3.5*
10	68.7	-	-	-	-	-	-	-	-	-	-	-

*Significant differences between means (HSD = 2.41 mm) at the 95% level.

b. Experimental codend.

Tow number	$\bar{x}$	Tow number: Dry 142.3	1 -	2 139.0	3 -	4 140.1	5 144.6	6 141.2	7 139.8	8 138.6	9 139.3	10 144.5
Dry	142.3	-	-	3.3	-	2.2	2.3	1.1	2.5	3.7*	3.0	2.2
1	-	-	-	-	-	-	-	-	-	-	-	-
2	139.0	-	-	-	-	1.1	5.6*	2.2	0.8	0.4	0.3	5.5*
3	-	-	-	-	-	-	-	-	-	-	-	-
4	140.1	-	-	-	-	-	4.5*	1.1	0.3	1.5	0.8	4.4*
5	144.6	-	-	-	-	-	-	3.4*	4.8*	6.0*	5.3*	0.1
6	141.2	-	-	-	-	-	-	-	1.4	2.6	1.9	3.3*
7	139.8	-	-	-	-	-	-	-	-	1.2	0.5	4.7*
8	138.6	-	-	-	-	-	-	-	-	-	0.7	5.9*
9	139.3	-	-	-	-	-	-	-	-	-	-	5.2*
10	144.5	-	-	-	-	-	-	-	-	-	-	-

*Significant differences between means (HSD = 3.04 mm) at the 95% level.

Table 11. Species composition of the catch (Kg) from each tow in the Montauk area during the Long Island mesh selection experiments.

Species	Tow number 1	2	3	4	5	6	7	8	9	10	Total
					SEAFARER - Control						
Summer flounder	77.5	41.5	-	-	-	-	-	-	-	-	119.0
Winter flounder	20.5	9.0	-	-	-	-	-	-	-	-	29.5
Black sea bass	3.3	-	-	-	-	-	-	-	-	-	3.3
Scup	2.5	6.2	-	-	-	-	-	-	-	-	8.7
Butterfish	1.3	2.0	-	-	-	-	-	-	-	-	3.3
Long-finned squid	342.5	366.0	-	-	-	-	-	-	-	-	708.5
Other	484.0	1503.5	-	-	-	-	-	-	-	-	1987.5
TOTAL	931.6	1928.2	-	-	-	-	-	-	-	-	2859.8
					SEAFARER - Experimental						
Summer flounder	72.0	29.0	-	-	-	-	-	-	-	-	101.0
Winter flounder	3.5	3.6	-	-	-	-	-	-	-	-	7.1
Black sea bass	-	2.3	-	-	-	-	-	-	-	-	2.3
Scup	1.0	-	-	-	-	-	-	-	-	-	1.0
Butterfish	-	-	-	-	-	-	-	-	-	-	-
Long-finned squid	8.0	2.5	-	-	-	-	-	-	-	-	10.5
Other	882.5	340.0	-	-	-	-	-	-	-	-	1222.5
TOTAL	967.0	377.4	-	-	-	-	-	-	-	-	1344.4
					RIANDA S - Control						
Summer flounder	115.0	66.0	166.0	95.7	150.6	121.0	116.9	72.5	-	-	903.7
Winter flounder	4.0	7.8	11.8	19.7	10.0	2.3	9.3	1.1	-	-	66.0
Black sea Bass	4.0	2.4	2.5	1.2	2.9	3.8	0.9	4.8	-	-	22.5
Scup	4.0	41.7	8.8	2.1	2.1	1.5	23.1	2.9	-	-	86.2
Butterfish	-	40.0	29.4	-	53.2	59.4	49.0	19.8	-	-	250.8
Long-finned squid	444.3	342.0	825.8	61.0	3.6	112.0	22.4	546.3	-	-	2357.8
Other	1071.0	876.7	2869.9	1325.7	630.0	898.7	681.0	344.4	-	-	8693.2
TOTAL	1642.3	1376.6	3914.2	1505.4	852.4	1198.7	902.6	991.8	-	-	12380.2
					RIANDA S - Experimental						
Summer flounder	50.4	31.0	58.4	86.1	71.5	52.3	96.2	64.5	-	-	510.4
Winter flounder	1.0	3.5	1.3	7.3	1.9	2.6	5.1	3.2	-	-	25.9
Black sea bass	-	-	-	1.0	4.5	1.5	-	-	-	-	7.0
Scup	-	2.6	-	1.2	3.5	-	0.4	4.8	-	-	12.5
Butterfish	-	-	0.3	0.5	0.5	1.3	-	0.3	-	-	2.9
Long-finned squid	3.5	13.2	0.8	2.6	1.1	1.3	6.3	2.4	-	-	31.2
Other	343.5	359.7	540.0	404.7	253.5	189.7	310.7	260.8	-	-	2662.6
TOTAL	398.4	410.0	600.8	503.4	336.5	248.7	418.7	336.0	-	-	3252.5

Table 12. Species composition of the catch (kg) from each tow in the Shinnecock area during the Long Island mesh selection experiments.

Species	Tow number 1	2	3	4	5	6	7	8	9	10	Total
					PATRIOT - Control						
Summer flounder	203.5	128.0	88.0	80.5	100.0	64.0	98.0	113.0	42.0	40.0	957.0
Winter flounder	32.0	35.0	9.5	8.0	42.0	41.6	38.0	63.0	27.5	25.5	322.1
Black sea Bass	-	-	1.2	1.5	11.3	5.5	2.2	0.7	7.7	10.3	40.4
Scup	15.0	-	2.3	3.6	-	5.4	5.3	2.1	17.8	9.8	61.3
Butterfish	-	-	0.2	0.7	-	1.2	2.7	0.2	4.1	2.3	11.4
Long-finned squid	-	-	6.6	77.6	82.0	66.1	38.7	3.3	2.0	22.3	298.6
Other	455.0	455.0	136.0	409.0	773.0	410.0	364.0	295.0	318.0	636.0	4251.0
TOTAL	705.5	618.0	243.8	580.9	1008.3	593.8	548.9	477.3	419.1	746.2	5941.8
					PATRIOT - Experimental						
Summer flounder	90.0	147.0	174.0	125.0	91.5	64.0	197.0	60.0	33.5	41.0	1023.0
Winter flounder	9.0	13.5	9.5	11.6	21.5	13.5	55.0	12.5	5.0	7.5	158.6
Black sea Bass	-	-	0.8	2.8	1.8	0.8	0.2	-	1.5	-	7.9
Scup	-	-	1.5	2.0	-	0.3	1.3	0.6	4.2	0.5	10.4
Butterfish	-	-	0.2	-	-	-	0.2	-	0.2	0.2	0.8
Long-finned squid	-	-	0.6	1.7	2.0	0.5	2.3	0.2	0.3	-	7.6
Other	682.0	1136.0	364.0	545.0	136.0	136.0	227.0	182.0	91.0	318.0	3817.0
TOTAL	781.0	1296.5	550.6	688.1	252.8	215.1	483.0	255.3	135.7	367.2	5025.3
					RUTH ANN - Control						
Summer flounder	69.5	148.0	446.0	172.0	112.0	89.0	226.0	141.0	20.0	42.0	1465.5
Winter flounder	18.5	22.2	21.5	15.5	43.0	46.0	63.0	27.5	19.5	36.5	313.2
Black sea Bass	11.5	6.9	10.5	3.1	7.2	2.2	3.3	2.0	7.5	13.0	67.2
Scup	10.5	6.3	25.3	2.3	6.5	7.8	13.8	2.6	21.5	12.5	109.1
Butterfish	0.8	-	17.3	0.3	0.3	0.2	3.4	-	2.2	8.9	33.4
Long-finned squid	10.0	2.8	20.5	2.9	20.9	3.1	30.5	6.3	1.6	1.7	100.3
Other	1319.8	739.3	455.7	581.7	359.9	373.7	363.3	279.6	343.5	585.4	5401.9
TOTAL	1440.6	925.5	996.8	777.8	549.8	522.0	703.3	459.0	415.8	700.0	7490.6
					RUTH ANN - Experimental						
Summer flounder	160.0	73.5	121.5	95.5	110.0	59.0	103.5	112.5	35.0	25.0	895.5
Winter flounder	8.2	16.0	3.6	5.0	6.0	15.0	32.5	23.5	19.0	8.5	137.3
Black sea bass	1.0	0.4	-	0.9	-	0.5	0.5	0.2	0.2	0.1	3.8
Scup	0.3	0.9	0.9	1.6	0.9	0.5	2.3	0.4	0.7	0.7	9.2
Butterfish	-	-	-	1.0	-	-	-	0.1	-	0.4	1.5
Long-finned squid	-	-	2.3	1.0	-	0.8	0.7	0.6	0.5	0.3	6.2
Other	237.0	304.0	200.5	190.6	265.6	357.4	320.5	255.0	487.5	404.0	3022.1
TOTAL	406.5	394.8	328.8	295.6	382.5	433.2	460.0	392.3	542.9	439.0	4075.6

Table 13. Mean catch per tow in kg (and percent age composition) for control (A) and experimental (B) codends by vessel, area, and overall.

	Montauk area						Shinnecock area							
	SEAFARER		RIANDA S		Both		PATRIOT		RUTH ANN		Both		Overall	
Species	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Summer flounder	59.5 (4.2)	50.5 (7.5)	113.0 (7.3)	63.8 (15.7)	86.2 (5.8)	57.2 (10.6)	95.7 (16.1)	102.3 (20.4)	146.6 (19.6)	89.5 (22.0)	121.2 (18.0)	95.9 (21.1)	103.7 (9.6)	76.5 (15.4)
Winter flounder	14.8 (1.0)	3.6 (0.5)	8.2 (0.5)	3.2 (0.8)	11.5 (0.8)	3.4 (0.6)	32.2 (5.4)	15.9 (3.2)	31.3 (4.2)	13.7 (3.4)	31.8 (4.7)	14.8 (3.3)	21.6 (2.0)	9.1 (1.8)
Black sea bass	1.6 (0.1)	1.2 (0.2)	2.8 (0.2)	0.9 (0.2)	2.2 (0.1)	1.0 (0.2)	4.0 (0.7)	0.8 (0.2)	6.7 (0.9)	0.4 (0.1)	5.4 (0.8)	0.6 (0.1)	3.8 (0.4)	0.8 (0.2)
Scup	4.4 (0.3)	0.5 (0.1)	10.8 (0.7)	1.6 (0.4)	7.6 (0.5)	1.0 (0.2)	6.1 (1.0)	1.0 (0.2)	10.9 (1.5)	0.9 (0.2)	8.5 (1.3)	1.0 (0.2)	8.0 (0.7)	1.0 (0.2)
Butterfish	1.6 (0.1)	- (-)	31.4 (2.0)	0.4 (0.1)	16.5 (1.1)	0.2 (<0.1)	1.1 (0.3)	0.1 (<0.1)	3.3 (0.4)	0.2 (<0.1)	2.2 (0.3)	0.2 (<0.1)	9.4 (0.9)	0.1 (<0.1)
Long-finned squid	354.2 (24.8)	5.2 (0.8)	294.7 (19.0)	3.9 (1.0)	324.5 (21.8)	4.6 (0.9)	29.9 (5.0)	0.8 (0.2)	10.0 (1.3)	0.6 (0.1)	20.0 (3.0)	0.7 (0.2)	172.2 (15.9)	2.6 (0.5)
Other	993.8 (69.5)	611.2 (90.9)	1086.6 (70.2)	332.8 (81.8)	1040.2 (69.8)	472.0 (87.5)	425.1 (71.5)	381.7 (76.0)	540.2 (72.1)	302.2 (74.1)	482.7 (71.9)	342.0 (75.1)	761.4 (70.5)	407.0 (81.9)
TOTAL	1429.9 (100.0)	672.2 (100.0)	1547.5 (100.0)	406.6 (100.0)	1488.7 (100.0)	539.4 (100.0)	594.2 (100.0)	502.5 (100.0)	749.1 (100.0)	407.6 (100.0)	671.7 (100.0)	455.1 (100.0)	1080.2 (100.0)	497.2 (100.0)

Table 14. Percentage change in mean catch (kg) per tow between control and experimental codends by vessel, area, and overall.

	Montauk area			Shinnecock area			
Species	SEAFARER	RIANDA S	Both	PATRIOT	RUTH ANN	Both	Overall
Summer flounder	-15	-44	-34	+ 7	-39	-21	-26
Winter flounder	-76	-61	-70	-51	-56	-54	-58
Black sea bass	-30	-69	-55	-80	-94	-89	-79
Scup	-89	-86	-86	-83	-92	-88	-87
Butterfish	-100	-99	-99	-93	-96	-95	-98
Long-finned squid	-99	-99	-99	-97	-94	-97	-98
Other	-38	-69	-55	-10	-44	-29	-47
TOTAL	-53	-74	-64	-15	-46	-32	-54

Table 15. Length frequency distributions of summer flounder caught by the SEAFARER in the Montauk area with 65-mm (A) and 148-mm (B) mesh codends and the proportion retained by the 148-mm mesh.

Length (cm)	Numbers caught A	Numbers caught B	Proportion retained B/A	Proportion retained B/1.09A	Proportion retained 3-point moving ave.
21	1	-	0.00	0.00	-
22	1	-	0.00	0.00	-
23	-	-	-	-	-
24	-	-	-	-	-
25	-	-	-	-	-
26	-	-	-	-	-
27	-	-	-	-	-
28	1	-	0.00	0.00	-
29	-	-	-	-	-
30	1	-	0.00	0.00	-
31	-	-	-	-	-
32	-	-	-	-	0.23
33	4	3	0.75	0.69	0.27
34	8	1	0.13	0.11	0.32
35	12	2	0.17	0.15	0.14
36	6	1	0.17	0.15	0.27
37	15	8	0.53	0.49	0.37
38	18	9	0.50	0.46	0.81
39	10	16	1.60	1.47	0.94
40	25	24	0.96	0.88	1.40
41	9	18	2.00	1.84	1.27
42	11	13	1.18	1.09	1.40
43	10	14	1.40	1.29	0.93
44	9	4	0.44	0.41	0.79
45	11	8	0.73	0.67	0.42
46	5	1	0.20	0.18	0.90
47	2	4	2.00	1.84	0.67
48	-	5	-	-	0.61
49	2	-	0.00	0.00	0.31
50	2	2	1.00	0.92	0.92
51	1	2	2.00	1.84	0.92
52	-	-	-	-	0.61
53	1	-	0.00	0.00	-
54	-	-	-	-	-
55	-	1	-	-	-
56	-	-	-	-	-
57	-	-	-	-	-
58	2	-	0.00	0.00	-
59	1	-	0.00	0.00	-
60	-	-	-	-	-
61	1	-	0.00	0.00	-
62	-	-	-	-	-
63	1	-	0.00	0.00	-
Total(39-63)	103	112	1.09	-	-
Total	170	136	-	-	-
Mean	40.4	41.3	-	-	-

Table 16. Length frequency distributions of summer flounder caught by the RIANDA S in the Montauk area with 64-mm (A) and 145-mm (B) mesh codends and the proportion retained by the 145-mm mesh.

Length (cm)	Numbers caught A	Numbers caught B	Proportion retained B/A	Proportion retained B/0.85A	Proportion retained 3-point moving ave.
25	1	-	0.00	0.00	-
26	6	-	0.00	0.00	-
27	5	-	0.00	0.00	0.20
28	8	4	0.00	0.59	0.25
29	22	3	0.14	0.16	0.27
30	36	2	0.06	0.07	0.09
31	34	1	0.03	0.03	0.08
32	46	5	0.11	0.13	0.08
33	85	5	0.06	0.07	0.11
34	108	11	0.10	0.12	0.13
35	117	20	0.17	0.20	0.15
36	136	16	0.12	0.14	0.22
37	132	36	0.27	0.32	0.33
38	154	68	0.44	0.52	0.51
39	100	59	0.59	0.69	0.73
40	132	110	0.83	0.98	0.97
41	77	81	1.05	1.24	1.11
42	64	60	0.94	1.10	1.05
43	60	42	0.70	0.82	0.92
44	43	31	0.72	0.85	1.01
45	27	31	1.15	1.35	1.10
46	16	15	0.94	1.10	1.19
47	16	15	0.94	1.10	1.18
48	15	17	1.13	1.33	1.44
49	5	8	1.60	1.88	1.42
50	9	8	0.89	1.05	1.29
51	5	4	0.80	0.94	0.86
52	6	3	0.50	0.59	0.90
53	3	3	1.00	1.18	0.98
54	4	4	1.00	1.18	0.78
55	1	-	0.00	0.00	0.39
56	3	-	0.00	0.00	0.00
57	3	-	0.00	0.00	0.16
58	5	2	0.40	0.47	0.16
59	-	1	-	-	0.55
60	2	2	1.00	1.18	0.39
61	2	-	-	-	0.59
62	4	2	0.50	0.59	0.20
63	-	-	-	-	0.20
64	-	1	-	-	-
65	-	-	-	-	-
66	-	-	-	-	-
67	-	1	-	-	-
Total(42-67)	293	250	0.85	-	-
Total	1492	671	-	-	-
Mean	38.0	41.2	-	-	-

Table 17. Length frequency distributions of summer flounder caught by the PATRIOT in the Shinnecock area with 58-mm (A) and 42-mm (B) mesh codends and the proportion retained by the 142-mm mesh.

Length (cm)	Number caught A	Number caught B	Proportion retained B/A	Proportion retained B/1.25A	Proportion retained 3-point moving ave.
21	1	1	1.00	0.80	0.53
22	1	1	1.00	0.80	0.53
23	-	3	-	-	0.53
24	1	1	1.00	0.80	0.27
25	2	-	0.00	0.00	0.37
26	5	2	0.40	0.32	0.13
27	10	1	0.10	0.08	0.14
28	27	1	0.04	0.03	0.05
29	31	1	0.03	0.03	0.05
30	69	7	0.10	0.08	0.12
31	103	33	0.32	0.26	0.25
32	179	90	0.50	0.40	0.42
33	207	155	0.75	0.60	0.59
34	238	233	0.98	0.78	0.74
35	200	207	1.04	0.83	0.88
36	185	238	1.29	1.03	0.93
37	136	160	1.18	0.94	0.96
38	148	171	1.16	0.92	0.92
39	108	121	1.12	0.90	0.97
40	100	136	1.36	1.09	1.06
41	56	84	1.50	1.20	1.13
42	58	79	1.36	1.09	1.24
43	28	50	1.79	1.43	1.25
44	20	31	1.55	1.24	1.16
45	14	14	1.00	0.80	0.83
46	14	8	0.57	0.46	0.73
47	6	7	1.17	0.93	0.89
48	5	8	1.60	1.28	1.14
49	4	6	1.50	1.20	1.04
50	5	4	0.80	0.64	0.88
51	3	3	1.00	0.80	0.61
52	4	2	0.50	0.40	0.93
53	1	2	2.00	1.60	0.67
54	3	-	0.00	0.00	0.80
55	1	1	1.00	0.80	0.40
56	4	2	0.50	0.40	0.93
57	1	2	2.00	1.60	0.67
58	1	-	0.00	0.00	1.07
59	1	2	2.00	1.60	0.53
60	1	-	0.00	0.00	0.53
61	-	2	-	-	-
62	2	-	0.00	0.00	-
63	-	2	-	-	-
64	-	-	-	-	-
65	-	-	-	-	-
66	-	-	-	-	-
67	-	-	-	-	-
68	-	-	-	-	-
69	-	1	0.00	0.00	-
Total(36-69)	909	1136	1.25	-	-
Total	1983	1872	-	-	-
Mean	35.8	37.1	-	-	-

Table 18. Length frequency distributions of summer flounder caught by the RUTH ANN in the Shinnecock area with 64-mm (A) and 141-mm (B) mesh codends and the proportion retained by the 141-mm mesh.

Length (cm)	Number caught A	Number caught B	Proportion retained B/A	Proportion retained B/0.98A	Proportion retained 3-point moving ave.
21	1	-	0.00	0.00	-
22	-	-	-	-	-
23	1	-	0.00	0.00	-
24	-	-	-	-	0.34
25	1	1	1.00	1.02	0.39
26	14	2	0.14	0.15	0.39
27	13	-	0.00	0.00	0.07
28	17	1	0.06	0.06	0.05
29	34	3	0.09	0.09	0.07
30	94	7	0.07	0.08	0.10
31	134	16	0.12	0.12	0.12
32	240	40	0.17	0.17	0.20
33	292	85	0.29	0.30	0.29
34	339	138	0.41	0.41	0.42
35	282	150	0.53	0.54	0.57
36	233	172	0.74	0.75	0.62
37	249	139	0.56	0.57	0.66
38	214	138	0.64	0.65	0.67
39	172	136	0.79	0.80	0.71
40	212	143	0.67	0.68	0.73
41	126	88	0.70	0.71	0.82
42	84	88	1.05	1.06	1.00
43	53	64	1.21	1.23	1.17
44	37	44	1.19	1.21	1.16
45	28	29	1.04	1.05	0.91
46	21	10	0.48	0.48	0.78
47	10	8	0.80	0.81	0.57
48	20	8	0.40	0.41	0.74
49	6	6	1.00	1.02	0.81
50	4	4	1.00	1.02	0.88
51	5	3	0.60	0.61	0.80
52	4	3	0.75	0.77	0.80
53	2	2	1.00	1.02	0.59
54	-	4	-	-	0.68
55	1	1	1.00	1.02	0.34
56	-	1	-	-	1.02
57	2	4	2.00	2.03	0.68
58	-	2	-	-	0.68
59	-	1	-	-	-
60	1	-	0.00	0.00	-
61	-	-	-	-	0.34
62	1	1	1.00	1.02	0.34
63	1	-	0.00	0.00	0.34
64	-	-	-	-	-
65	-	-	-	-	-
66	-	-	-	-	-
67	-	-	-	-	-
68	-	-	-	-	-
69	-	-	-	-	-
70	-	-	-	-	-
71	2	-	0.00	0.00	-
Total(43-71)	198	195	0.98	-	-
Total	2950	1542	-	-	-
Mean	36.2	38.1	-	-	-

Table 19. Length frequency distributions of winter flounder caught by the SEAFARER in the Montauk area with 65-mm (A) and 148-mm (B) mesh codends.

Length (cm)	Numbers caught A	Numbers caught B
23	1	-
24	1	-
25	1	-
26	-	-
27	1	-
28	4	-
29	2	1
30	2	2
31	10	-
32	7	-
33	5	1
34	10	2
35	3	-
36	1	-
37	2	2
38	2	1
39	-	1
40	1	1
41	-	1
Total	53	12
Mean	32.1	35.2

Table 20. Length frequency distributions of winter flounder caught by the RIANDA S in the Montauk area with 64-mm (A) and 145-mm (B) mesh codends and the proportion retained by the 145-mm mesh.

Length (cm)	Numbers caught A	Numbers caught B	Proportion retained B/A	Proportion retained B/0.92A	Proportion retained 3-point moving ave.
19	1	-	0.00	0.00	-
20	-	-	-	-	-
21	1	-	0.00	0.00	-
22	1	-	0.00	0.00	-
23	2	-	0.00	0.00	-
24	3	-	0.00	0.00	-
25	1	-	0.00	0.00	0.07
26	5	1	0.20	0.22	0.07
27	6	-	0.00	0.00	0.11
28	11	1	0.09	0.10	0.06
29	14	1	0.07	0.08	0.12
30	6	1	0.17	0.18	0.09
31	13	-	0.00	0.00	0.15
32	8	2	0.25	0.27	0.15
33	12	2	0.17	0.18	0.28
34	29	10	0.34	0.37	0.40
35	12	7	0.58	0.63	1.06
36	6	12	2.00	2.17	1.06
37	9	3	0.33	0.36	1.93
38	1	3	3.00	3.26	1.75
39	2	3	1.50	1.63	1.63
40	5	-	0.00	0.00	0.54
41	-	-	-	-	0.36
42	1	1	1.00	1.09	0.36
Total(36-42)	24	22	0.92	-	-
Total	149	47	-	-	-
Mean	31.9	35.0	-	-	-

Table 21. Length frequency distributions of winter flounder caught by the PATRIOT in the Shinnecock area with 58-mm (A) and 142-mm (B) mesh codends and the proportion retained by the 142-mm mesh.

Length (cm)	Numbers caught A	Numbers caught B	Proportion retained $\frac{B}{A}$	Proportion retained $\frac{B}{1.04A}$	Proportion retained 3-point moving ave.
14	1	-	0.00	0.00	-
15	2	-	0.00	0.00	-
16	2	-	0.00	0.00	-
17	4	-	0.00	0.00	0.04
18	9	1	0.11	0.11	0.04
19	10	-	0.00	0.00	0.04
20	16	-	0.00	0.00	0.06
21	17	3	0.18	0.17	0.11
22	30	5	0.17	0.16	0.13
23	32	2	0.06	0.06	0.09
24	43	2	0.05	0.04	0.06
25	50	4	0.08	0.08	0.06
26	53	4	0.08	0.07	0.09
27	81	10	0.12	0.12	0.11
28	119	16	0.13	0.13	0.17
29	109	31	0.28	0.27	0.26
30	126	48	0.38	0.37	0.47
31	79	64	0.81	0.78	0.62
32	77	57	0.74	0.71	0.86
33	43	49	1.14	1.09	0.85
34	37	29	0.78	0.75	0.99
35	19	22	1.16	1.11	1.04
36	10	13	1.30	1.25	1.64
37	3	8	2.67	2.56	1.38
38	6	2	0.33	0.32	1.28
39	1	1	1.00	0.96	0.75
40	1	1	1.00	0.96	0.64
Total(33-40)	120	125	1.04	-	-
Total	980	372	-	-	-
Mean	28.3	31.3	-	-	-

Table 22. Length frequency distributions of winter flounder caught by the RUTH ANN in the Shinnecock area with 64-mm (A) and 141-mm (B) mesh codends and the proportion retained by the 141-mm mesh.

Length (cm)	Numbers caught A	Numbers caught B	Proportion retained $\frac{B}{A}$	Proportion retained $\frac{B}{1.10A}$	Proportion retained 3-point moving ave.
14	1	-	0.00	0.00	-
14	-	-	-	-	-
15	3	-	0.00	0.00	-
16	2	-	0.00	0.00	-
17	11	-	0.00	0.00	0.02
18	14	1	0.07	0.06	0.04
19	15	1	0.07	0.06	0.04
20	19	-	0.00	0.00	0.06
21	31	4	0.13	0.12	0.05
22	26	1	0.04	0.03	0.09
23	36	5	0.14	0.13	0.10
24	48	7	0.15	0.13	0.12
25	69	8	0.12	0.11	0.11
26	76	7	0.09	0.08	0.12
27	88	16	0.18	0.17	0.11
28	113	11	0.10	0.09	0.18
29	110	34	0.31	0.28	0.30
30	66	39	0.59	0.54	0.47
31	75	49	0.65	0.59	0.59
32	57	40	0.70	0.64	0.68
33	34	30	0.88	0.80	0.86
34	20	25	1.25	1.14	0.97
35	12	13	1.08	0.98	1.01
36	8	8	1.00	0.91	0.80
37	7	4	0.57	0.52	0.48
38	-	2	-	-	0.32
39	2	1	0.50	0.45	0.15
40	1	-	0.00	0.00	0.15
41	-	1	-	-	-
42	-	-	-	-	-
43	-	-	-	-	-
44	-	-	-	-	-
45	-	-	-	-	-
46	-	-	-	-	-
47	-	-	-	-	-
48	-	-	-	-	-
49	-	1	-	-	-
50					
Total (35-50)	50	55	1.10	-	-
Total	944	308	-	-	-
Mean	28.4	31.6	-	-	-

Table 23. Length frequency distributions of black sea bass caught in the Long Island mesh selection experiments by vessel and control (A) and experimental (B) mesh codends.

Length (cm)	SEAFARER A	SEAFARER B	RIANADA S A	RIANADA S B	PATRIOT A	PATRIOT B	RUTH ANN A	RUTH ANN B
8	-	-	-	-	1	-	-	-
9	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	1	-
13	-	-	-	-	1	-	-	-
14	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	1	-
17	-	-	-	-	3	-	3	-
18	-	-	-	-	9	-	24	2
19	-	-	-	-	8	1	34	1
20	-	-	-	-	23	1	40	1
21	-	-	2	-	28	2	52	2
22	-	-	6	-	32	4	73	2
23	-	-	3	1	33	1	46	-
24	2	-	4	-	23	3	34	3
25	1	-	4	-	15	1	20	1
26	-	-	2	-	8	-	13	-
27	-	-	-	-	5	-	13	-
28	-	-	2	-	3	1	2	1
29	-	-	1	-	4	1	1	-
30	-	-	3	-	2	-	4	-
31	-	-	1	-	1	-	3	-
32	-	-	-	-	2	1	2	-
33	3	-	-	-	3	-	3	1
34	-	-	2	-	1	3	2	-
35	1	-	1	-	-	-	3	-
36	-	-	-	-	-	1	-	-
37	-	-	2	-	1	-	-	-
38	1	-	-	1	-	-	-	-
39	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-
41	-	-	1	-	-	2	-	1
42	-	-	1	-	-	-	-	-
43	-	-	-	-	-	-	1	-
44	-	-	1	-	-	-	-	-
45	-	-	-	-	-	-	-	-
46	-	-	1	-	-	-	-	-
47	-	-	-	1	1	-	-	-
48	-	-	1	1	-	-	-	-
49	-	-	-	-	-	-	-	-
50	-	-	1	-	-	-	-	-
51	-	-	-	-	-	-	-	-
52	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	-
54	-	-	-	-	-	-	-	-
55	-	-	-	-	-	-	-	-
56	-	-	-	-	-	-	-	-
57	-	-	-	1	-	-	-	-
58	-	-	1	-	-	-	-	-
Total	8	-	40	5	207	22	375	15
Mean	30.6	-	30.1	42.6	22.9	27.2	22.4	24.0

Table 24. Length frequency distributions of scup caught in the Long Island mesh selection experiments by vessel and control (A) and experimental (B) mesh codends.

Length (cm)	SEAFARER A	SEAFARER B	RIANDA S A	RIANDA S B	PATRIOT A	PATRIOT B	RUTH ANN A	RUTH ANN B
5	-	-	-	-	2	1	-	-
6	-	-	-	-	-	-	-	-
7	-	-	-	-	8	1	-	-
8	1	-	-	-	69	5	4	-
9	-	-	1	-	168	15	15	2
10	1	-	13	-	126	8	17	1
11	-	-	6	-	33	4	9	1
12	2	-	4	-	24	3	12	1
13	-	-	-	-	10	1	9	1
14	1	1	2	-	3	-	6	-
15	-	-	3	-	15	4	35	1
16	3	-	10	1	93	12	185	18
17	4	1	42	-	138	11	293	13
18	7	-	42	2	48	9	138	17
19	6	1	49	2	28	10	85	6
20	12	-	47	2	17	9	74	6
21	3	-	59	4	12	5	21	2
22	2	1	26	4	6	3	18	5
23	1	-	15	2	4	-	6	-
24	3	-	12	-	-	-	9	-
25	-	-	6	1	-	-	2	-
26	-	-	-	1	-	-	-	-
27	-	-	1	2	-	-	-	-
28	1	-	1	-	-	-	-	-
29	-	-	-	-	-	-	-	-
30	-	-	-	1	-	-	-	-
31	-	1	-	1	-	-	-	-
32	1	-	-	-	-	-	-	-
33	-	-	-	3	-	-	-	-
34	-	-	-	-	-	-	-	-
35	-	-	-	-	-	-	-	-
36	-	-	-	1	-	-	-	-
37	-	-	-	1	-	-	1	-
38	-	-	-	-	-	-	-	-
39	-	-	-	-	-	-	-	-
40	-	-	-	-	-	-	-	-
41	-	-	-	1	-	-	-	-
42	-	-	-	-	-	-	-	-
Total	48	5	339	29	804	101	939	74
Mean	19.0	20.6	19.1	25.1	13.0	14.9	17.2	17.3

Table 25. Length frequency distributions of butterfish caught in the Long Island mesh selection experiments by vessel and control (A) and experimental (B) mesh codends.

Length (cm)	SEAFARER		RIANDA S		PATRIOT		RUTH ANN	
	A	B	A	B	A	B	A	B
5	-	-	-	-	1	-	-	-
6	-	-	-	-	2	-	-	-
7	-	-	-	-	8	-	-	-
8	-	-	-	-	-	-	-	-
9	-	-	-	-	1	-	-	-
10	1	-	12	-	8	-	2	-
11	3	-	27	-	29	-	19	-
12	1	-	101	-	42	1	32	-
13	11	-	194	-	38	1	60	-
14	1	-	148	1	42	-	85	-
15	-	-	128	-	10	-	63	-
16	2	-	230	-	4	1	24	-
17	8	-	420	2	19	1	25	-
18	8	-	371	2	20	2	48	-
19	2	-	279	2	9	-	22	-
20	-	-	84	6	6	-	16	-
21	1	-	33	4	1	-	9	-
22	-	-	23	-	-	-	1	-
23	-	-	-	-	-	-	3	-
Total	38	-	2050	17	240	6	409	-
Mean	15.3	-	16.5	19.2	13.6	15.7	15.2	-

Table 26. Length frequency distributions of long-finned squid caught in the Long Island mesh selection experiments by vessel and control (A) and experimental (B) mesh codends.

Length (cm)	SEAFARER A	SEAFARER B	RIANDA S A	RIANDA S B	PATRIOT A	PATRIOT B	RUTH ANN A	RUTH ANN B
4	-	-	-	-	37	2	10	-
5	-	-	-	-	52	5	3	-
6	-	-	-	-	112	3	4	-
7	-	-	-	-	81	4	13	2
8	-	-	2	-	94	4	24	-
9	41	-	72	-	167	1	29	1
10	296	5	121	-	392	7	116	2
11	562	9	677	8	422	14	323	5
12	1082	18	1732	19	270	11	283	3
13	1926	23	2146	29	221	12	156	7
14	819	6	2348	39	158	7	101	5
15	804	8	1227	27	158	3	59	3
16	457	5	728	20	191	2	59	5
17	477	9	1413	32	128	6	38	1
18	505	3	987	37	160	7	52	7
19	456	5	1681	17	174	1	36	1
20	335	9	733	18	70	3	67	5
21	117	3	526	15	104	2	20	1
22	41	4	286	8	48	2	12	6
23	-	3	119	10	32	-	4	2
24	101		921	6	19	2	7	-
25	-		112	1	28	1	5	-
26	41		409	3	15	-	1	1
27	-		147	3	1	-	-	1
28	20		-	-	-	1	-	1
29	-		18	2	7	-	-	-
30	-		18	2	-	1	-	1
31	-		-	1	1	-	2	-
32	-		18	1	-	-	-	-
33	19		-	-	-	-	-	-
34	-		-	-	-	-	-	-
35	-		-	-	-	-	-	-
36	-		-	-	-	-	-	-
37	-		-	-	-	-	-	-
38	-		-	-	-	-	-	-
39	-		-	-	-	-	-	-
40	-		-	-	-	-	-	-
41	-		72	-	-	-	-	-
Total	8099	110	16513	298	3142	101	1424	60
Mean	14.7	15.0	16.6	17.1	13.3	13.2	13.2	16.5

Table 27. Mesh selectivity summaries for summer flounder and winter flounder by vessel from the Long Island mesh selectivity experiments.

Vessel	Experimental codend mesh			50% retention length			Selection factor
	Mean		95% confidence limit	Mean		95% confidence limit	
	(mm)	(in)	(cm)	(cm)	(in)	(cm)	
			Summer flounder				
SEAFARER	148.0	5.8	147.5-148.7	37.3	14.7	36.7-37.9	2.52
RIANDA S	145.0	5.7	144.7-145.3	37.9	14.9	37.7-38.2	2.62
PATRIOT	141.9	5.6	141.4-142.5	32.5	12.8	32.3-32.7	2.29
RUTH ANN	141.0	5.6	140.5-141.5	34.5	13.6	34.3-34.7	2.45
			Winter flounder				
RIANDA S	145.0	5.7	144.7-145.3	34.2	13.5	33.7-34.6	2.36
PATRIOT	141.9	5.6	141.4-142.5	30.2	11.9	30.0-30.4	2.13
RUTH ANN	141.0	5.6	140.5-141.5	31.2	12.3	30.9-31.6	2.22

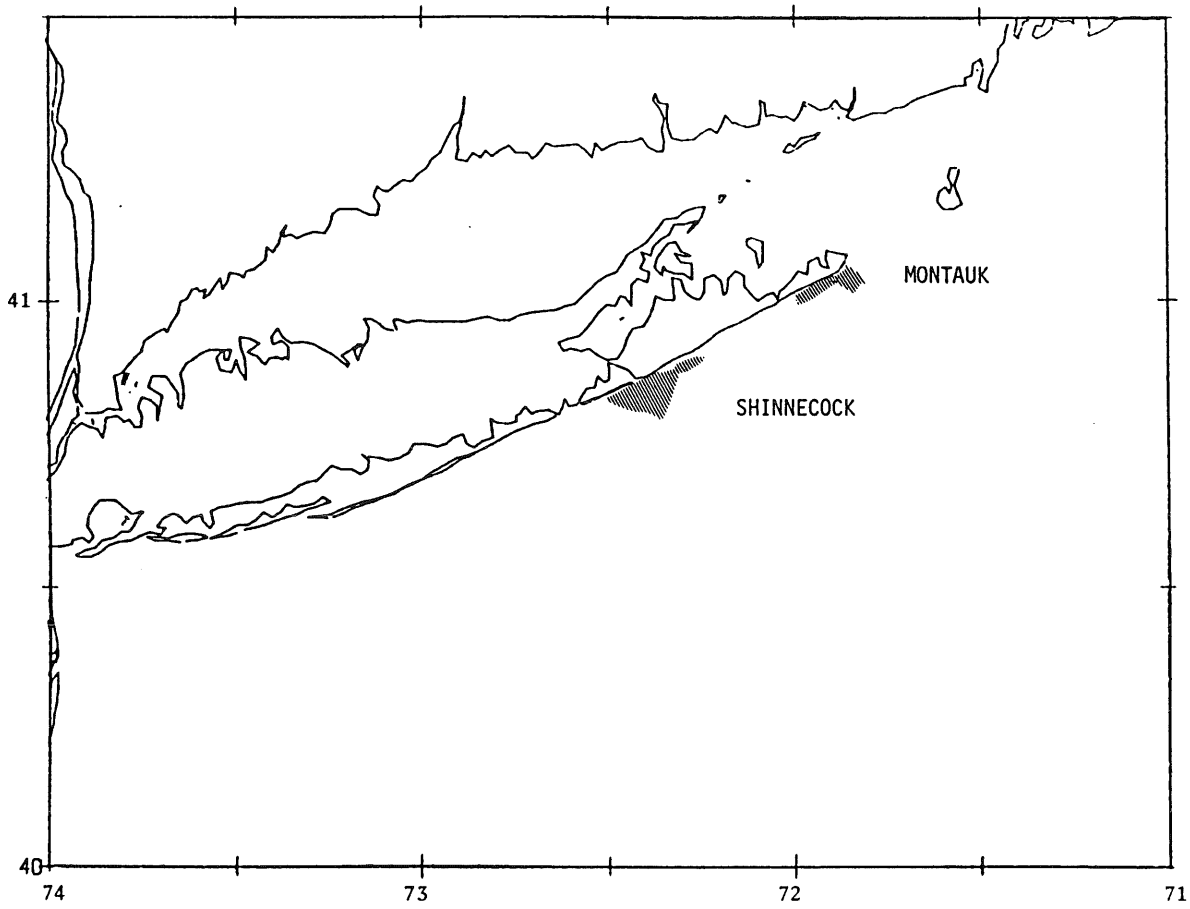

Figure 1. Shaded areas represent the two locations where the Long Island mesh selection experiments were conducted during May-June 1983.

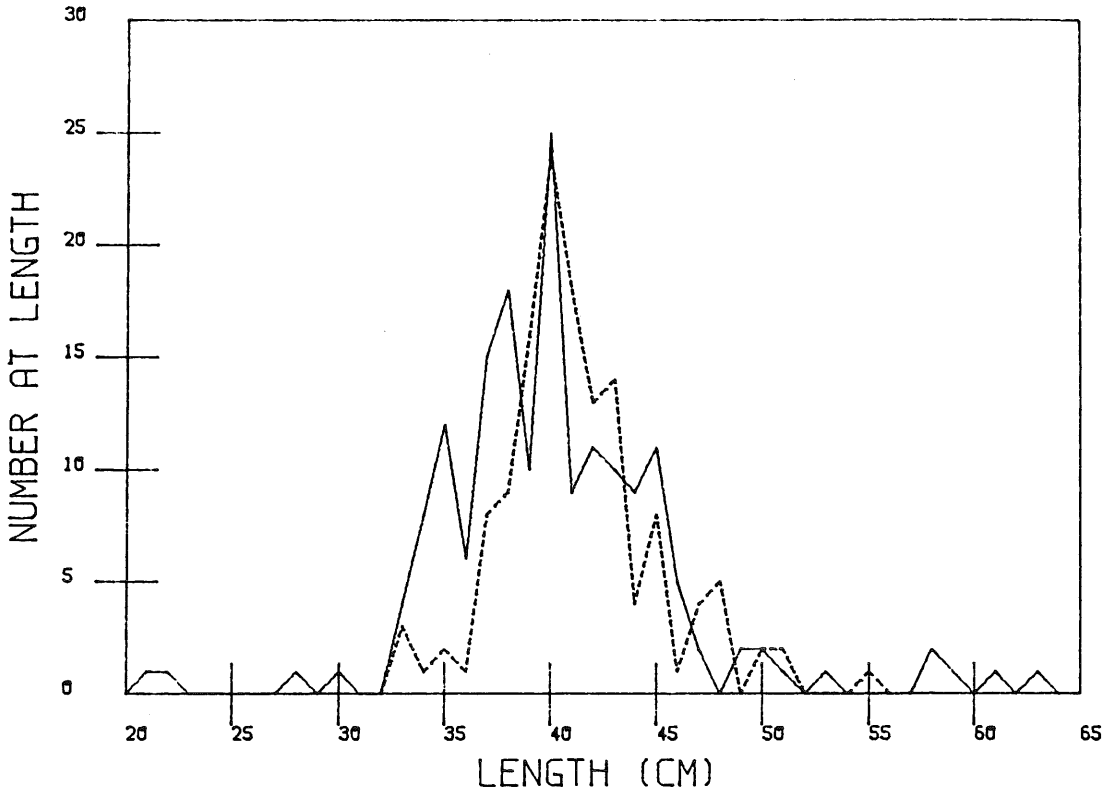

Figure 2. Length frequency distributions of summer flounder caught by the SEAFARER in the Montauk area with 65-mm (solid line) and 148-mm (dashed line) mesh codends.

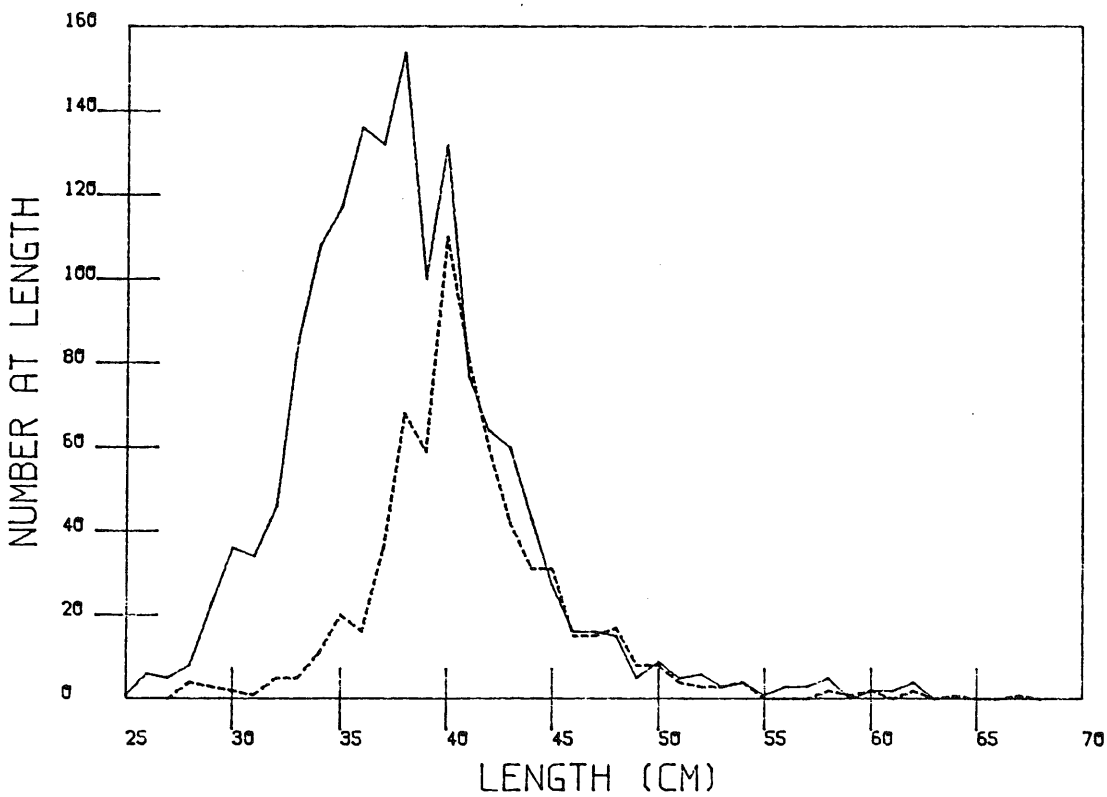

Figure 3. Length frequency distributions of summer flounder caught by the RIANDA S in the Montauk area with 64-mm (solid line) and 145-mm (dashed line) mesh codends.

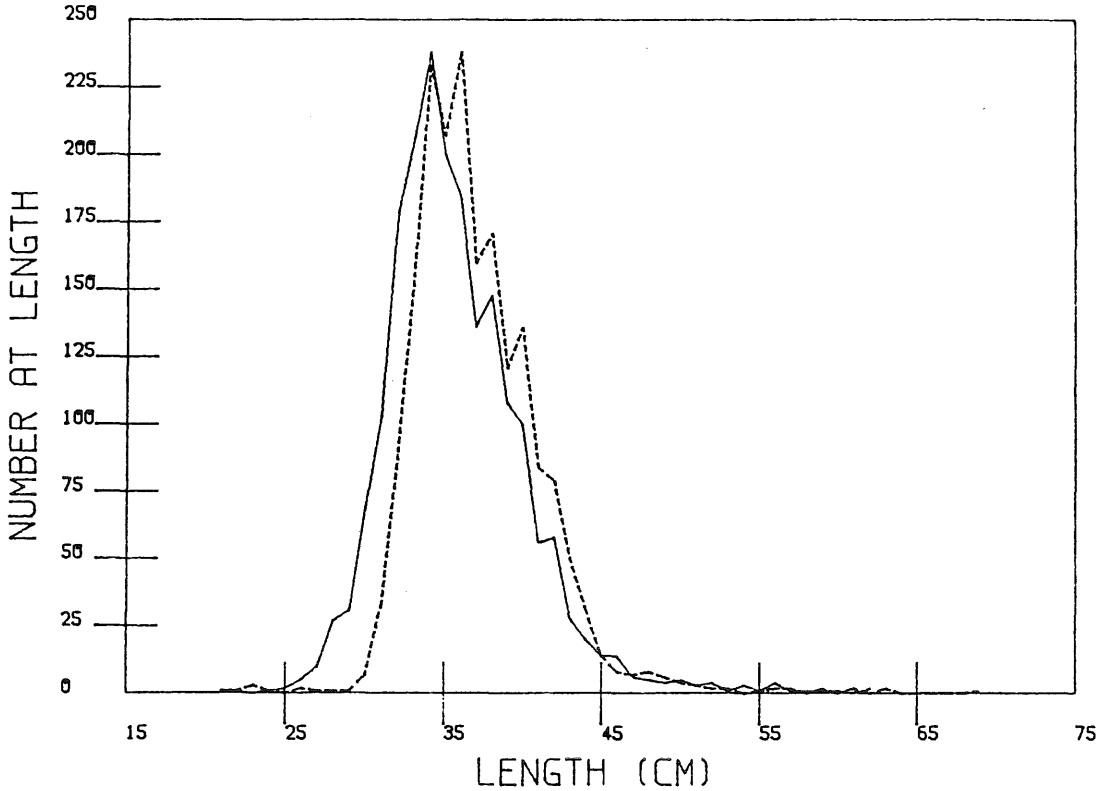

Figure 4. Length frequency distributions of summer flounder caught by the PATRIOT in the Shinnecock area with 58-mm (solid line) and 142-mm (dashed line) mesh codends.

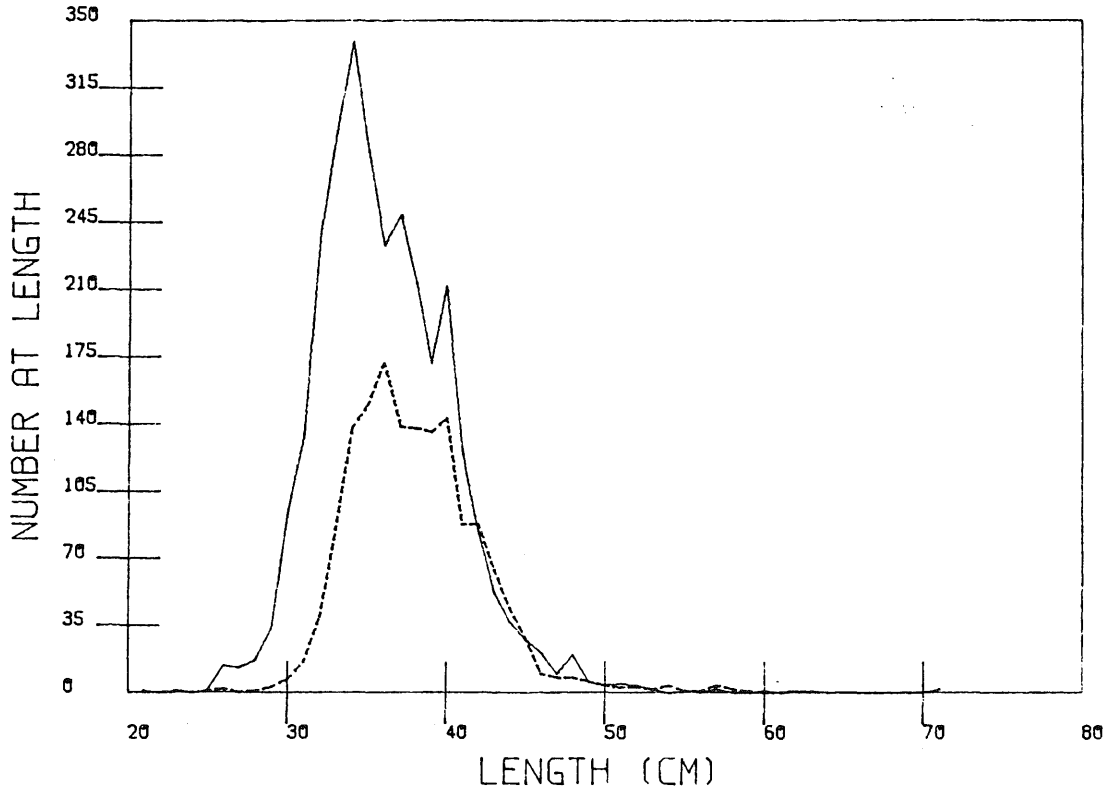

Figure 5. Length frequency distributions of summer flounder caught by the RUTH ANN in the Shinnecock area with 64-mm (solid line) and 141-mm (dashed line) mesh codends.

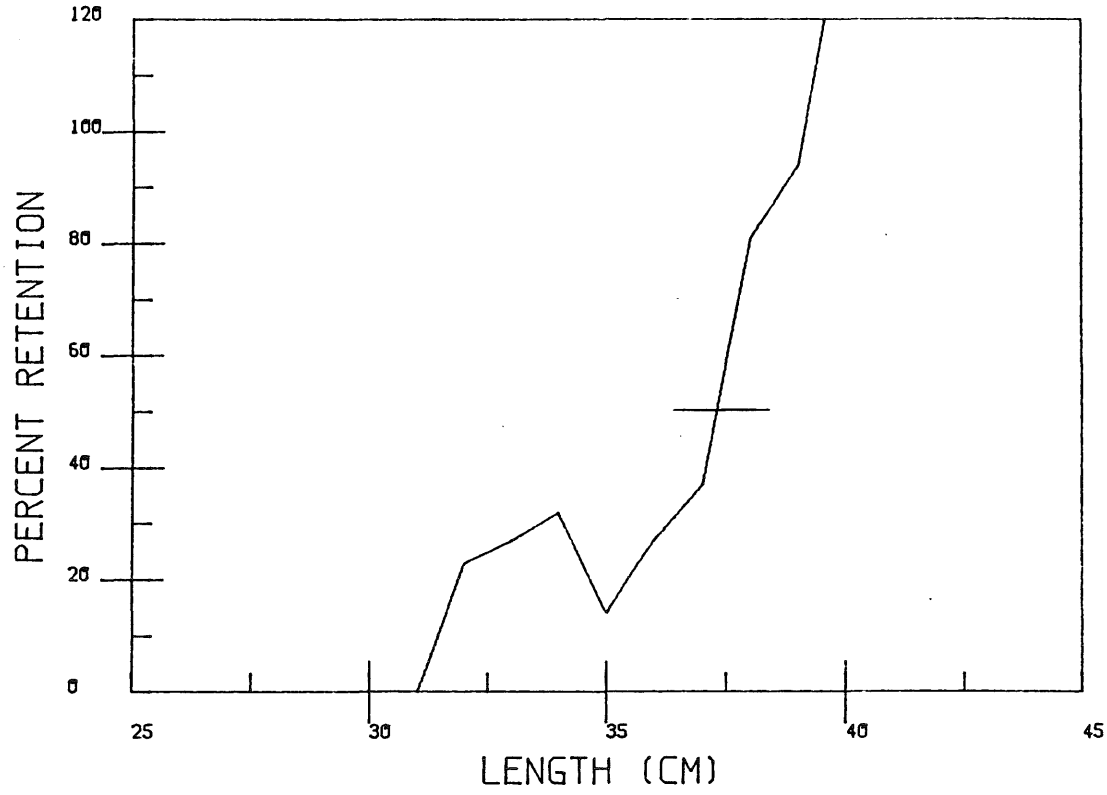

Figure 6. Selection curve for summer flounder (plot of 3-point moving averages) for the 148-mm (5.8-in) mesh codend used by the SEAFARER in the Montauk area.

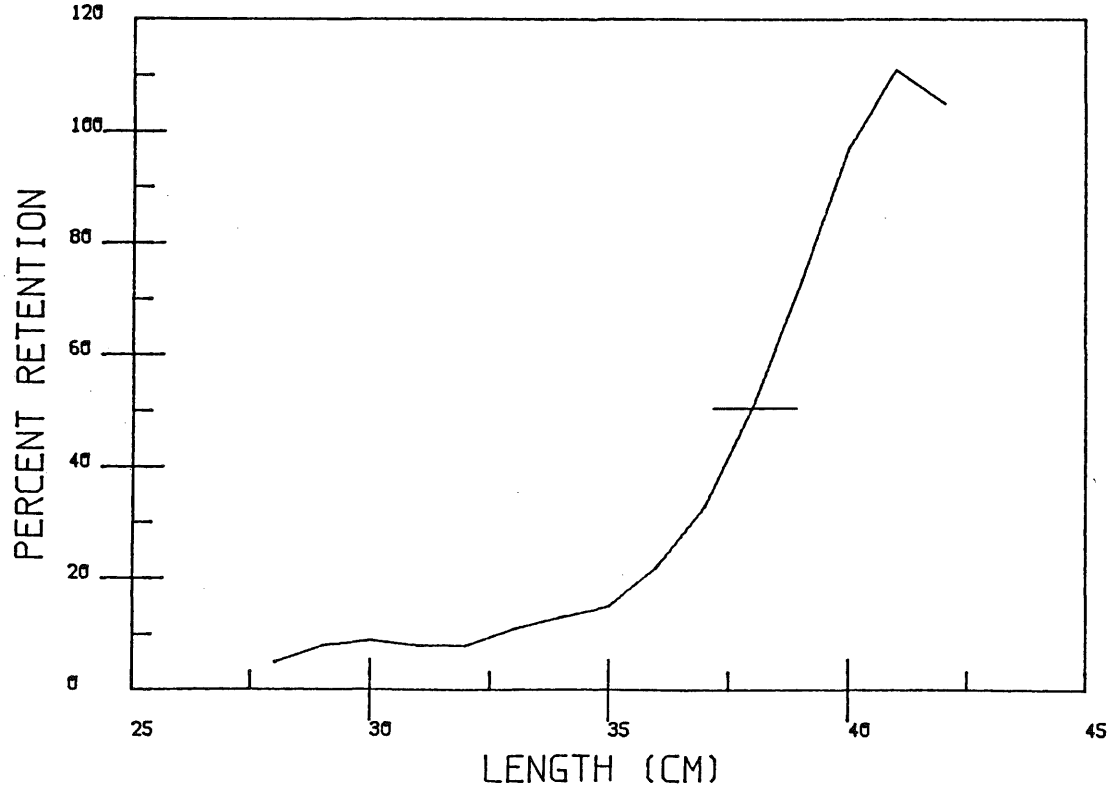

Figure 7. Selection curve for summer flounder (plot of 3-point moving averages) for the 145-mm (5.7-in) mesh codend used by the RIANDA S in the Montauk area.

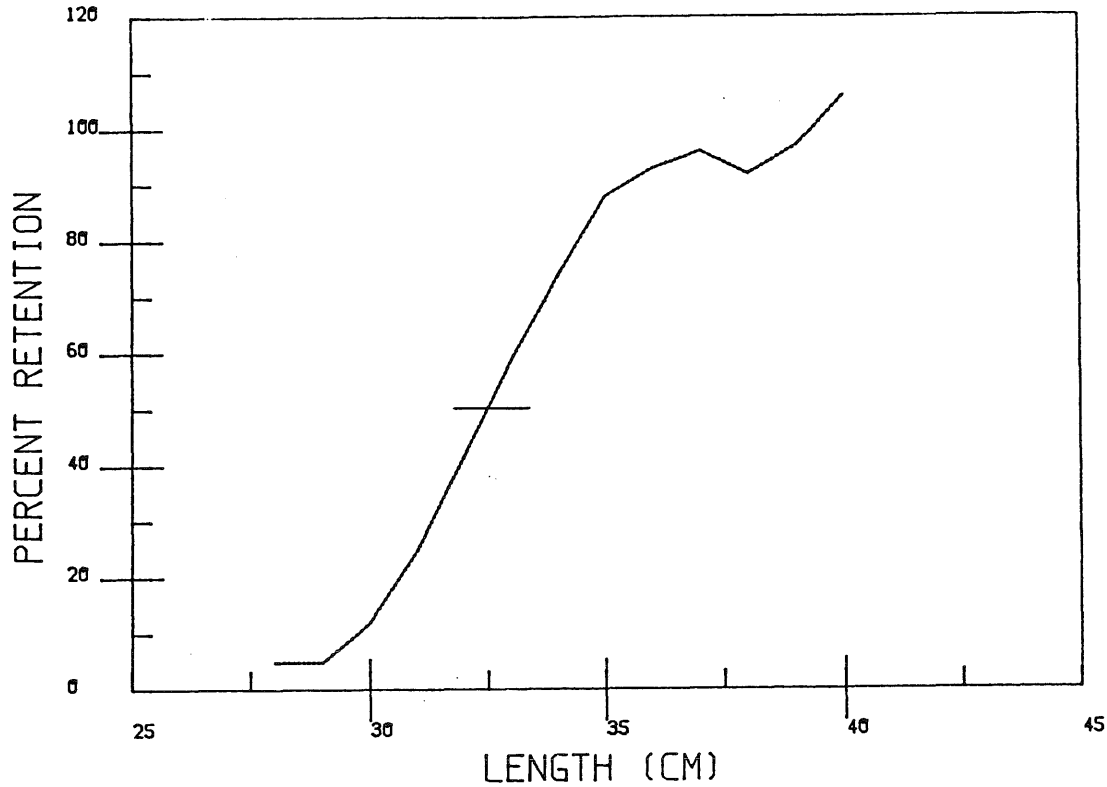

Figure 8. Selection curve for summer flounder (plot of 3-point moving averages) for the 142-mm (5.6-in) mesh codend used by the PATRIOT in the Shinnecock area.

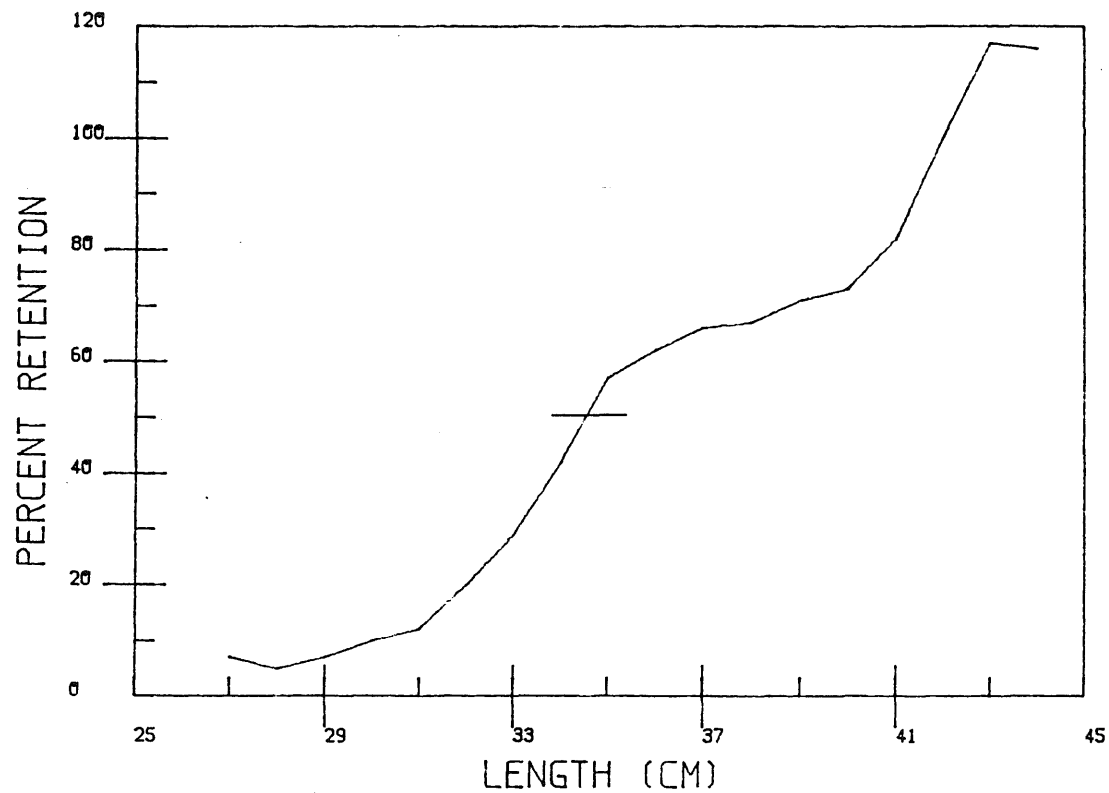

Figure 9. Selection curve for summer flounder (plot of 3-point moving averages) for the 141-mm (5.6-in) mesh codend used by the RUTH ANN in the Shinnecock area.

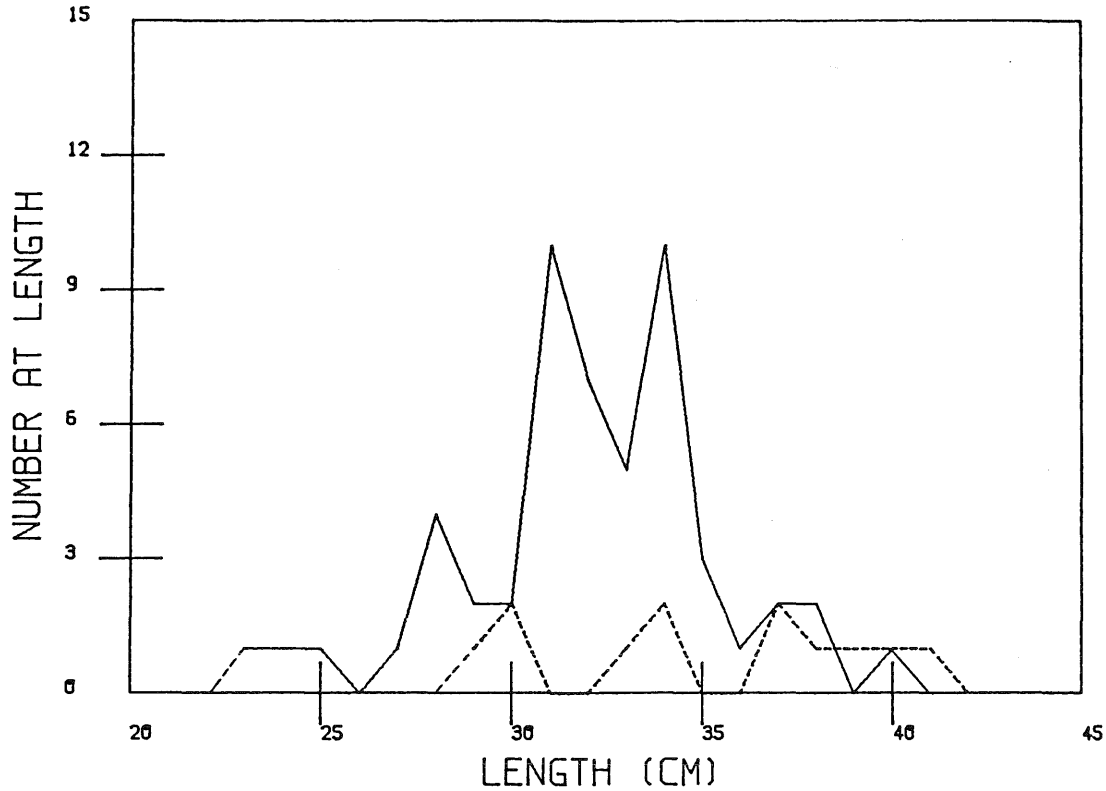

Figure 10. Length frequency distributions of winter flounder caught by the SEAFARER in the Montauk area with 65-mm (solid line) and 148-mm (dashed line) mesh codends.

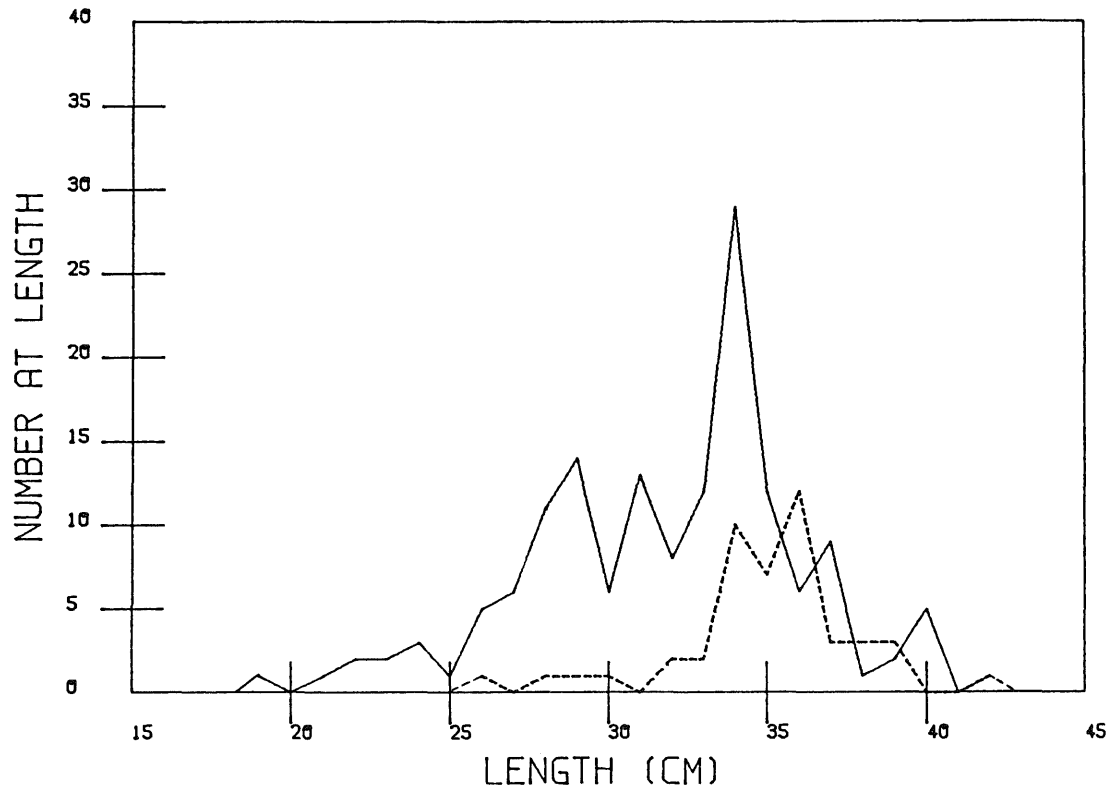

Figure 11. Length frequency distributions of winter flounder caught by the RIANDA S in the Montauk area with 64-mm (solid line) and 145-mm (dashed line) mesh codends.

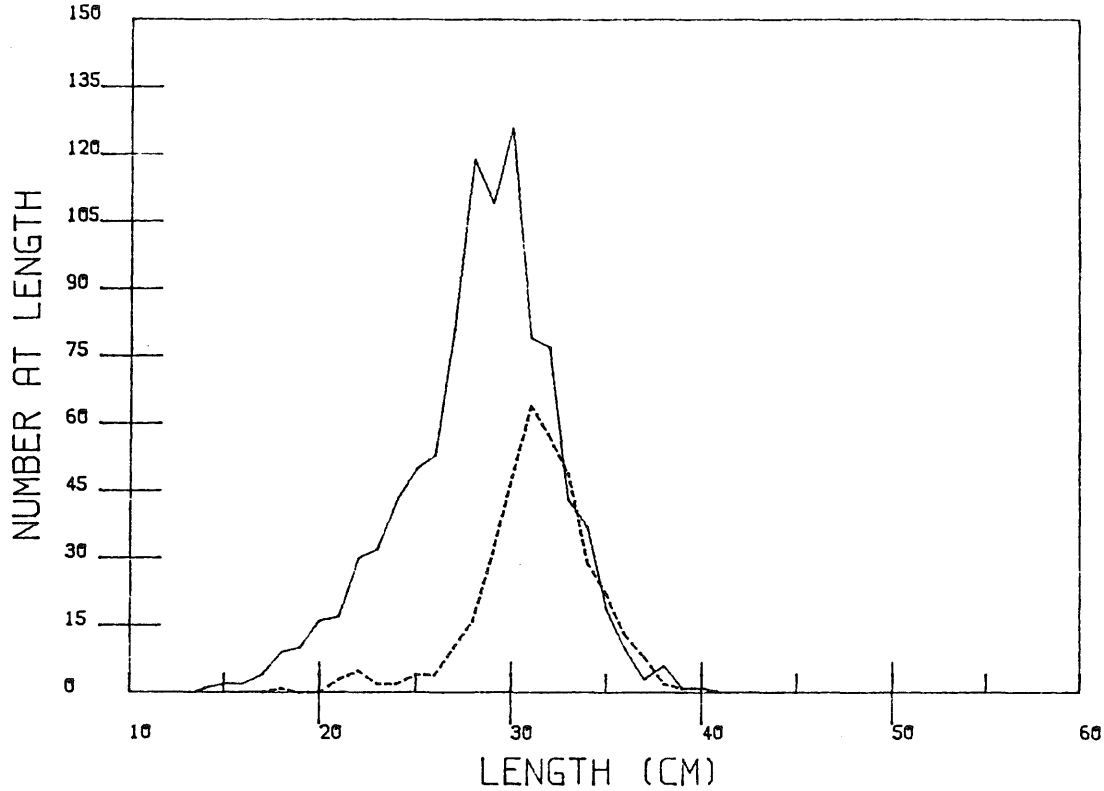

Figure 12. Length frequency distributions of winter flounder caught by the PATRIOT in the Shinnecock area with 58-mm (solid line) and 142-mm (dashed line) mesh codends.

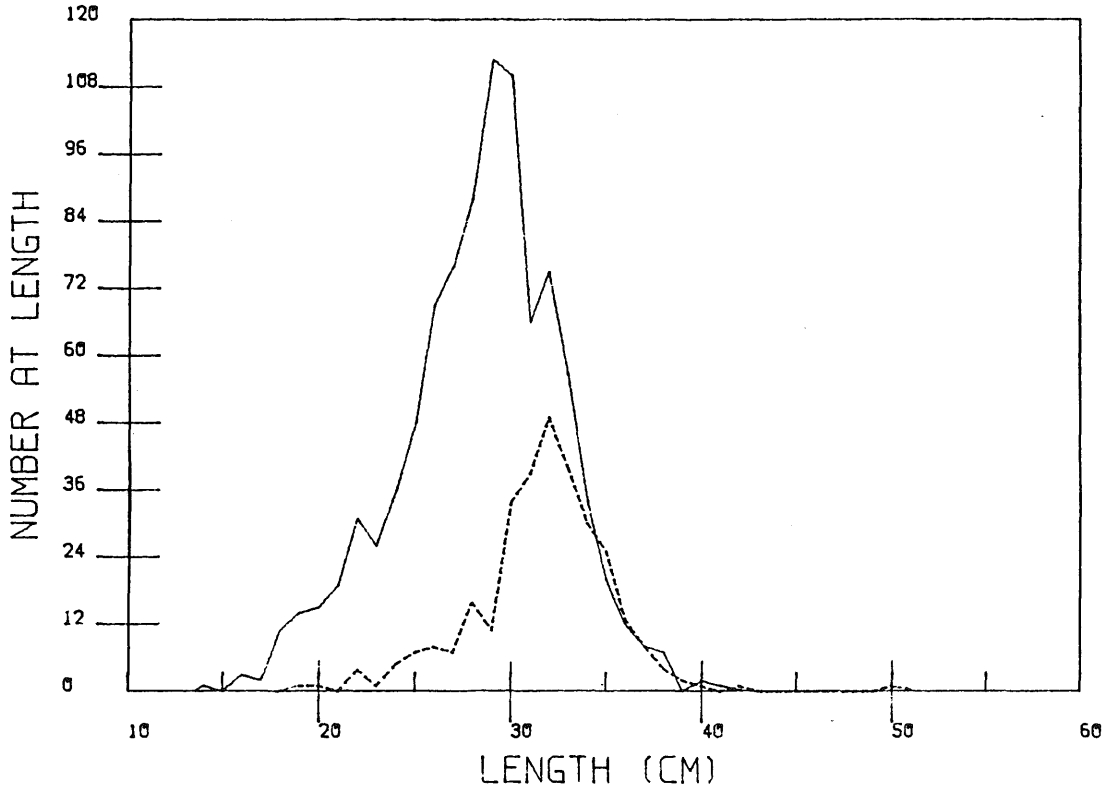

Figure 13. Length frequency distributions of winter flounder caught by the RUTH ANN in the Shinnecock area with 64-mm (solid line) and 141-mm (dashed line) mesh codends.

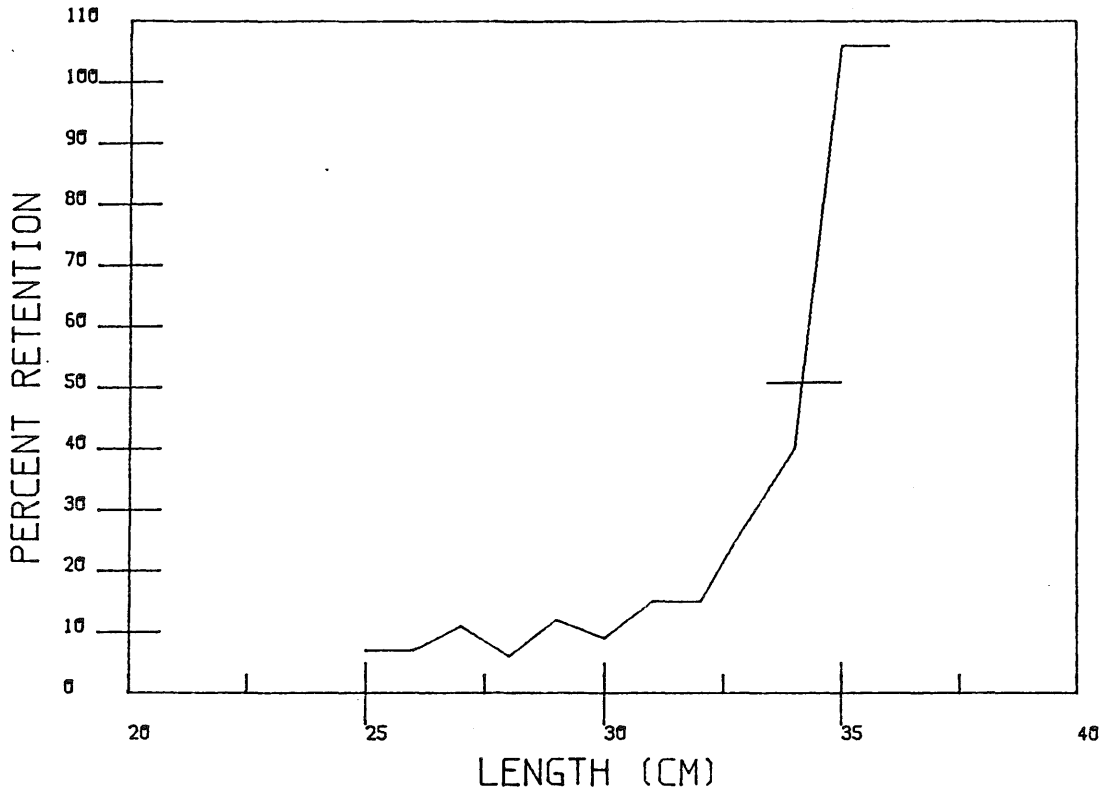

Figure 14. Selection curve for winter flounder (plot of 3-point moving averages) for the 145-mm (5.7-in) mesh codend used by the RIANDA S in the Montauk area.

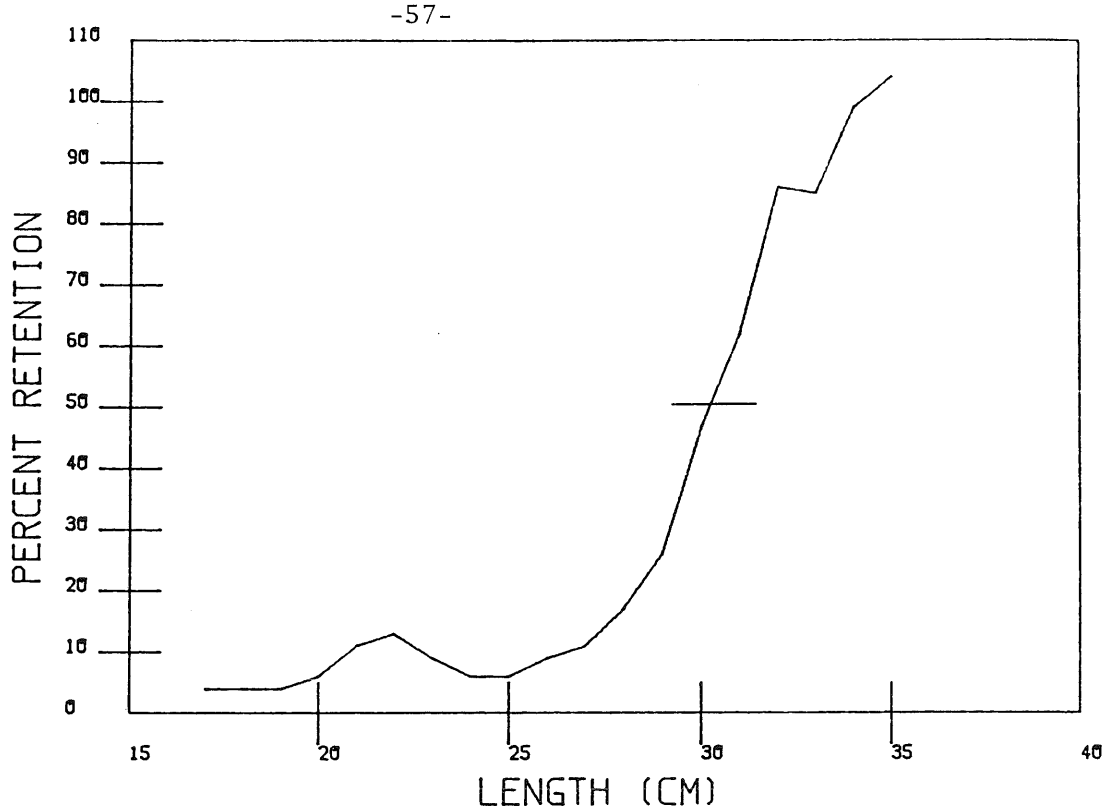

Figure 15. Selection curve for winter flounder (plot of 3-point moving averages) for the 142-mm (5.6-in) mesh codend used by the PATRIOT in the Shinnecock area.

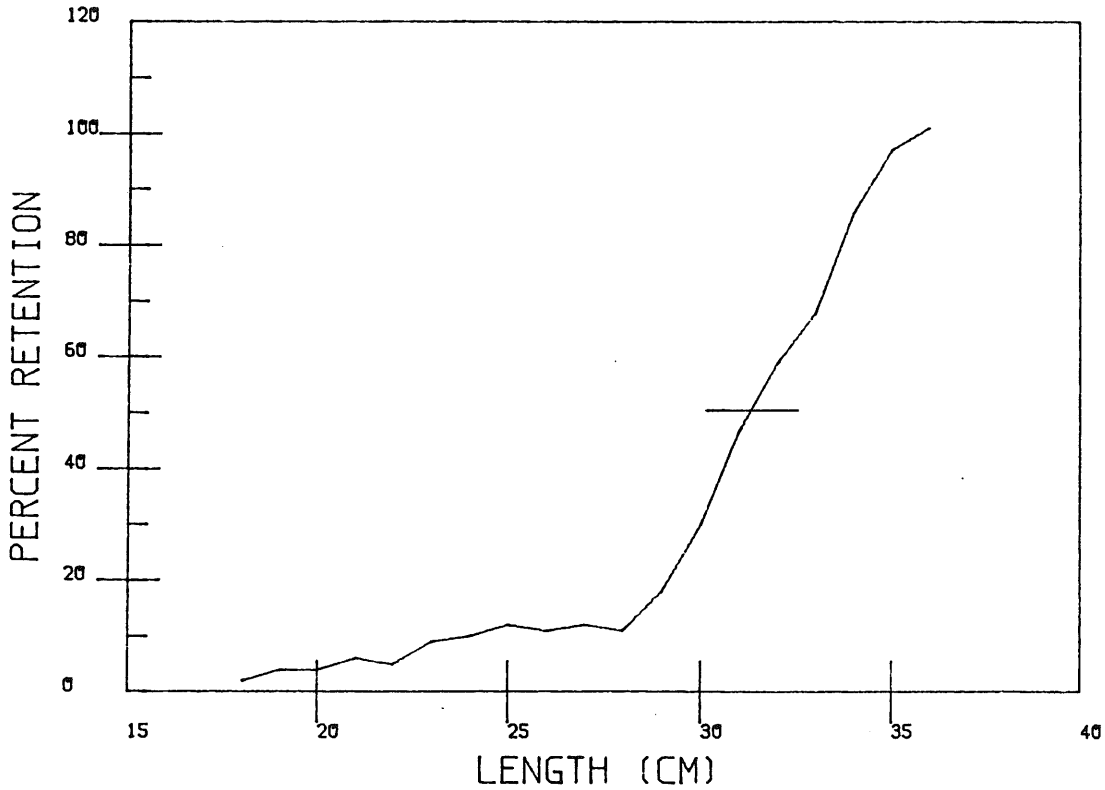

Figure 16. Selection curve for winter flounder (plot of 3-point moving averages) for the 141-mm (5.6-in) mesh codend used by the RUTH ANN in the Shinnecock area.

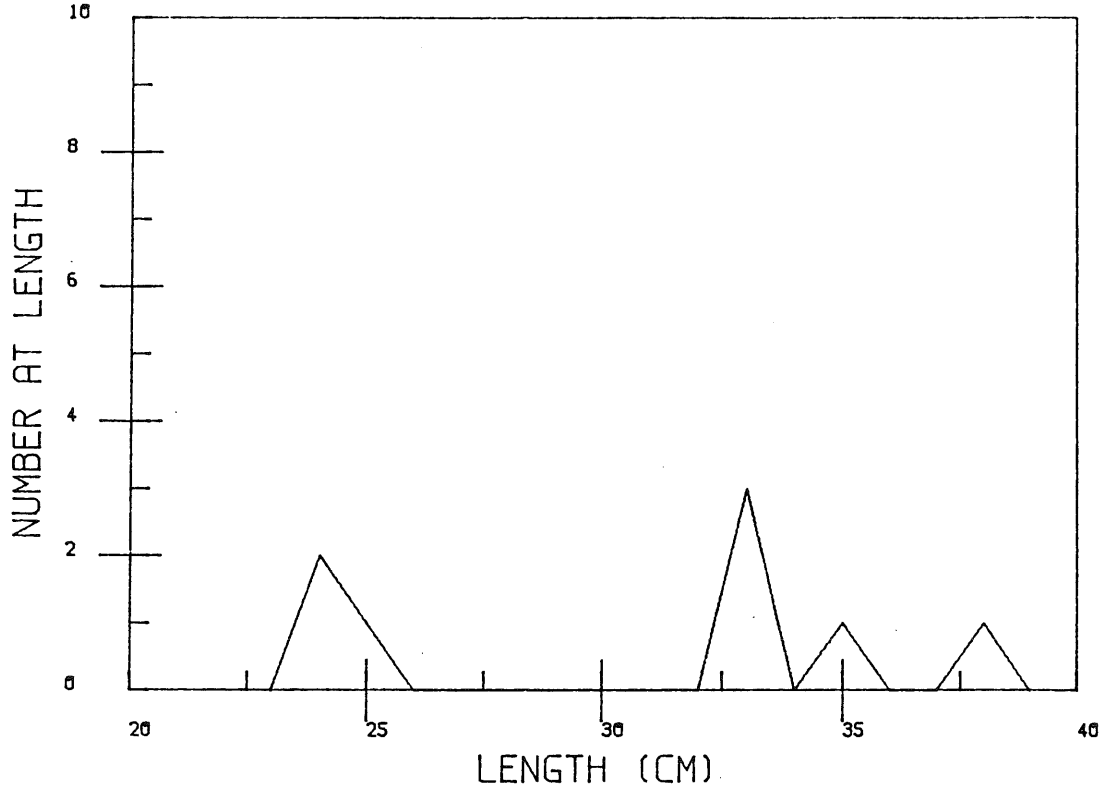

Figure 17. Length frequency distribution of black sea bass caught by the SEAFARER in the Montauk area with a 65-mm mesh codend.

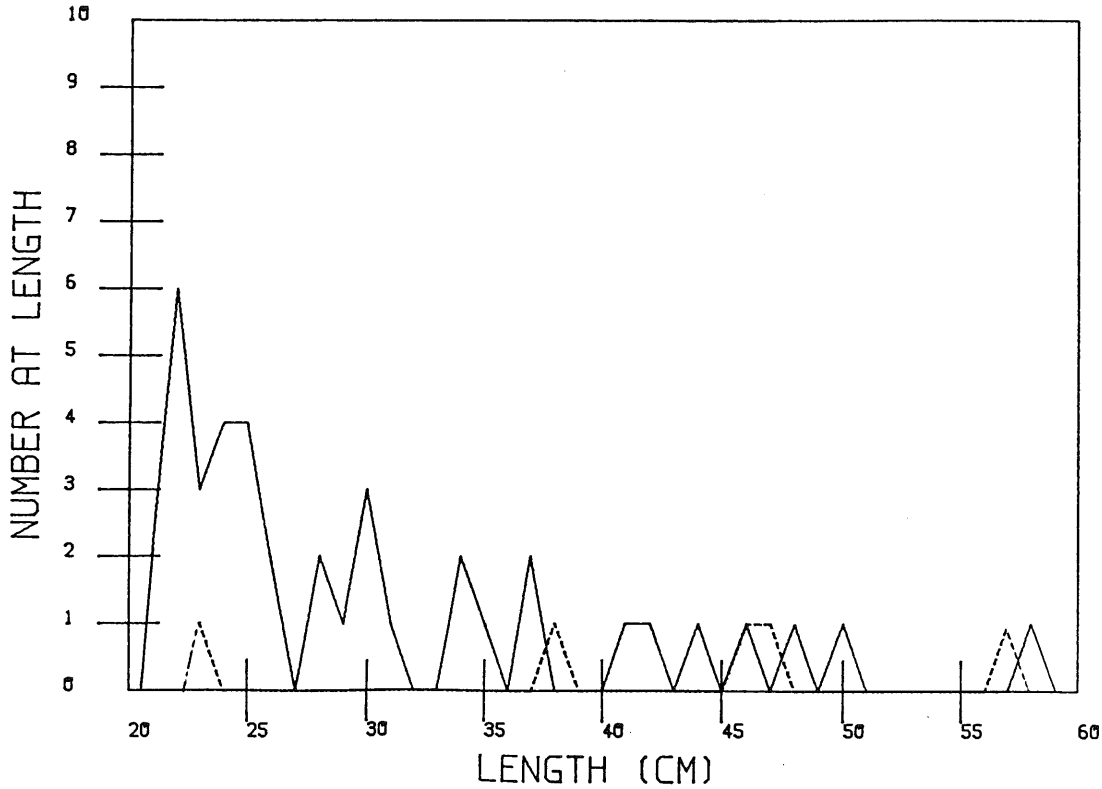

Figure 18. Length frequency distributions of black sea bass caught by the RIANDA S in the Montauk area with 64-mm (solid line) and 145-mm (dashed line) mesh codends.

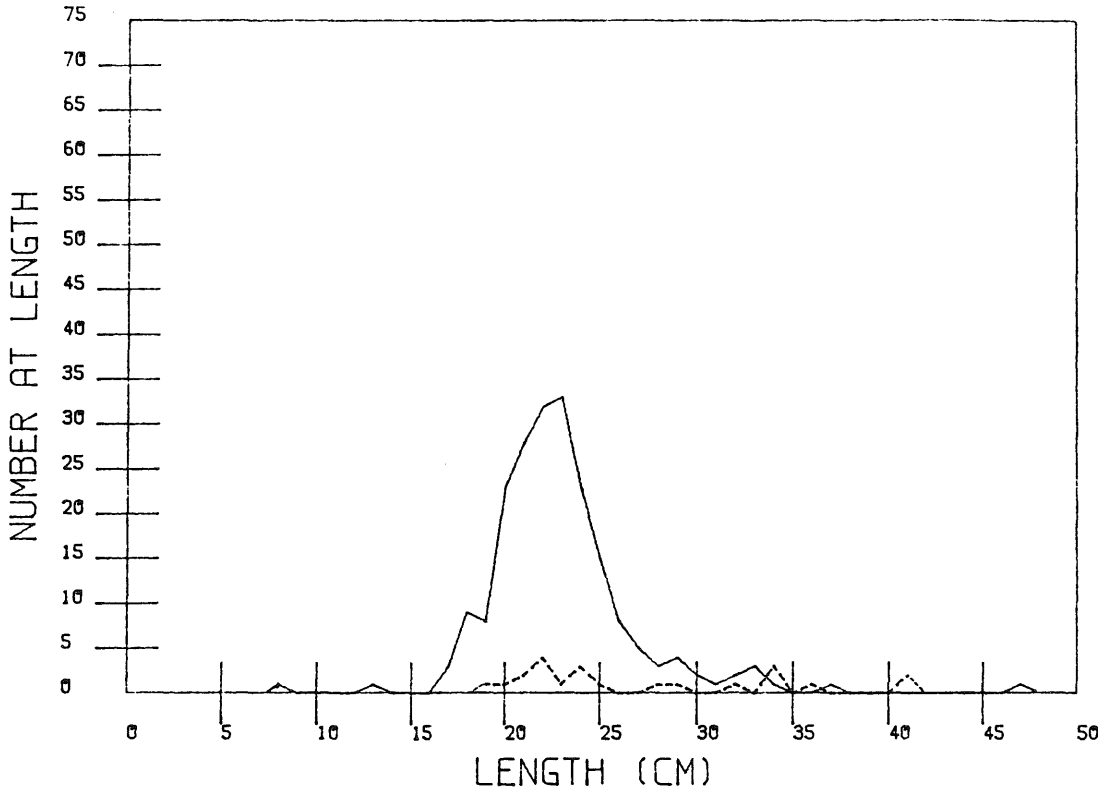

Figure 19. Length frequency distributions of black sea bass caught by the PATRIOT in the Shinnecock area with 58-mm (solid line) and 142-mm (dashed line) mesh codends.

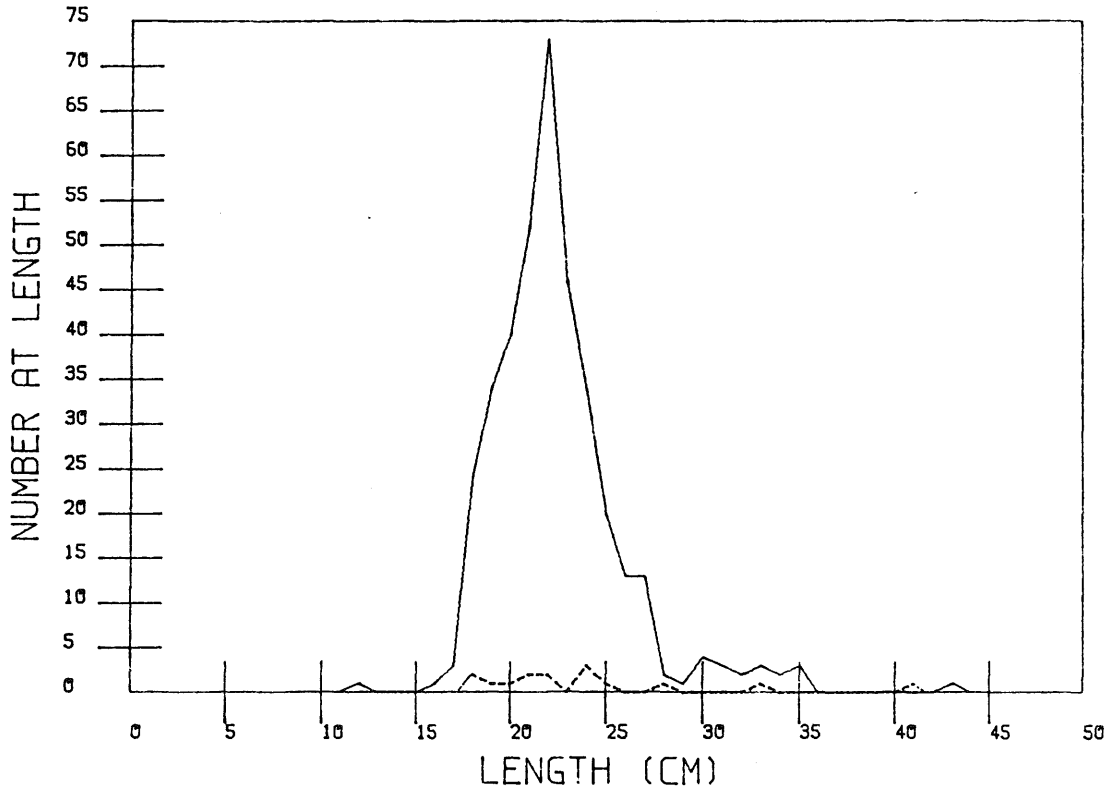

Figure 20. Length frequency distributions of black sea bass caught by the RUTH ANN in the Shinnecock area with 64-mm (solid line) and 141-mm (dashed line) mesh codends.

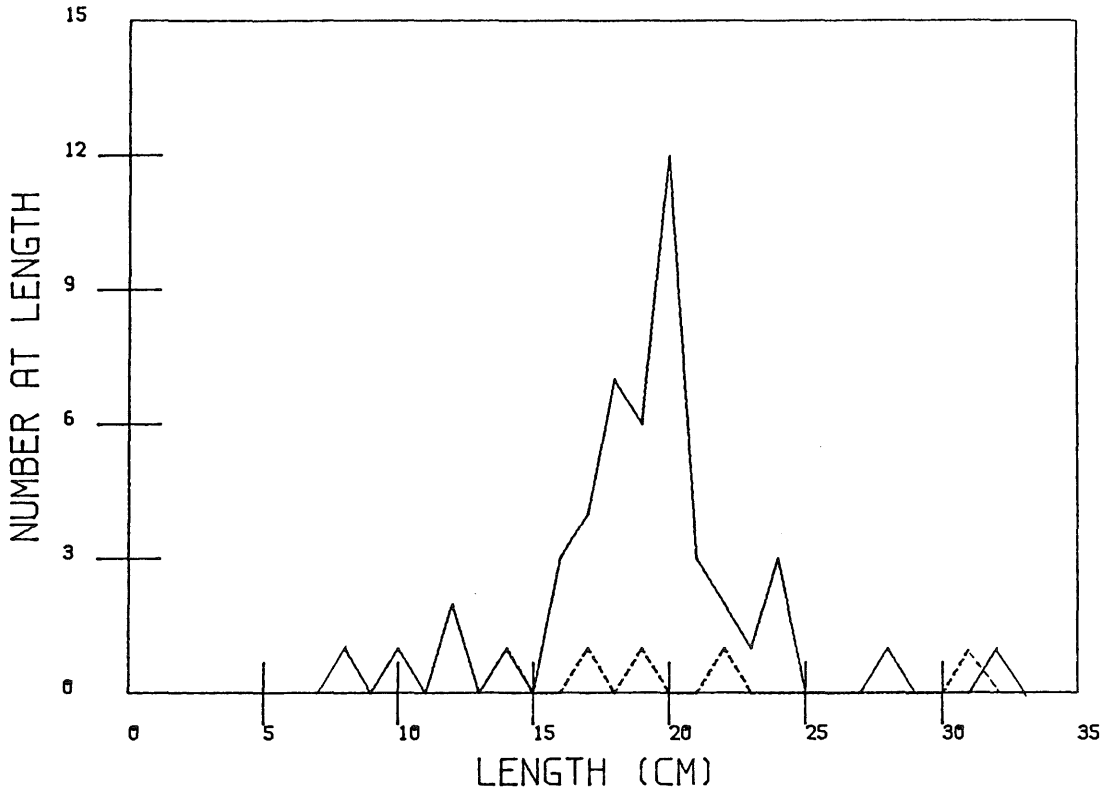

Figure 21. Length frequency distributions of scup caught by the SEAFARER in the Montauk area with 65-mm (solid line) and 148-mm (dashed line) mesh codends.

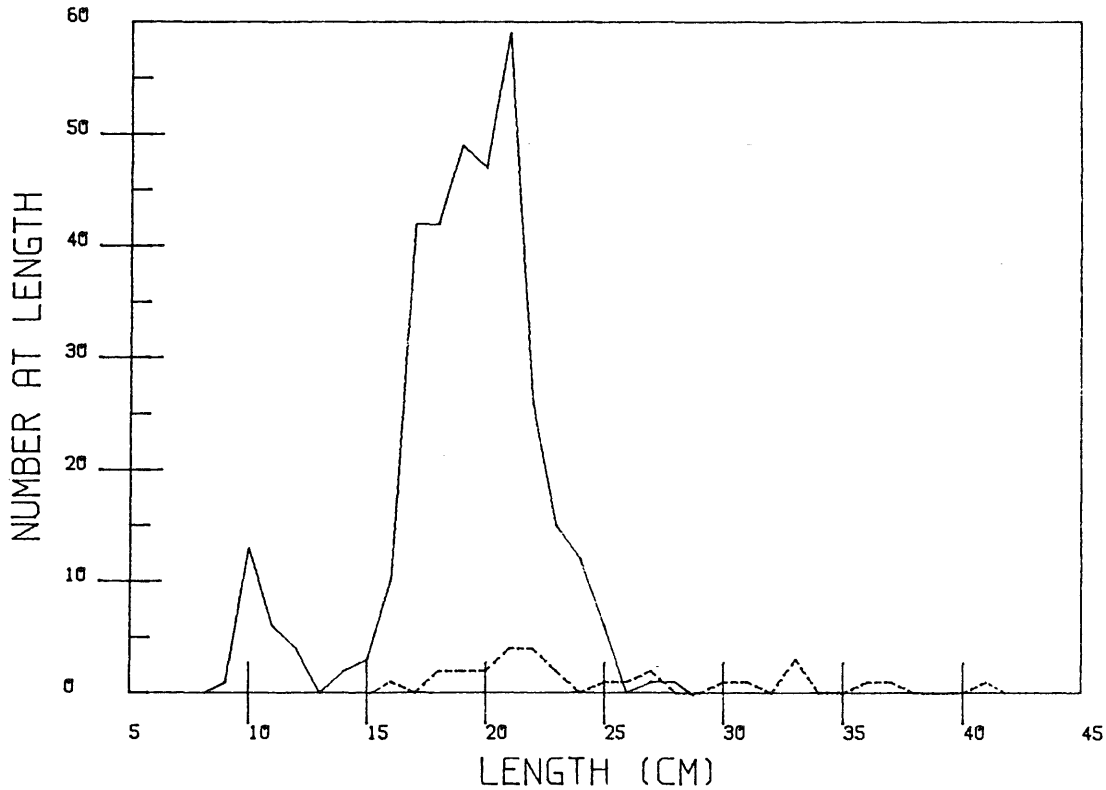

Figure 22. Length frequency distributions of scup caught by the RIANDA S in the Montauk area with 64-mm (solid line) and 145-mm (dashed line) mesh codends.

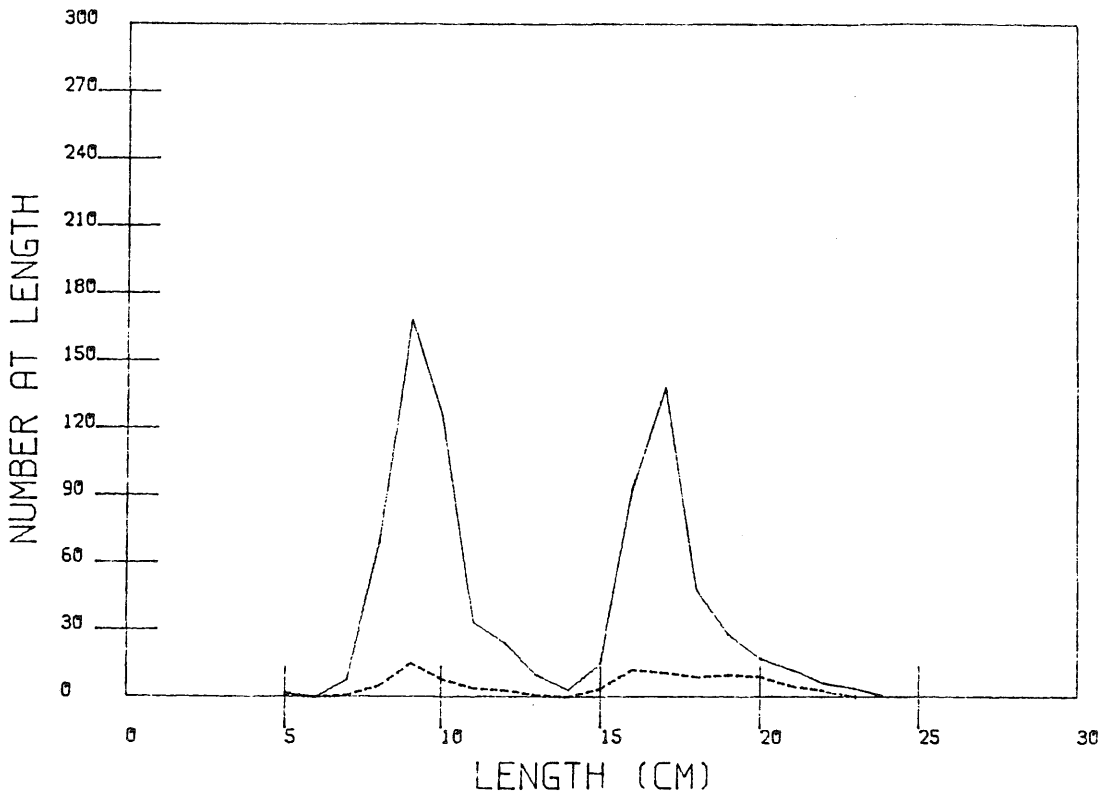

Figure 23. Length frequency distributions of scup caught by the PATRIOT in the Shinnecock area with 58-mm (solid line) and 142-mm (dashed line) mesh codends.

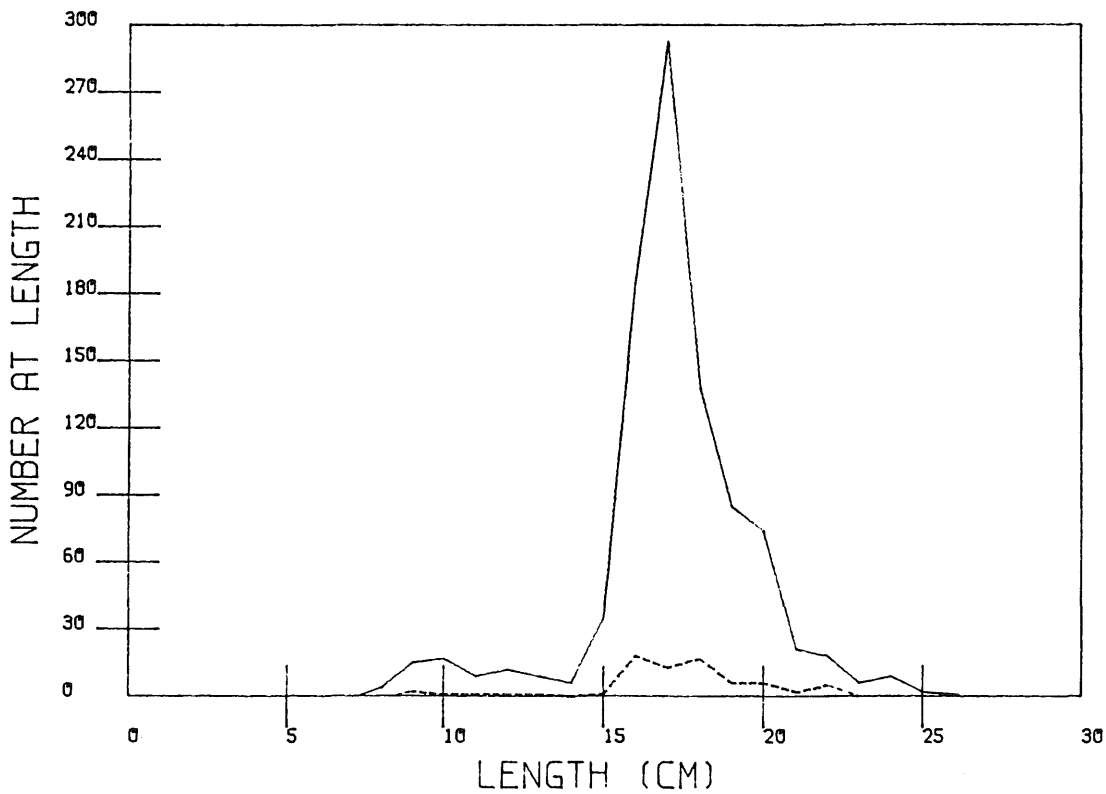

Figure 24. Length frequency distributions of scup caught by the RUTH ANN in the Shinnecock area with 64-mm (solid line) and 141-mm (dashed line) mesh codends.

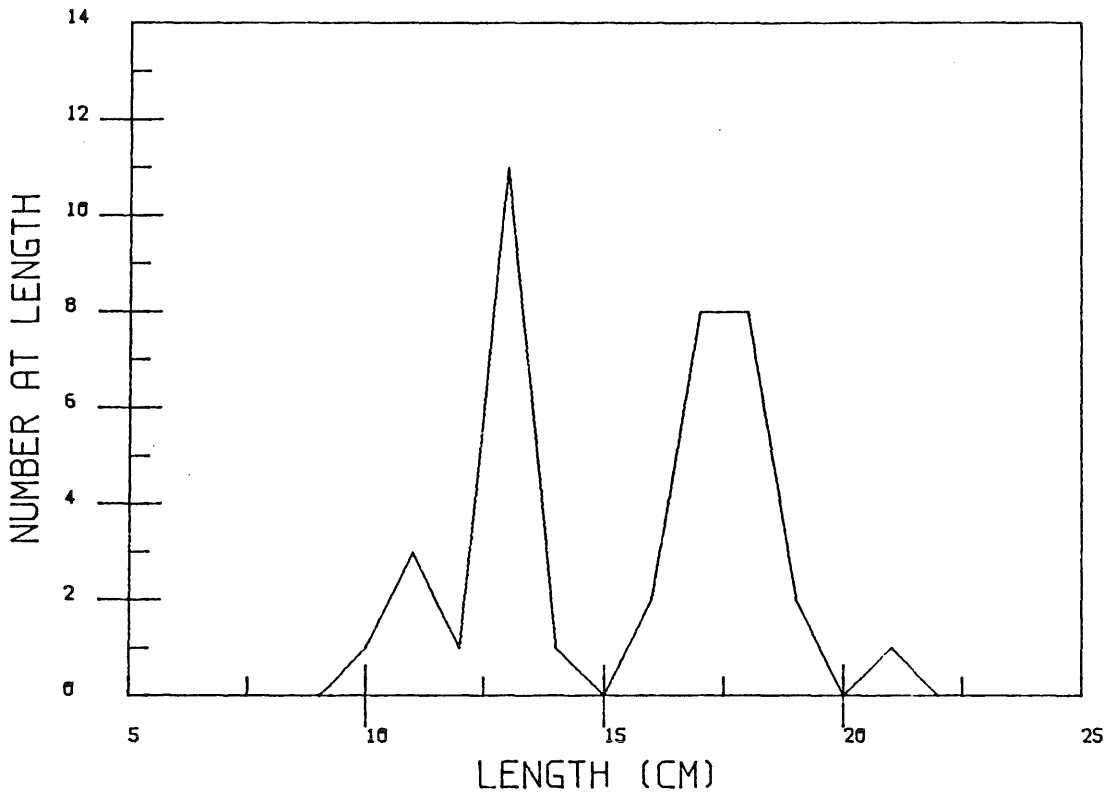

Figure 25. Length frequency distribution of butterfish caught by the SEAFARER in the Montauk area with a 65-mm mesh codend.

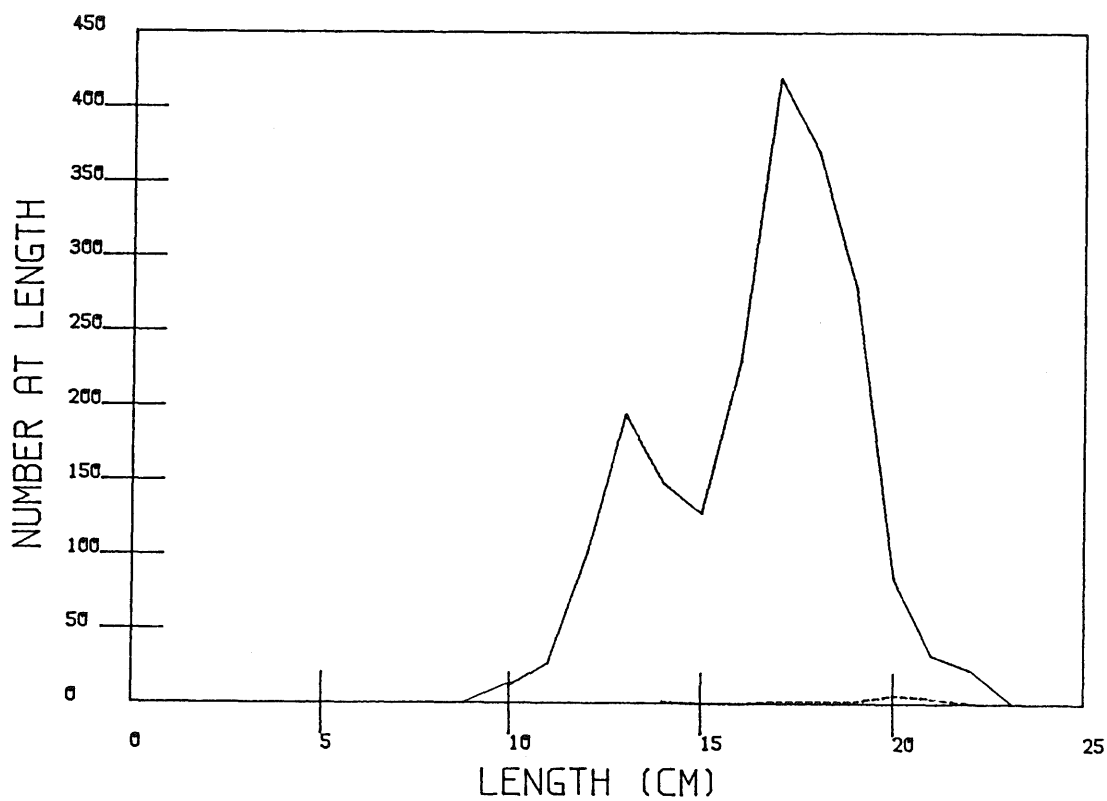

Figure 26. Length frequency distributions of butterfish caught by the RIANDA S in the Montauk area with 64-mm (solid line) and 145-mm (dashed line) mesh codends.

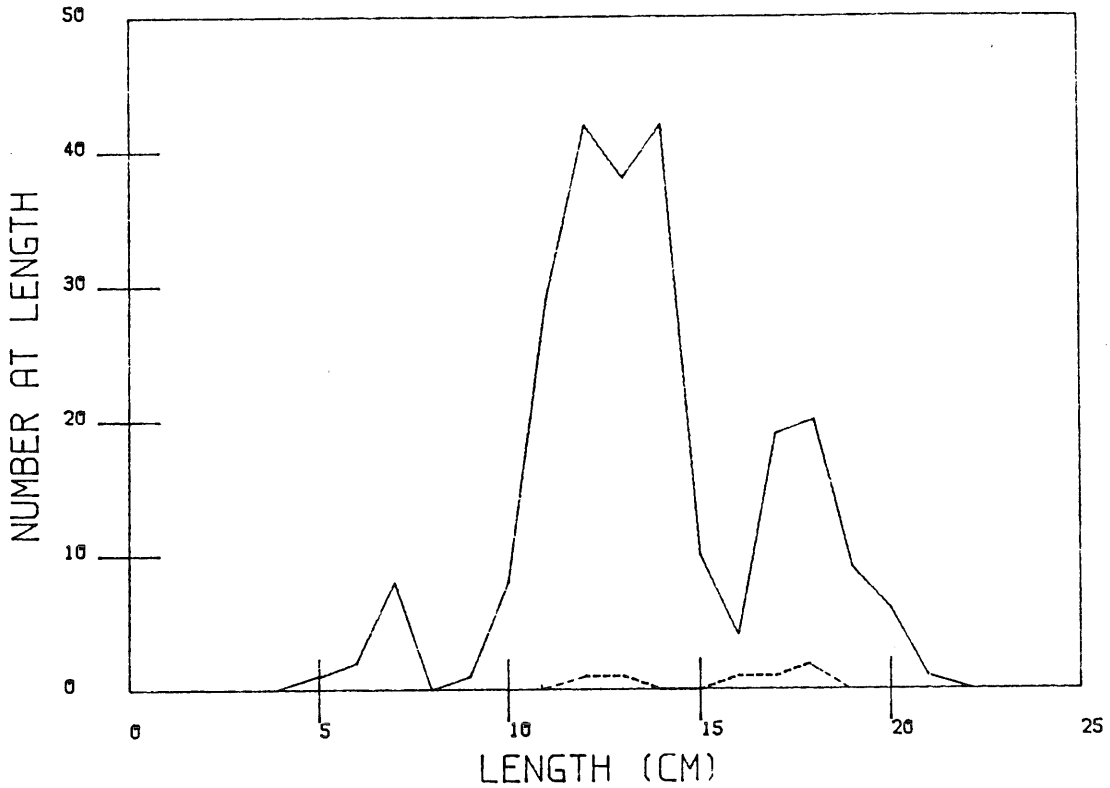

Figure 27. Length frequency distributions of butterfish caught by the PATRIOT in the Shinnecock area with 58-mm (solid line) and 142-mm (dashed line) mesh codends.

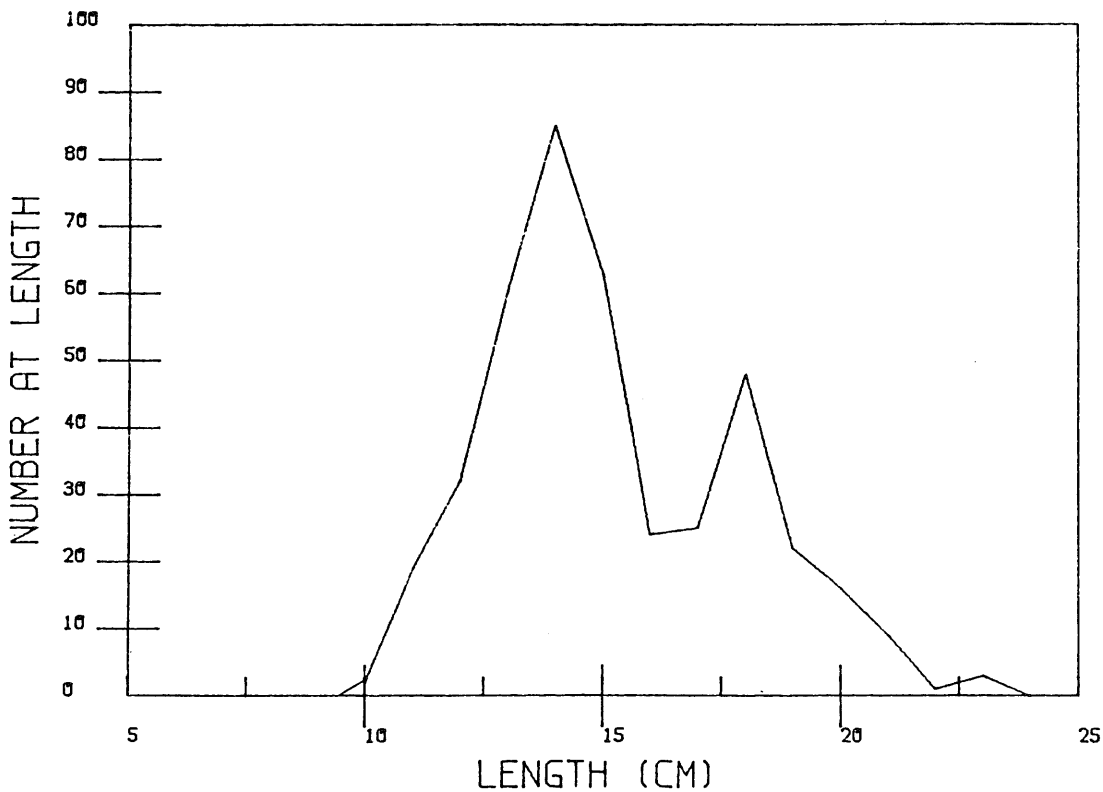

Figure 28. Length frequency distribution of butterfish caught by the RUTH ANN in the Shinnecock area with a 64-mm mesh codend.

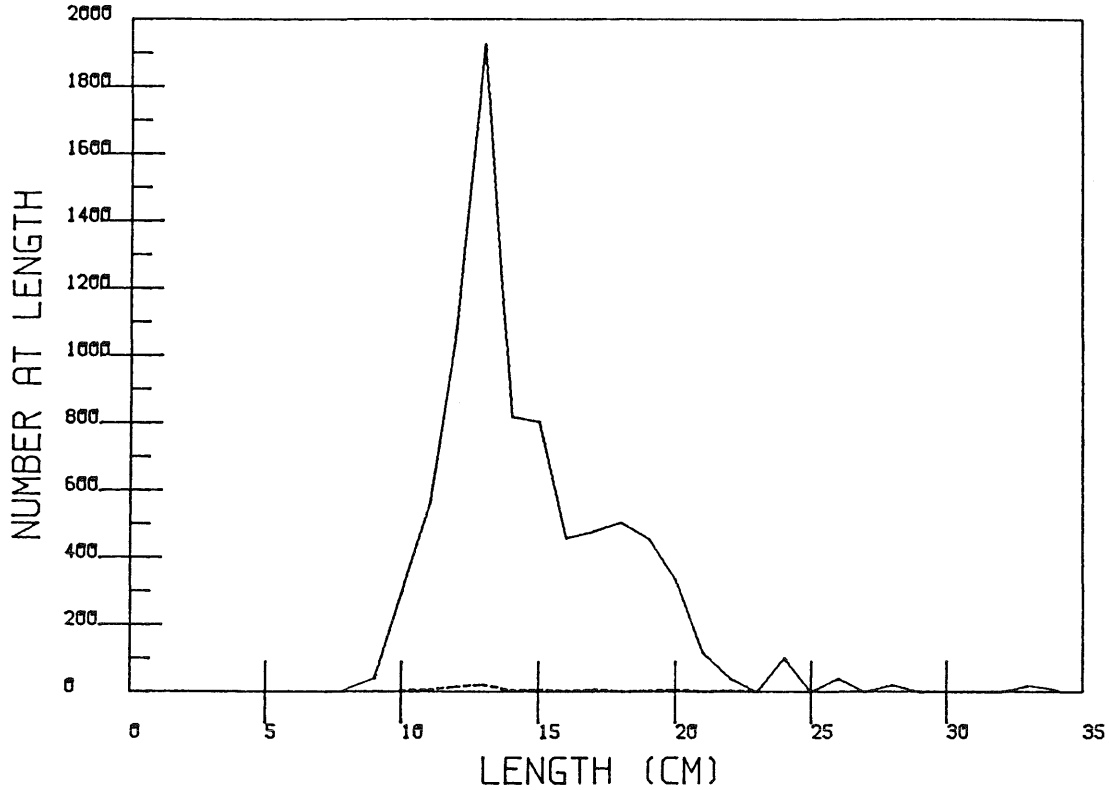

Figure 29. Length frequency distributions of long-finned squid caught by the SEAFARER in the Montauk area with 65-mm (solid line) and 148-mm (dashed line) mesh codends.

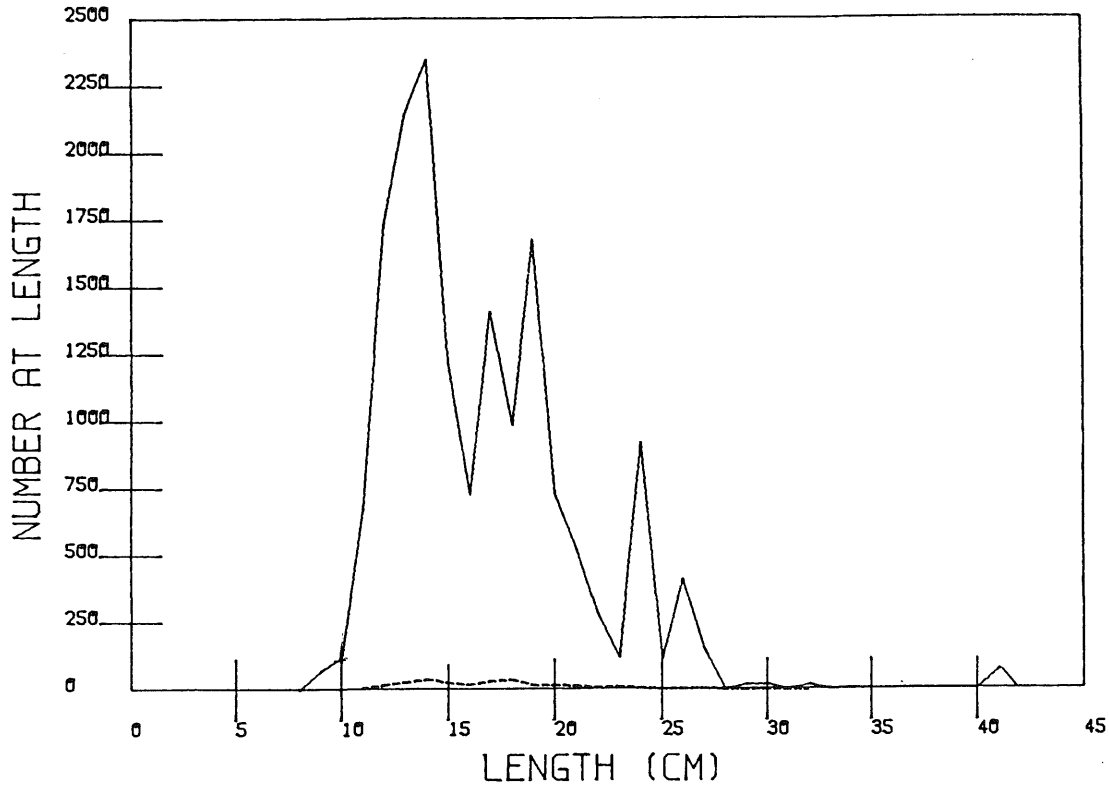

Figure 30. Length frequency distributions of long-finned squid caught by the RIANDA S in the Montauk area with 64-mm (solid line) and 145-mm (dashed line) mesh codends.

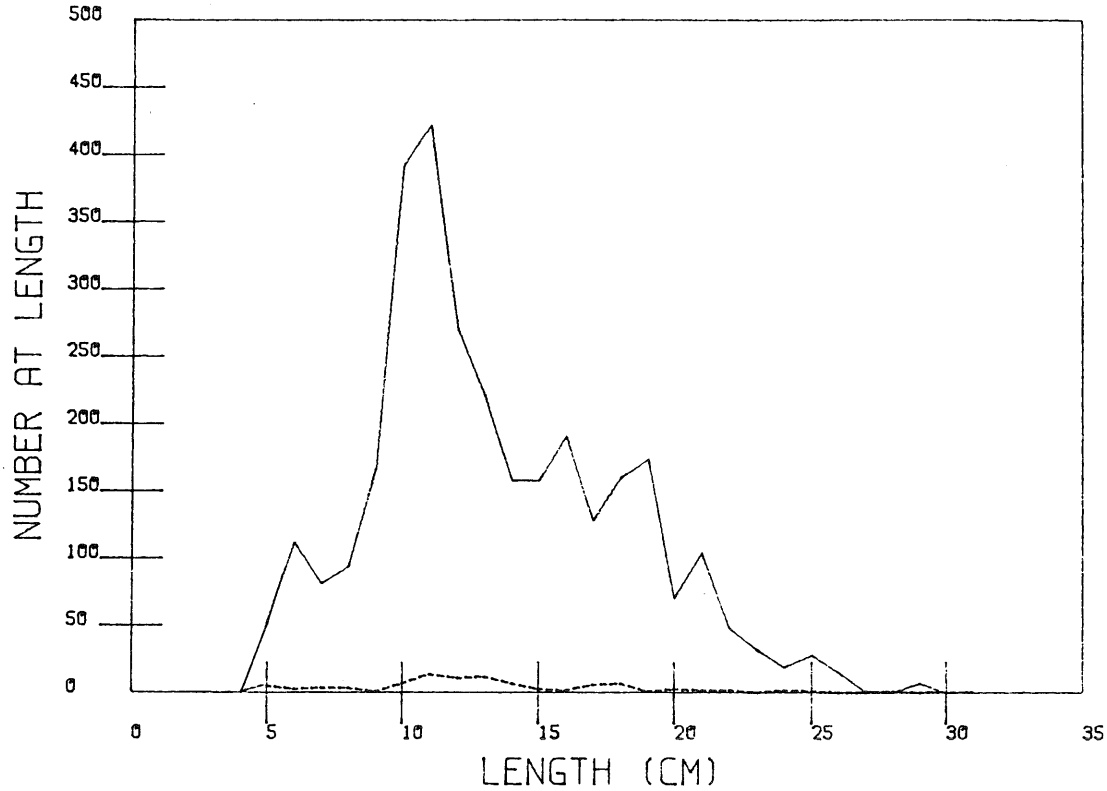

Figure 31. Length frequency distributions of long-finned squid caught by the PATRIOT in the Shinnecock area with 58-mm (solid line) and 142-mm (dashed line) mesh codends.

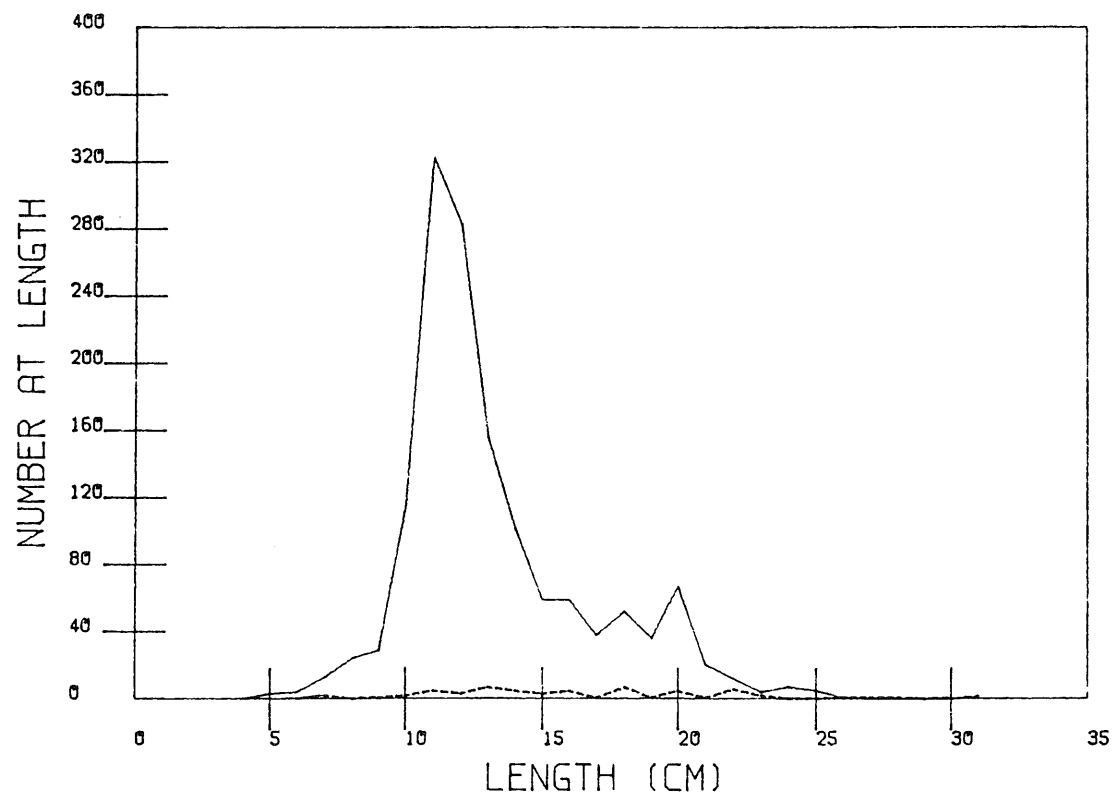

Figure 32. Length frequency distributions of long-finned squid caught by the RUTH ANN in the Shinnecock area with 64-mm (solid line) and 141-mm (dashed line) mesh codends.