APPROVED

COMPLETION REPORT

Project Title: 2006 Fishery Independent Scup Survey of hard bottom areas in Southern New England Waters (SNE).

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PROJECT SUMMARY

Unvented scup pots were fished on twelve hard bottom areas in Southern New England (SNE) waters during the period 06/01/06 through 10/31/06. A total of 10,324 scup were captured in the unvented pots in two selected areas in Massachusetts and Rhode Island. The CPUE (number of fish captured per pot hauled per set-over-time) varied without trend in both areas. Mean length of scup between the sampling areas ranged between 22.7 and 23.8 cm with very little difference between stations and areas. Results were compared to the National Marine Fisheries Service (NMFS) 2006 spring and fall trawl data and the Rhode Island Department of Environmental Management (RIDEM) 2006 trawl survey (spring and fall combined). Additionally, comparisons were made between pot fishing time where gear was set for a period of 1 hour versus overnight, generally about 24 hour-set. The analysis showed no significant difference between CPUEs of pots fished for 24 hours versus 1 hour. Similar results were found relative to age distribution between the pot survey and the trawl surveys. The proportion of older scup (ages 3+) was higher for the pot survey than for the trawl surveys suggesting that the trawl gear is not adequately sampling the older, larger scup and therefore not characterizing the size structure of the scup population as a whole. Fishing mortality estimates from catch curve analysis suggested that the exploitation rate is moderate at F=0.18-0.2. The unvented pot survey has demonstrated to be useful scientific data which can supplement the trawl survey for population assessments.

INTRODUCTION

This project was designed to collect data on scup, which inhabit the hard bottom areas in SNE, and compare the length frequency distribution of the unvented fish pots to the catch in the NMFS trawl survey and the state (RIDEM) trawl survey. This project was initiated because of the major uncertainties noted in the 2002 scup assessment. Specifically, the 2002 scup assessment noted that the current level of sampling, and general lack of information on scup, impedes the development of an analytical assessment of the population. In particular, the lack of older animals in the NMFS survey is a major source of uncertainty in evaluating the status of the population and hinders the development of mortality estimates.

The 35th Stock Assessment Workshop (SAW) Report noted major uncertainties in the 2002 scup assessment and recommended the development of alternative sampling methodologies to characterize the population. The major deficiencies relate to the following:

- "Increased and more representative sea and port sampling of the various fisheries in which scup are landed and discarded is needed to adequately characterize length composition of both landings and discards. The current level of sampling, particularly of discards, particularly impedes the development of analytical assessments and forecasts of catch and stock biomass for this stock" (NEFSC 2002).
- "Several previous SARC panels (SAW 25, 27 and 31) have concluded that new or enhanced data reporting or sampling are required to produce a reliable assessment. Members of the 35th Stock Assessment Review Committee emphasized that an analytical formulation for scup will not be feasible until the quality and quantity of the input data (biological sampling and all components of catches) are significantly improved for and adequate time series" (NEFSC 2002).

- "Fishing mortality could not be estimated on older animals because they're currently absent from the NMFS spring and autumn surveys" (NEFSC 2000).

Scup associate with bottom structure for a major part of the year and are therefore unavailable to traditional bottom trawl gear, particularly during the early spring, summer, and fall months. Since existing State and Federal research vessels, which rely on bottom trawls as their primary collection method, sample only fishable grounds they do not survey hard bottom areas which constitute the majority of summer inshore habitat of scup. All of the sampling sites in this study are on rocky substrate and are located a considerable distance offshore, where there is little or no scup pot fishery and no active trawl fisheries. Due to the distance from coastal ports, in combination with low trip limits, these study areas are fished infrequently, if at all. In addition, the sampling locations are in close proximity to deep water, which may attract and hold larger scup.

Since scup inhabit a narrow geographic range (New York to Southeastern Massachusetts) during the summer months, it may be possible to implement a fishery independent survey of hard bottom areas to better characterize the size composition of the population, or further supplement and complement the existing state and federal sampling program. If this technique proves useful, it may substantially improve the current and future understanding of the scup resource. In addition, sampling in offshore areas may result in the collection of larger fish which are currently absent from the NMFS survey.

SAMPLING PROTOCOL

The proposed project is similar in design to a fishery independent survey of rocky bottom areas in Southern New England conducted during 2004 and 2005. The scope of work is separated into a western and eastern sampling design (Table 1; Figure 1). At the beginning of the project, the research vessel(s) fished at each collection site in order to focus the sampling activity on areas with a high abundance of scup.

Scup were collected from each site utilizing standard fish pots (2 x 2 x 2 foot) made with 1½ x 1½ inch coated wire mesh with double entry wire heads. Pots were unvented and therefore had the capability to retain all size classes of scup. The sampling protocol required the commercial vessels to take and set 30 pots to each sampling site once during each of the five sampling cycles. The sampling cycles are mid June, July, August, September, and the first week in October. Pots were baited with clams, which fish quickly, and set on the sampling sites. In the Western zone all traps were set for 24 hours soak times prior to being hauled and recording the catch. For the Eastern zone two different soak times were used, 1 hour and 24 hours, prior to hauling and recording the catch. If a 15-trap set was made on a site, the gear was baited again and reset within 200 yards of the original site. The different soak times in each area were recorded and grouped by set over time for analysis purposes. Each scup was measured for total length. The date, area, depth, and catch were recorded and all scup captured were measured. Sampling of the spawning sites was conducted beginning June 2nd to June 16th.

RESULTS

The overall length frequency distribution was compared using the Kolmogorov-Smirnov test within sampling areas and among areas. Results showed no difference between the size distribution sampled in all 5 stations in the eastern area. Similarly, there was no statistical difference in the size distribution sampled in the western area, with the exception of station 4, likely due to low sample size (Figure 2). A graphic presentation of the pooled length frequencies by station and by area is presented in sequence in Figure 3. The low CPUE in the selected spawning stations did not offer a sufficient sample size to make similar comparisons. The mean lengths of all samples by area were computed with slight variation in all the three areas. The mean lengths were 22.73 cm, 23.81 cm, and 22.94 cm in the western, eastern and spawning sites, respectively (Table 2; Figure 4). The standard errors were almost identical for all sites, suggesting no statistical difference between the mean lengths (Table 2).

During the sampling season a series of sets were made at random to explore differences in the catch rates using two sets of soak time. The first set was done overnight followed by an immediate set after hauling for one hour on the same location. Table 3 shows the results of the paired comparison in the western area. A paired *t*-test was computed to compare the 2 sets of soak time. The mean difference was 28.35, the standard deviation difference was 15.5, and the 95% confidence interval varied between 24.7 and 32.0. A *P*-value suggested no significant difference between the two sets of soak time.

As a result of no statistical difference between the size distribution in the two sampling sites, and the considerations of the remarkable representation of older fish in the pots, we used the size structure of unweighted pooled samples as representation of all sampling efforts in 2006. A simple comparison was computed between the size distribution from the unvented scup pots and the pooled trawl surveys fall and spring of the NMFS and the RIDEM trawl surveys. A significant difference was apparent with high degree of distinction between the two sampling gears. Trawl survey samples were dominated by young of the year and age 1, while the unvented pot samples were composed largely of older fish with a wide range of sizes between 11 to 40 cm (Figure 5). The unvented pots selectivity for smaller fish is the result of the 1½ x 1½ inch coated wire mesh of the pots. This analysis strongly implies that traditional trawl gear is not adequately sampling the older, larger scup and therefore not characterizing the size structure of the population as a whole.

The catch matrix was standardized in catch per unit of effort for the period of the study from May through October 2006, where natural mortality was assumed M=0.15. The CPUEi at length were converted into CPUEi at age using the pooled NMFS trawl survey Age-Length-Keys and the 2006 RIDEM fishtrap samples. A linear regression was calculated for the descending limb of the curve for ages 4-10 and 4-8. Results of the catch curve analysis showed a moderate to high fishing mortality varying from 0.15 to 1.0 depending on the selection of the age group. Unfortunately, there is no completely appropriate statistical procedure for determining the age groups and accounting for source of errors such as recruitment and natural mortality. A non-linear multiplicative model approach ($C=a*exp(b*age)+u$ and other semi-log models can be considered and compared. We did not consider these models with sensitivity analysis. If M=15, the fishing mortality estimates ranged

from 0.18 to 0.2, according the results of the catch curve (Figure 6).

Future assessments of the population might be improved by developing a composite index based on the traditional trawl data in combination with data from an unvented pot survey. This study is ongoing and continued in 2007 and sampling is scheduled to begin in May of 2008. Therefore, these results are preliminary and final conclusions would be premature. The potential benefits of this approach should become more apparent as we evaluate the time series results of future ventless pot studies.

REFERENCES

NEFSC. 2000. Report of the 31st Northeast Regional Stock Assessment Workshop (31st SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments. Northeast Fisheries Science Center Ref. Doc. No. 00-15, Woods Hole, MA. 400 pp.

NEFSC. 2002. Report of the 35th Northeast Regional Stock Assessment Workshop (35th SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments. Northeast Fisheries Science Center Ref. Doc. No. 02-14, Woods Hole, MA. 259 pp.

Table 1. Sampling locations.

Number	Description	Loran
Western Sampling Sites		
1	South of Sakonnet Point, RI (most likely inner Mayo Ledge or Elisha Ledge)	14330/43957
2	Western end of Buzzards Bay (most likely south of Old Cock rock or in the proximity of Buzzards Bay Tower)	14285/43953
3	Browns ledge (approximately ten miles southwest of Westport Harbor, MA in federal waters)	14315/43920
4	West or south of Nomans Island	14250/43850
5	South of Newport, RI (Elbow Ledge)	14368/43975
Eastern Sampling Sites		
1	Horse Shoals	14025/43915
2	Cape Pogue	14075/43895
3	Hart Haven / East Chop	14105/43915
4	Mink Meadows / West Chop	14115/43930
5	Cedar Tree Neck / Norton Rock	14167/43917
Spawning Sampling Sites		
1	Collier's Ledge	13995/43948
2	Bishops and Clerks	13970/43935

Table 2. Mean length (cm) and STD error.

	Western Area	Eastern Area	Spawning Sites
Mean Length (cm)	22.73	23.81	22.94
STD Error	4.18	4.13	4.51

Table 3. Catch (number of scup) per pot by set over-time in the western area.

	24 hour set	1 hour set
1	105	141
2	247	98
3	184	106
4	229	274
5	160	152
6	193	217
7	202	117
8	135	123
Mean	181.87	153.5
Std Error	16.68	21.67

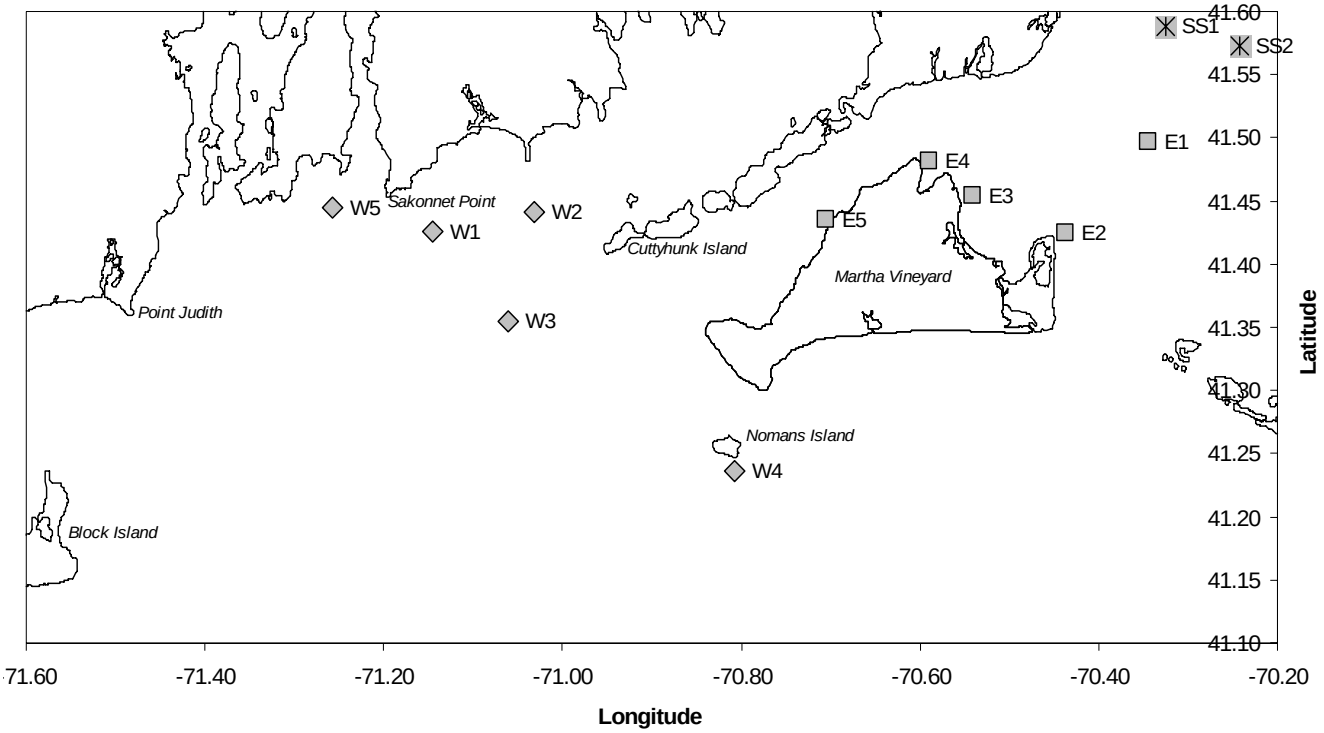

Figure 1. Map of sampling locations

Western Stations (1-5) Eastern Stations (1-5)

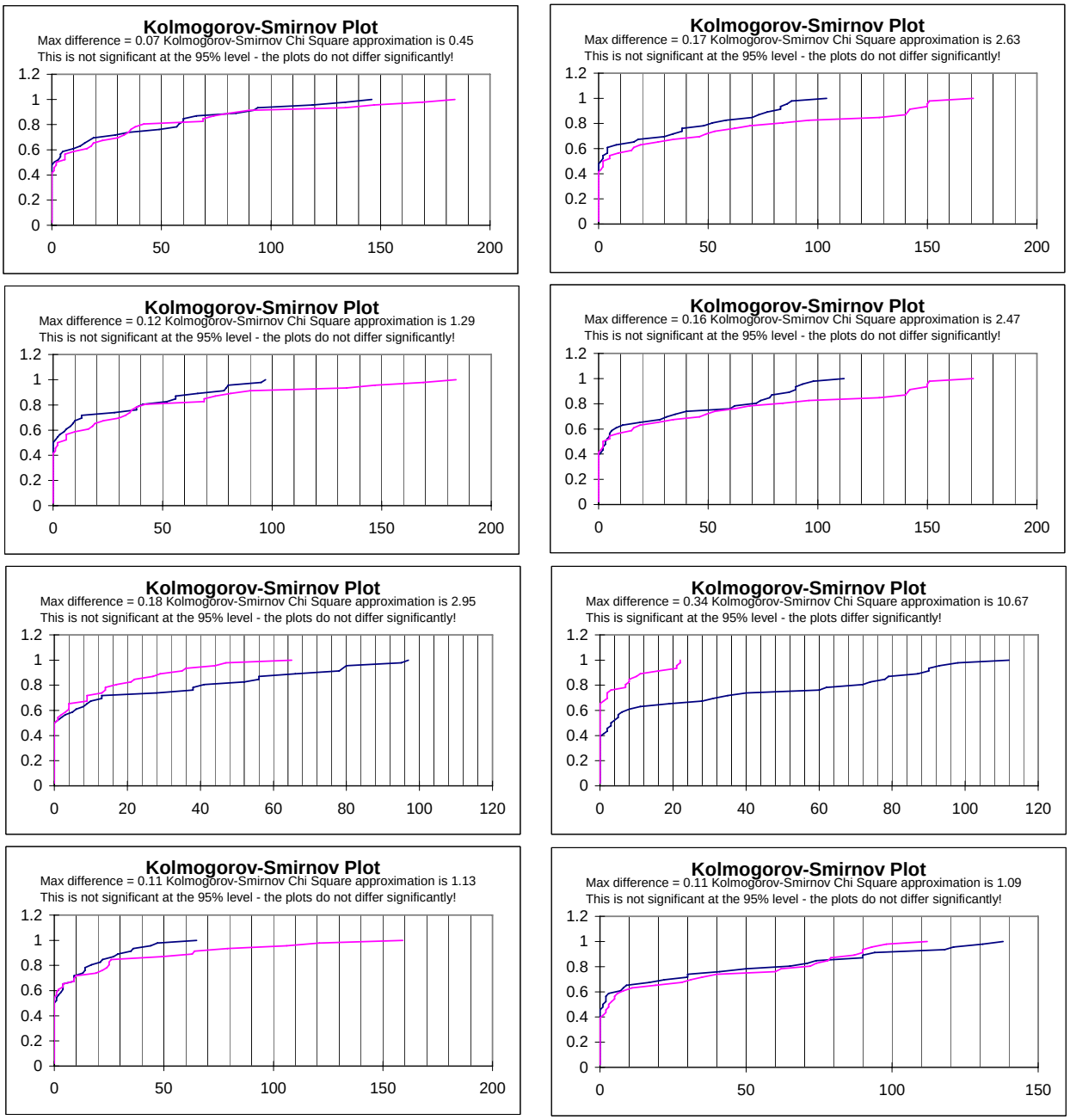

Figure 2. Kolmogorov-Smirnov test plots for the comparison of the length distribution within the western and eastern stations.

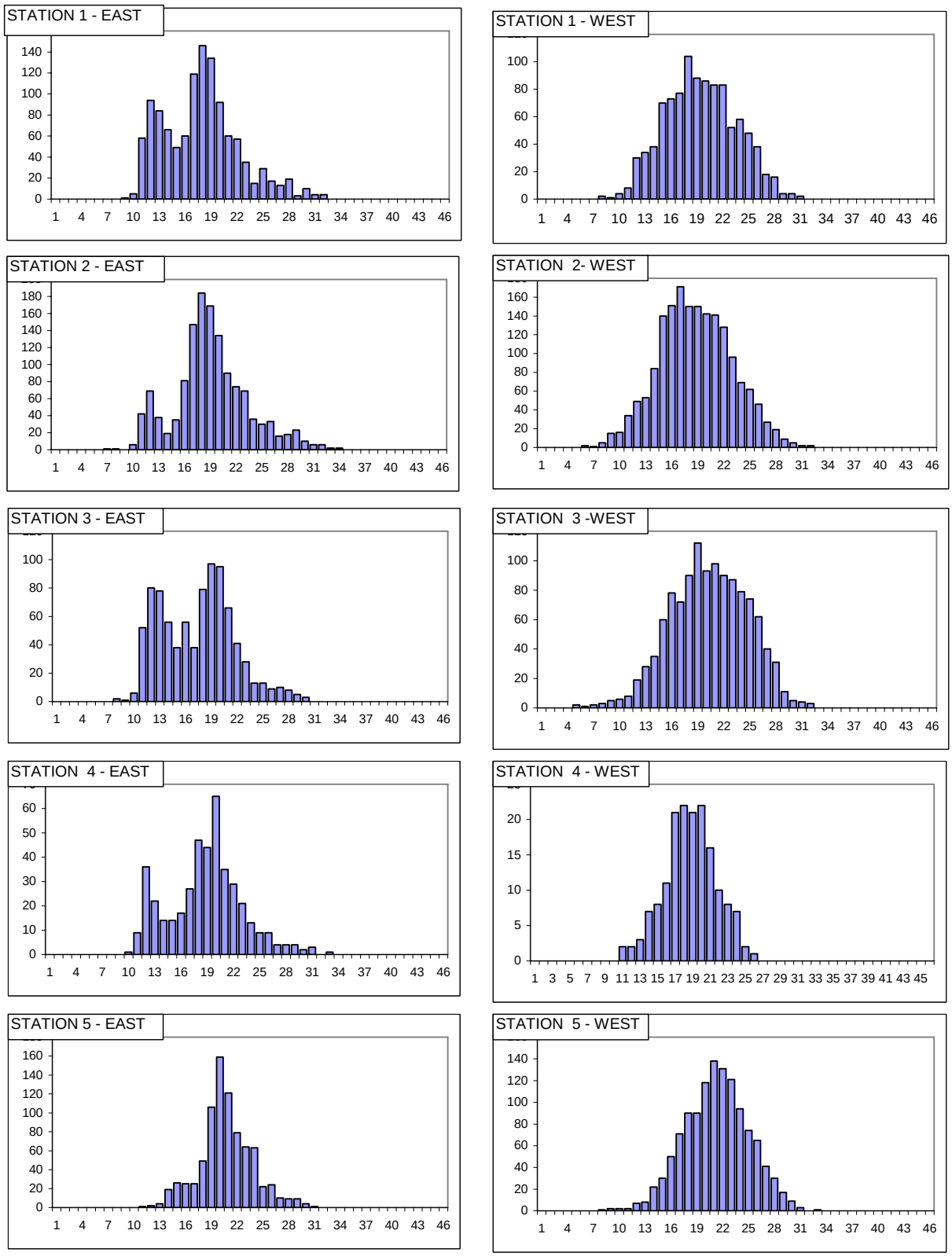

Figure 3. Scup length frequencies by station in the eastern and western sampling areas.

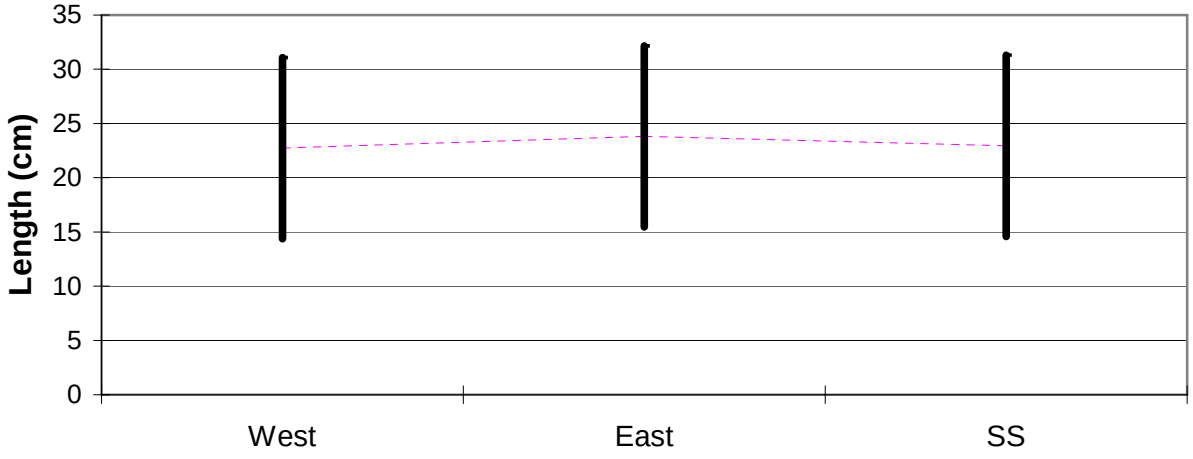

Figure 4. Mean length (cm) per area.

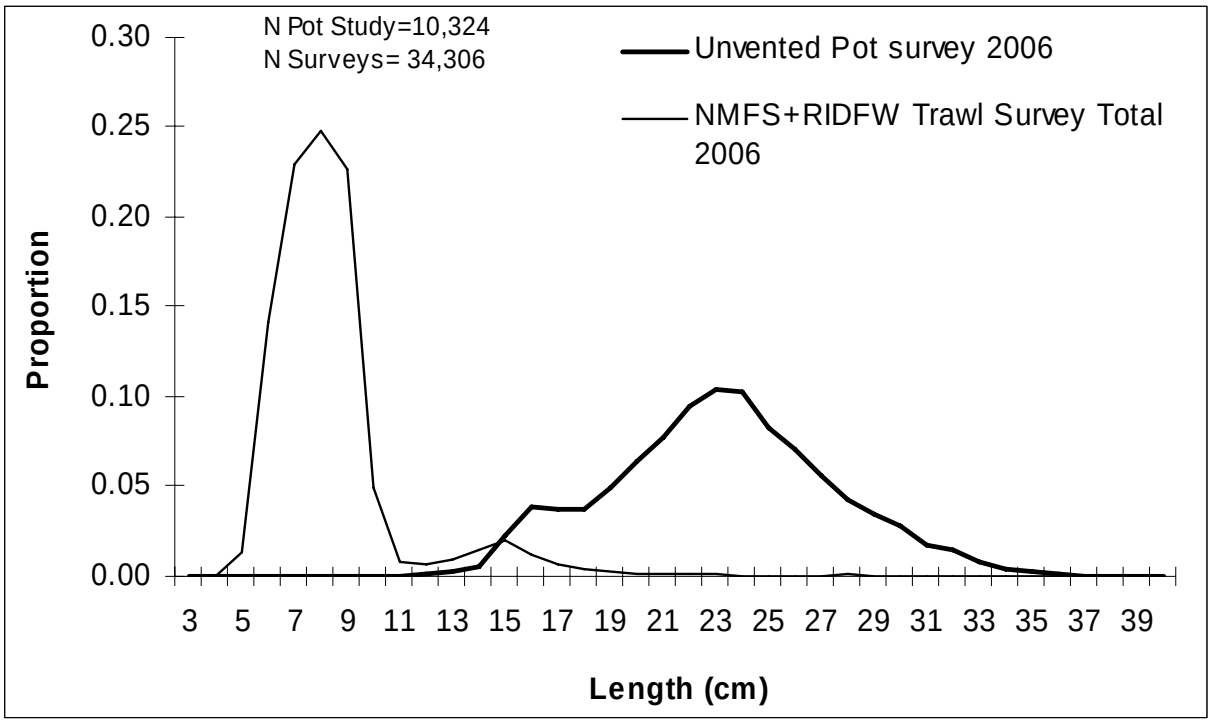

Figure 5. Scup size comparison between trawl surveys and unvented pot survey (2006).

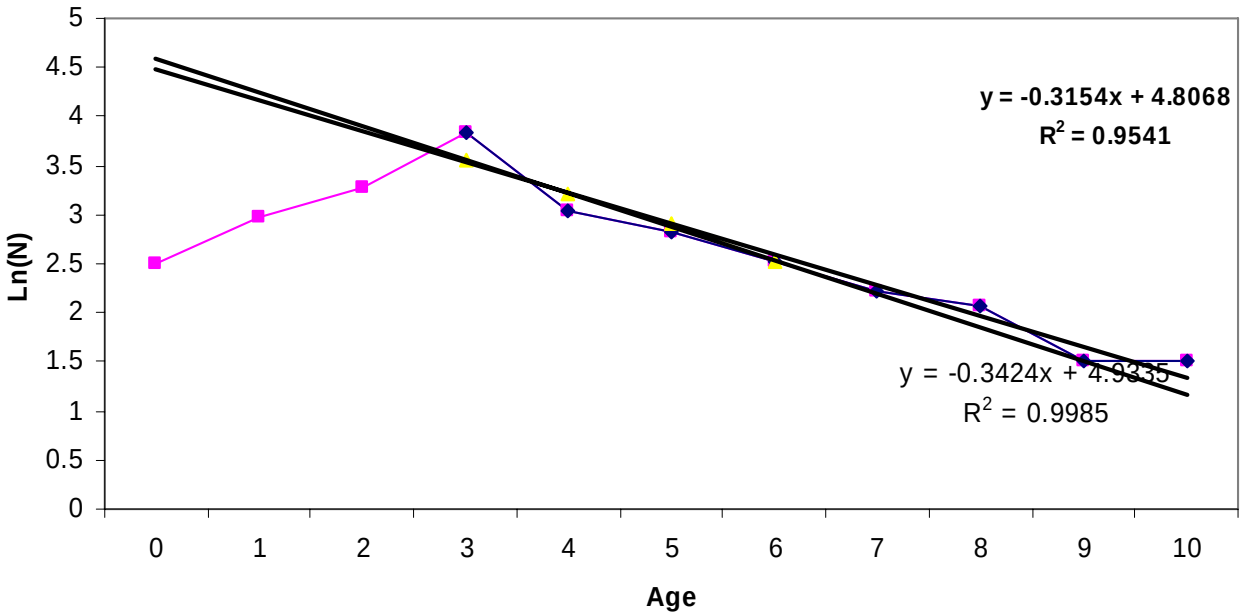

Figure 6. Total mortality estimate from catch curve.