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Summary of 2013 and 2014 Herring Acoustic Surveys in Northwest Atlantic Fisheries Organization (NAFO) Divisions 4VWX

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Canada

Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the Secretariat.

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TABLE OF CONTENTS

ABSTRACT

Automated acoustic recording systems deployed on commercial fishing vessels have been used since 1997 to document the distribution and relative abundance of Atlantic herring from industry vessel surveys and fishing excursions in the Bay of Fundy and coastal Nova Scotia area within Northwest Atlantic Fisheries Organization (NAFO) divisions 4VWX. In 2013 and 2014, regularly scheduled surveys at approximately 14 day intervals were again conducted on the main herring spawning components, and the spawning stock biomass for each component estimated by summing these results. In 2013, seven structured surveys were conduct in Scots Bay, with six conducted in 2014. Five usable structured surveys were conducted on German Bank in both 2013 and 2014. Two structured surveys were completed in the Trinity Ledge area in both 2013 and 2014. There were no structured surveys conducted in 2013 or 2014 for Spectacle Buoy. In most cases, these surveys provided good coverage of the spawning areas consistent with established protocols.

In 2013, the biomass estimate decreased to approximately 72% of the 2012 estimate for the combined survey areas of Scots Bay, Trinity Ledge and German Bank (known as the Southwest Nova Scotia/Bay of Fundy (SWNS/BoF) (4X) stock). The 2014 estimate for the same overall areas rebounded to 98% of the 2012 estimate; both the 2012 and 2014 biomass estimates are slightly (6% and 4%, respectively) above the long term average since 1999. These estimates provide mixed indications with regards to the SWNS/BoF stock. The German Bank spawning biomass estimate has decreased at an average annual rate of 8% since 2011. The Trinity Ledge spawning biomass remained below the long term average, which is consistent with the trend in the area since 2006. Most of the recent fluctuation in the SWNS/BoF spawning complex is occurring in the Scots Bay area, as the biomass in 2013 was less than half of the previous year before reaching a high in 2014 since the acoustic surveys began in 1999.

Biomass estimates from surveys of the coastal Nova Scotia spawning components for the Little Hope/Port Mouton, Halifax/Eastern Shore and Glace Bay areas were also examined. Three (2013) and four (2014) surveys were completed for Little Hope, four (2013) and six (2014) surveys for Halifax/Eastern Shore and one (2013) for the Glace Bay area. In Little Hope, a substantial increase in the spawning biomass estimate was observed in 2013 (74,532t) over the four-year low documented in 2012 (12,756t). While the 2014 spawning biomass (46,077t) was approximately 62% of the 2013 level, it is still above the most recent five-year average of 37,664t. The total spawning biomass estimate for the Halifax/Eastern Shore area demonstrated increases in both 2013 (6,870t) and 2014 (9,586t), reaching near the recent five-year average of 10,664t, but remaining well below the long term average since 1998 (28,857t). Glace Bay showed virtually no fish in the one survey completed in 2013 (50t).

Résumé des relevés acoustiques sur le hareng effectués en 2013 et 2014 dans les divisions 4VWX de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO)

RÉSUMÉ

Des systèmes d'enregistrement acoustiques automatiques installés sur des bateaux de pêche commerciaux sont employés depuis 1997 pour documenter la répartition et l'abondance relative du hareng dans le cadre de relevés de l'industrie et de sorties de pêche effectués dans la baie de Fundy et la région côtière de la Nouvelle-Écosse à l'intérieur des divisions 4VWX de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO). En 2013 et 2014, on a effectué, à environ 14 jours d'intervalle, des relevés des principales composantes des frayères du hareng; on a ensuite évalué la biomasse du stock reproducteur de chaque composante en additionnant les résultats obtenus. Sept relevés structurés ont été réalisés dans la baie Scots en 2013 et six relevés ont été réalisés en 2014. Cinq relevés structurés utilisables ont été réalisés sur le banc German en 2013 et en 2014. Deux relevés structurés ont été réalisés dans la région du récif de la Trinité en 2013 et en 2014. Aucun relevé structuré n'a été réalisé en 2013 ou en 2014 à partir de la bouée Spectacle. Dans la plupart des cas, ces relevés ont assuré une couverture satisfaisante des frayères, globalement cohérente par rapport aux protocoles établis.

En 2013, l'estimation de la biomasse a diminué de près de 72 % par rapport à l'estimation de 2012 pour les zones de relevé combinées de la baie Scots, du récif de la Trinité et du banc German (stock de la région sud-ouest de la Nouvelle-Écosse et de la baie de Fundy [4X]). L'estimation de 2014 pour les mêmes zones globales est remontée à 98 % par rapport à l'estimation de 2012; les estimations de la biomasse en 2012 et en 2014 sont légèrement (6 % et 4 %, respectivement) supérieures à la moyenne à long terme depuis 1999. Ces estimations donnent différentes indications en ce qui a trait au stock de la région sud-ouest de la Nouvelle-Écosse et de la baie de Fundy. L'estimation de la biomasse du stock reproducteur du banc German a chuté à un taux annuel moyen de 8 % depuis 2011. La biomasse du stock reproducteur du récif de la Trinité est demeurée inférieure à la moyenne à long terme, ce qui respecte la tendance dénotée dans cette région depuis 2006. La plupart des fluctuations récentes pour le complexe de stock du sud-ouest de la Nouvelle-Écosse et de la baie de Fundy a lieu dans le secteur de la baie Scots, puisque la biomasse en 2013 était moins de la moitié de celle de l'année précédente, pour atteindre un sommet en 2014 depuis la création des relevés acoustiques en 1999.

Les estimations de la biomasse à partir des relevés des composantes de reproducteurs des côtes de la Nouvelle-Écosse pour les secteurs de Little Hope/Port Mouton, d'Halifax/côte Est et de Glace Bay ont également été examinées. On a réalisé trois (2013) et quatre (2014) relevés pour Little Hope, quatre (2013) et six (2014) relevés pour Halifax/côte Est, et un (2013) relevé pour Glace Bay. À Little Hope, une augmentation considérable de l'estimation de la biomasse du stock reproducteur a été observée en 2013 (atteindre 74 532 t) comparativement au niveau faible de quatre ans en 2012 (12 756 t). Même si la biomasse du stock reproducteur en 2014 (46 077 t) était à environ 62 % du niveau de 2013, elle se situe toujours au-dessus de la plus récente moyenne quinquennale de 37 664 t. L'estimation de la biomasse totale du stock reproducteur pour la zone de Halifax/côte est a démontré une augmentation en 2013 (6 870 t) et en 2014 (9 586 t). Elle a presque atteint la récente moyenne quinquennale de 10 664 t; cependant, elle demeure bien inférieure à la moyenne à long terme depuis 1998 (28 857 t). Selon un relevé réalisé en 2013, il n'y avait pratiquement aucun poisson dans le secteur de Glace Bay (50 t).

INTRODUCTION

Since 1997, the spawning stock biomass (SSB) of Northwest Atlantic Fisheries Organization (NAFO) divisions 4WX Atlantic herring has been estimated using acoustic surveys conducted by the fishing industry (Stephenson et al. 1998; Power and Melvin 2010). Each year, commercial fishing vessels equipped with calibrated acoustic logging systems undertake both scheduled and unscheduled surveys of herring aggregations on the spawning grounds. The data collected during these surveys serve two purposes. First, when necessary, the data can be analyzed in near real-time and used as input for the "survey, assess, then fish" protocol to apportion fishing effort on individual spawning grounds. Second, the estimates for individual spawning areas is summed, under specific assumptions about elapsed time between surveys, to provide an annual index of SSB for assessment processes. The development and implementation of the automatic acoustic systems represented a major improvement in quantifying fish biomass. Pre-1997 estimates relied on the experience of the observer to estimate the amount of fish from mapping surveys, and are considered qualitative only (Melvin et al. 2002).

The use of commercial fishing vessels to survey and estimate SSB was initially developed to provide additional protection of individual spawning components within a global total allowable catch (TAC) during a period (1994/95) of declining biomass. The original qualitative approach, commonly referred to as the "survey, assess, then fish" protocol, continues today, but now uses a quantitative acoustic methodology with a standard survey design (DFO 1997; Melvin and Power 1999; Melvin et al. 2004; Power and Melvin 2010) to provide an index of spawning biomass. Several major improvements to the approach have been made in survey design and in the standardization of survey coverage to a point where they can be considered comparable from year to year (Melvin and Power 1999; Melvin et al. 2003, 2004; Power and Melvin 2010). The purpose of this document is to report and to summarize the NAFO divisions 4VWX Atlantic herring stock assessment related survey data collected during the 2013 and 2014 fishing and survey season.

METHODS

Acoustic and mapping surveys using commercial fishing vessels have been employed to estimate SSB of individual components within the herring stock complex since 1999. The methods and procedures are well established and described in more detail in previous research documents (Melvin et al. 2004; Power and Melvin 2010; Power et al. 2012; Singh et al. 2014).

Data from the 2013 and 2014 fishing seasons were obtained during regularly scheduled structured surveys. Structured surveys included mapping and/or acoustic surveys (Melvin et al. 2001). In 2013 and 2014, only the acoustic surveys were used to determine the biomass estimates. There were 22 structured surveys completed in 2013 and 23 structured surveys in 2014 (Table 1). An additional two structured surveys were conducted in both 2013 and 2014 on the German Bank, although these had to be excluded due to closeness in the number of days to another conducted survey. The total number of survey boat nights (using acoustic recording systems) completed in 2013 and 2014 were 117 and 99, respectively. In 2013, there was three survey nights from 'mapping' vessels without recording systems. In 2014, no 'mapping vessels without recording systems were used. All surveys were undertaken with acoustic recording systems (Table 2A and 2B).

Structured surveys were conducted in accordance with the protocol established by Melvin and Power (1999), and completed transects provided appropriate coverage of the defined spawning survey areas. A few exceptions to the normal protocols of survey design did take place. These are explained in more detail where they occur below.

DATA QUALITY ISSUES

Most of the previous issues with data quality, detailed in Power et al. (2012), have been resolved. Those issues included the following of surveying protocols, provision and verification of the raw data and editing, and issues of noise and interference. However, as mentioned previously in Singh et al. (2014), some issues continue to surface including not following survey protocols (i.e., doing a series of loops instead of parallel lines or not maintaining straight lines) when documenting fish aggregations. Data collections inconsistent with established protocols were given a low priority for analysis or were not incorporated into the SSB estimate.

Most of the task associated with processing the raw acoustic survey data files have been split between the Herring Science Council (HSC) and Fisheries and Oceans Canada (DFO), as detailed in Power et al. (2012). At the framework assessment meeting held in January 2007, it was recommended that all raw data files should be made available on a regular basis for review prior to finalizing the acoustic biomass estimates (Power and Melvin 2008). In 2013 and 2014, as has been the case in previous years, all raw data files were received and the data was compared with the edited results before the final analysis was completed. The main reason for these comparisons is to check for target uncertainty, to distinguish fish from bottom and to examine interference/noise patterns. As a result of these examinations, some data problems were identified and resolved by re-editing the data for some vessels and for specific surveys. In a few cases, the bottom was not completely removed or some non-herring species were apparent.

Vessel noise/interference tests were again completed for each vessel outfitted with an acoustic recording system in 2013 and 2014 as part of the calibration process, and recommended speed or vessel revolutions per minute (RPM) levels were established. As a result of these efforts, the resulting raw data collected continues to have less background noise and was useable from all survey vessels. However, the appearance of sonar noise did occur on a few recordings and this resulted in more editing requirements.

LENGTH/WEIGHT RELATIONSHIP

Prior to 2001, the fish weight variable in the Target Strength (TS) equation (Table 3A and 3B) was estimated using a length/weight relationship developed from combined average monthly data for each area. TS was estimated using the generic clupeid equation from Foote (1987). A correction factor of 1.02 was also applied to each length measurement to account for the shrinkage of fish due to freezing, prior to calculating the length/weight relationship (Hunt et al. 1986). This relationship was then used to estimate the weight of a fish for a given length. The time window used to select data appropriate for individual surveys has been narrowed since 2001, to provide a more representative estimate of mean fish weight at the time of surveying.

Recent initiatives and continued collaboration with the processing plants have greatly improved sampling, such that it is now possible to obtain a significant number of detailed samples (length/weight data) within a nine -day window (four days prior to or after each of the surveys). These data are used to develop a weight/length relationship specific to each acoustic survey (Table 3A and 3B). The mean length of herring sampled during the night of the survey (or from landings of the previous night) and the calculated mean weight is then used to estimate TS specific to each survey period. When samples were not available, TS was estimated using values for an ‘average spawning fish’ at 28 cm in length with adjustment for sounder frequency as required.

INTEGRATION CALIBRATION FACTOR

In 2003, an option to account for the non-square waveform observed in a ball calibration was incorporated into the Hydroacoustic Data Processing Software (HDPS; Melvin et al. 2004). This approach is used by several acoustic manufacturers when calibrating their echo sounders. The effect of including a Calibration Integration Factor (CIF) to estimate backscatter in the integration process varies depending on the vessel's acoustic hardware. The multiplier for the factor, which is applied to the standard calibration, typically lies between 0.4 and 1.6, with 1.0 equivalent to an ideal square wave and thus requires no adjustment.

Given that the inclusion of the CIF is deemed to provide a more accurate estimate of biomass, it was recommended that all future analyses utilize the CIF to calculate absolute biomass (Melvin et al. 2004). However, when comparing observations from year to year, it was recommended that the comparisons be made between biomass estimates that exclude the adjustment, until a time series had been established with the CIF included. In Singh et al. (2014), for the 2011 and 2012 summary, results were presented using calculations with only the CIF. This is the case again in this document; all biomass estimates are presented using calculations with only the CIF unless otherwise noted. Recalculation of SSB estimates using the CIF for the years prior to the option (i.e., from 1999 to 2002) were completed in 2011/2012 and were presented at the 2013 Science Advisory Process (SAP) meeting (Melvin et al. 2014a). Those recalculated SSB estimates were included in Singh et al. (2014) and are presented again in this document.

ACOUSTIC SYSTEMS

As in previous years, acoustic data were collected in 2013 and 2014 using automated logging systems aboard commercial fishing vessels during both standard fishing excursions and structured surveys. The systems, which were activated whenever the captain wished to document observations, automatically saved all data to a hard drive. The data were downloaded at regular intervals prior to archiving, data editing and analysis.

A total of 20 automated acoustic logging systems (i.e., Femto Model DE9320, Simrad Model ES60 or Simrad Model ES70) were deployed on commercial fishing vessels in 2013. Systems from Femto Electronics were installed and calibrated aboard nine purse seine vessels: *Canada 100*; *Sealife II*; *Island Pride*; *Lady Janice II*; *Lady Melissa*; *Tasha Marie*; *Dual Venture*; *Lady Patricia*; and *Silver Harvester*. There were also four Simrad ES60 acoustic systems calibrated and used on the following purse seine vessels: *Margaret Elizabeth*; *Morning Star*; *Brunswick Provider*; and *Leroy & Barry II*. There were five Femto systems on the following inshore herring gillnet vessels: *Bradley K*; *Miss Owls Head*; *Kayla and Katrina*; *TBS*; *and Miracle.* There were two Simrad ES70 acoustic systems used on the inshore herring gillnet vessels *Atlantic Star* and *Eagle 8*. In 2013, the vessel *Miracle* was equipped with an acoustic logging system, but did not log any acoustic surveys.

In 2014, a total of 18 of automated acoustic logging systems (i.e., Femto Model DE9320 or Simrad Model ES60) were deployed on commercial fishing vessels. The *Island Pride* and *Lady Patricia* were not available. In 2014, the *TBS (Crabs R Us)* and *Miracle* were equipped with acoustic logging systems, but did not log any acoustic surveys. The *Lady Janice II*, *Sealife II* and *Lady Melissa* (after September 4) switched from a Femto Model DE9320 to a Simrad Model ES60 logging system. The *Eagle8* and the *Atlantic Star* switched from a Simrad Model ES70 to a Simrad Model ES60 logging system.

STRUCTURED SURVEYS

Structured surveys play an important role in the understanding of the 4WX herring stock. Structured surveys are defined as those surveys that follow the standard protocol described by

Melvin and Power (1999). Under this protocol, commercial vessels follow a series of randomly selected transects within a pre-defined area. The number of transects depends upon the number of vessels involved. Acoustic recording vessels are distributed throughout the survey area to provide representative coverage. The surveys conducted periodically throughout the spawning season are generally scheduled at two-week intervals. Flexibility is built into the process to allow for schedule changes and for investigation of areas of interest or uncertainty. Structured surveys were conducted on each of the major, and several of the minor, spawning grounds within 4WX, and additional recordings were made of both spawning and non-spawning aggregations during fishing night operations.

FISHING EXCURSIONS

Fishing nights are defined as those occasions when acoustic data are collected by fishing vessels equipped with automated acoustic logging systems during the search phase of a fishing excursion. Singh et al. (2014) provide more details on how and when data from fishing nights are used. No fishing night data were collected in 2013 and 2014.

RESULTS

The spawning biomass for individual components of the 4WX herring stock complex in 2013 and 2014 was estimated from industry collected data using multiple structured acoustic surveys on major spawning grounds (Figure 1). These surveys, when summed, provide an index of SSB and form the foundation for evaluation of stock status. The following text provides a summary of the 2013 and 2014 observations and SSB estimates for each of the main spawning components within the stock complex.

BAY OF FUNDY/SOUTHWEST NOVA SCOTIA (SWNS) SPAWNING COMPONENT

Biological Sampling for Maturity

The timing of surveys in relation to the residence time of spawning groups on the spawning grounds continues to be an issue of major concern. The current hypothesis for surveys on individual spawning grounds assumes that there is constant spawning on each ground over the season with individual spawning groups or waves continuously arriving, spawning and then leaving within 10-12 days (or less). Results of a study by Mevin et al. (2014b) indicate that between 13-19% of fish may remain on spawning grounds between surveys. This new information will have to be considered in a future framework review assessment meeting.

Sampling data for maturity supports the view of continuous spawning or waves with high proportions of ripe and running (Stage 6) fish observed over an extended period. The 10-14 day window between surveys also assumes that there will be no double counting and that the maturing (hard/Stage 5), as well as the spawning (Stage 6), fish in the samples will also have spawned and left before the next survey.

The samples from the standard biological sampling program conducted by staff at the St. Andrews Biological Station (SABS) provide data on individual fish for length, weight, sex, maturity stage, gonad weight, and age. These samples are collected from various sources including research surveys, tagging trips and acoustic surveys, and from landings at various fish processing plants. For comparison with the industry categorization, a modification to the SABS lab procedure to weigh all gonad stages was implemented in 2003. SABS samples were combined for female fish by day and percent numbers and percent weight by the categories determined. The fish processing plant classification system of maturity must not be confused with the standardized International Council for the Exploration of the Sea (ICES) scientific scale

of 1 to 8 (Parrish and Saville 1965), but the industry roe data can be compared with SABS data based on knowledge of the two methods. Analysis of the roe maturities was completed for the data available on an individual survey basis and is presented with the details for each survey area.

Spawning Ground Turnover Rates

The current acoustic survey method on spawning grounds is dependent on the assumption of periodic turnover of spawning fish. Acoustic surveys are required to be separated by at least 10-14 days to allow for turnover and to prevent double counting (Power et al. 2002). This aspect of the assessment method was the subject of investigation in 2001 and of intensive sampling for maturity stage since that fishing season. The results and application to the acoustic surveys are summarized by Melvin et al. (2002, 2003, and 2004), Power et al. (2005, 2006, 2007, and 2008) and by Power and Melvin (2010) and were used to assist in the evaluation of turnover timing and the inclusion or exclusion of specific acoustic surveys.

From 1998 to 2002, the Pelagics Research Council**/**Herring Science Council (PRC/HSC), in partnership with DFO, tagged herring on spawning grounds and on the major Nova Scotia over-wintering grounds. The information on tags returned from this study has been summarized by Waters and Clark (2005). Evidence from tagging experiments conducted in 1998 of ripe and running (spawning) herring showed that the residence time for most returns on the same grounds was less than 7-10 days; however, 25% of returns were captured on the same grounds after more than 10 days at large (Paul 1999). In contrast, a similar experiment in September 2001 on German Bank showed no recaptures after nine days on the same grounds during the same spawning season (Power et al. 2002). This latter result was complicated by a large decrease in fishing effort (and thus returns) during the second week after tagging.

In response to a recommendation from the 2005 regional advisory process review, tags were applied to herring on the spawning grounds of Scots Bay and German Bank (Clark 2007). The results from the tag returns indicated that some tagged herring remained on the spawning grounds for at least three weeks after tagging and, in some cases, up to 5-6 weeks after tagging. Thus, acoustic surveys that were spaced at 2-week intervals were surveying some of the same fish twice or possibly even three times.

These results may have serious implications in how the acoustic surveys are evaluated and used to determine stock status. Some preliminary analysis has been completed comparing three different approaches for the interpretation of the acoustic biomass estimates in an absolute sense (Power et al. 2006). The results showed that caution is warranted when employing the cumulative biomass estimates as absolute in any of the survey areas. The results also indicated that some proportion of herring remain in the survey area for three weeks or longer. However, these adjustments do not change the overall trends over time, but rather apply a scaling to the absolute amounts.

The framework assessment meeting in January 2007 determined that double counting does occur, but the extent has not been well determined (DFO 2007). However, it was still recommended to continue to do surveys at 10-14 day intervals to avoid double sampling. The timing/turnover issue was considered to be of highest importance for further study, which should include work on the duration of the maturation process, further tagging with more frequent intervals to estimate turnover rates and increased survey frequency to reflect maturity stage duration.

Melvin et al. (2014b) updated the tagging study on German Bank during the spawning period that was completed in 2011. Approximately 23,000 spawning herring were marked and released on German Bank during the 2009-2011 spawning season. This data was combined with data

from previous Scots Bay and German Bank tagging studies for the analysis. Overall, 13% of tagged fish in Scots Bay and 19% on German Bank were recaptured after two weeks. Regression analysis indicates a strong relationship between the days at large and the proportion of fish remaining on the bank. Corrections for the 2012 Scots Bay and German Bank spawning biomass for elapsed time reduced the biomass from 397,590t to 308,069t, or by 22.5%. A review of this study and its result should be conducted at the next framework review on, if and how, these data should be incorporated into the assessment. Incorporation will require adjustments also be made to the reference points that utilize acoustic biomass estimates.

Acoustic Surveys

Scots Bay

The Scots Bay herring purse seine fishery has been an important component of the summer fishery with catches since 1987, ranging from 1,000t to 24,400t during the period of early July to late August-early September (Power et al. 2010). In both 2013 and 2014, the Scots Bay purse seine fishery was again restricted to an industry imposed cap of 5,000t.

In 2013, purse seine landings in Scots Bay decreased to 4,702t (from 4,940t in 2012), with landing dates from June 24 to September 2. Those numbers decreased again in 2014 to 4,498t, with landing dates from June 23 to September 1. Most of the catches in 2013 and 2014 were located within the defined survey box area. Substantial catches also occurred outside the box either in Advocate Bay or into the upper part of Scots Bay, predominantly in 2013.

Sampling was adequate in 2013 and even better in 2014 with samples from most landings allowing detailed description of the size and maturity of fish captured (Figures 2A, 2B, 3A and 3B). Samples for gonad maturity showed the majority as maturing/hard (stage 5), particularly in 2014, as well as ripe and running (Stage 6) stages, particularly later in 2013 (Figure 3A and 3B). Some immature juvenile fish were also picked up from research bottom trawl samples collected in the area from March 13 to 17t in 2014. Detail HDPS outputs from each survey are provided in the Appendix.

2013 Scots Bay Acoustic Surveys

Seven structured surveys were conducted between June 22 and September 14 during the 2013 spawning season in Scots Bay (Table 2A) up from five done in 2012. The surveys were separated by a minimum of 12 days and covered the survey area.

Scots Bay Acoustic Survey #1: June 22, 2013

- This survey was conducted by seven vessels all with acoustic systems. The vessel *Brunswick Provider* did not turn on the logging recorder during the survey because no one onboard was familiar with the new system.
- Figure 4A shows the tracks of the vessels (excluding the *Brunswick Provider*) and the location of the fishery samples. Twenty one length frequency and five detailed samples were processed giving a mean size of 28.2 cm and a mean weight of 175 g (Figure 5A).
- Maturity analyses showed that 61% of the fish were Stage 5 “maturing” condition and 24% of the fish were in the Stage 6 “ripe and running” condition (Figure 3A).
- The initial analysis resulted in a biomass of 14,028t for the survey area of 732 km² using the standard TS.
- The biomass value was adjusted to 13,245t after edits to the files and using sample generated TS. Analysis by depth layer showed that 60% of the biomass was in the 0-10 m depth zone off the bottom (Figure 6A).

Scots Bay Acoustic Survey #2: July 6, 2013

- Eight vessels participated in this survey, all with acoustic systems. The vessel *Brunswick Provider* did not have the Global Positining System (GPS) on and deck sheets were kept only for the first line.
- Figure 7A shows the tracks of the vessels and the location of the fishery samples. Fourteen length frequency and one detailed sample plus samples from the CCGS *Alfred Needler* survey were used to generate the TS giving a mean size of 27.4 cm and a mean weight of 165 g (Figure 8A).
- Maturity analyses showed that 38% of the fish were Stage 5 “maturing” condition and 9% of the fish were in the Stage 6 “ripe and running” condition (Figure 3A).
- The initial analysis resulted in a biomass of 8,606t for the survey area of 904 km² using the standard TS.
- The biomass value was adjusted to 8,098t after edits to the files and using sample generated TS. Analysis by depth layer showed that 44% of the biomass was in the 0-10 m depth zone off the bottom (Figure 9A).

Scots Bay Acoustic Survey #3: July 21, 2013

- This survey was conducted by 10 acoustic survey vessels. The vessels conducted a broad scale systematic parallel transect survey. The vessel *Brunswick Provider* did not have the GPS on and deck sheets were incomplete. There was also acoustic interference in the data from the vessel *Canada 100*, so the data was excluded when it was not possible to remove the interference.
- Figure 10A shows the tracks of the vessels and the location of the fishery samples. Nineteen length frequency and four detailed samples were used to generate the TS giving a mean size of 27.2 cm and a mean weight of 162 g (Figure 11A).
- Maturity analyses showed that 19% of the fish were Stage 5 “maturing” condition and 80% of the fish were in the Stage 6 “ripe and running” condition (Figure 3A).
- The initial analysis resulted in a biomass of 11,548t for the survey area of 783 km² using the standard TS.
- The biomass value was adjusted to 11,949t after edits to the files and using the sample generated TS. Analysis by depth layer showed that 37% of the biomass was in the 0-10 m depth zone off the bottom (Figure 12A).

Scots Bay Acoustic Survey #4: August 3, 2013

- Nine vessels with acoustic systems participated in this survey. The vessel *Brunswick Provider* surveyed the north of the box while the vessel *Canada 100* surveyed the area east of the box. There was some acoustic interference in the *Canada 100* data from other acoustic devices and from turbulence interference, but this did not significantly affect the overall biomass estimate. There were minor edits for overlapping of transects.
- Figure 13A shows the tracks of the vessels and the location of the fishery samples. Seventeen length frequency and two detailed samples were used to generate the TS giving a mean size of 26.9 cm and a mean weight of 154 g (Figure 14).
- Maturity analyses showed that 50% of the fish were Stage 5 “maturing” condition and 50% of the fish were in the Stage 6 “ripe and running” condition (Figure 3A).
- The initial analysis resulted in a biomass of 10,058t using the standard TS for the survey area of 827 km².
- The biomass was adjusted to 9,759t after edits to the files and using two detailed samples to generate the TS. Analysis by depth layer showed that 31% of the biomass was in the 0-10 m depth zone off the bottom (Figure 15A).

Scots Bay Acoustic Survey #5: August 17, 2013

- Six vessels with acoustic systems participated in this survey with the vessel *Sealife II* surveying the area to the north of the box. There were minor edits where transects overlapped.
- Figure 16A shows the tracks of the vessels and the location of the fishery sample. Eight length frequency samples were available for the August 17 survey, however, only one detailed sample was available from August 19 (Figure 17A); thus, one detailed sample from August 5 was also used to generate the TS. The samples were used to generate the TS giving a mean size of 26.5 cm and a mean weight of 157 g.
- Maturity analyses showed that 57% of the fish were Stage 5 “maturing” condition and 43% of the fish were in the Stage 6 “ripe and running” condition (Figure 3A).
- The initial analysis resulted in a biomass of 15,218t using the standard TS for the survey area of 731 km².
- The biomass was adjusted to 15,068t after edits to the files and using the two detailed samples to generate the TS. Analysis by depth layer showed that 13% of the biomass was in the 0-10 m depth zone off the bottom (Figure 18A).

Scots Bay Acoustic Survey #6: August 31, 2013

- Four acoustic survey vessels participated resulting with eight transects within the survey box.
- Figure 19A shows the tracks of the vessels and the location of the fishery samples. Six length frequency samples were available for September 2 survey. Only one detailed sample was available for September 2 (Figure 20A) so the sample from August 19 was also used to generate the TS. The two detailed samples with a mean size of 26.7 cm and a mean weight of 159 g were used to generate the TS.
- Maturity analyses showed that 57.5% of the fish were Stage 5 “maturing” condition and 42.5% of the fish were in the Stage 6 “ripe and running” condition (Figure 3A).
- The initial analysis resulted in a biomass of 14,437t using the standard TS for the survey area of 680 km².
- The biomass was adjusted to 13,917t after edits to the files and using the two detailed samples to generate the TS. Analysis by depth layer showed that 23% of the biomass was in the 0-10 m depth zone off the bottom (Figure 21A).

Scots Bay Acoustic Survey #7: September 14, 2013

- Four acoustic survey vessels participated resulting in eight transects within the survey box. Figure 22 shows the tracks of the vessels.
- There was no fishing and no samples were available for TS adjustment so the standard TS was used in the final analysis.
- The initial analysis resulted in a biomass of 4,148t using the standard TS for the survey area of 483 km².
- After minor edits to the files and to the area, the resulting biomass using the standard TS was 4,181t. Analysis by depth layer showed that 10% of the biomass was in the 0-10 m depth zone off the bottom (Figure 23).

2013 Scots Bay Acoustic Surveys Summary

The seven structured surveys used in the biomass estimate were completed between June 22 and September 14, 2013. Except for the last survey, biological sampling was available from catches to calculate the TS for use in estimating the total biomass. The 2013 Scots Bay acoustic survey SSB estimate from the seven structured surveys within the survey box area (inbox) was 66,912t (with CIF). The total biomass estimate for areas surveyed outside of the

standard survey box in the Scots Bay area was 9,306t from surveys. The final 2013 Scots Bay acoustic survey estimate for all areas was 76,218t with CIF (Table 4A).

2014 Scots Bay Acoustic Surveys

Six structured surveys were conducted between June 21 and August 30 during the 2014 spawning season in Scots Bay (Table 2B). The surveys were separated by a minimum of 11 days and covered the survey area. The calibration of the vessel *Dual Venture* did not happen until later in the season as a result initial survey biomass estimates used last year's calibration for the *Dual Venture*. The vessel *Tasha Marie* was re-calibrated later in the season due to a problem with the earlier calibration and the calculation of the final biomass estimates use the new calibration file.

Scots Bay Acoustic Survey #1: June 21, 2014

- This survey was conducted by seven vessels all with acoustic systems. The vessel *Lady Janice II* did not log any data on its new system and the vessel *Morning Star*, through no fault of the crew, logged data using the incorrect pulse settings. In order to use the data from the *Morning Star* a correction of 3 dB was applied.
- Figure 4B shows the tracks of the vessels (excluding the *Lady Janice II*). Three length frequency and one detailed samples were processed giving a mean size of 27.5 cm and a mean weight of 166 g (Figure 5B).
- Maturity analyses showed that 73% of the fish were Stage 5 "maturing" condition and 25% of the fish were in the Stage 6 "ripe and running" condition (Figure 3B).
- The initial analysis resulted in a biomass of 72,766t for the survey area of 795 km² using the standard TS.
- The biomass value was adjusted to 57,552t after edits to the files and using sample generated TS. Analysis by depth layer showed that 76% of the biomass was in the 0-10 m depth zone off the bottom (Figure 6B).

Scots Bay Acoustic Survey #2: July 8, 2014

- This survey was conducted by seven vessels all with acoustic systems. The data analyses indicate that a single transect contributed heavily to the estimate.
- Figure 7B shows the tracks of the vessels and the location of the fishery samples. Sixteen length frequency and five detailed samples were processed giving a mean size of 25.7 cm and a mean weight of 134 g (Figure 8B).
- Maturity analyses showed that 68% of the fish were Stage 5 "maturing" condition and 15% of the fish were in the Stage 6 "ripe and running" condition (Figure 3B).
- The initial analysis resulted in a biomass of 121,249t for the survey area of 777 km² using the standard TS.
- The biomass value was adjusted to 106,927t after edits to the files and using sample generated TS. Analysis by depth layer showed that 90% of the biomass was in the 0-10 m depth zone off the bottom (Figure 9B).

Scots Bay Acoustic Survey #3: July 19, 2014

- This survey was conducted by six acoustic survey vessels. The vessels conducted a broad scale systematic parallel transect survey.
- Figure 10B shows the tracks of the vessels and the location of the fishery samples. Nineteen length frequency and four detailed samples plus samples from the CCGS *Alfred Needler* survey were used to generate the TS giving a mean size of 27.0 cm and a mean weight of 160 g (Figure 11B).

- Maturity analyses showed that 63% of the fish were Stage 5 “maturing” condition and 12% of the fish were in the Stage 6 “ripe and running” condition (Figure 3B).
- The initial analysis resulted in a biomass of 25,884t for the survey area of 695 km² using the standard TS.
- The biomass value was adjusted to 24,748t after edits to the files and using the sample generated TS. Analysis by depth layer showed that 45% of the biomass was in the 0-10 m depth zone off the bottom (Figure 12B).

Scots Bay Acoustic Survey #4: August 2, 2014

- Eight vessels with acoustic systems participated in this survey. The data from the vessel *Brunswick Provider* exhibited an unusual time stamp error that was partially repaired. The data analyses indicated that a single transect contributed heavily to the estimate. There were minor edits for overlapping of transects.
- Figure 13B shows the tracks of the vessels and the location of the fishery samples. Twenty length frequency and five detailed samples were used to generate the TS giving a mean size of 27.5 cm and a mean weight of 176 g (Figure 14B).
- Maturity analyses showed that 79% of the fish were Stage 5 “maturing” condition and 14% of the fish were in the Stage 6 “ripe and running” condition (Figure 3B).
- The initial analysis resulted in a biomass of 19,975t using the standard TS for the survey area of 781 km².
- The biomass was adjusted to 20,565t after edits to the files and using the samples to generate the TS. Analysis by depth layer showed that 60% of the biomass was in the 0-10 m depth zone off the bottom (Figure 15B).

Scots Bay Acoustic Survey #5: August 16, 2014

- Five vessels with acoustic systems participated in this survey. As a result, the area to the north of survey box was not surveyed.
- Figure 16B shows the tracks of the vessels and the location of the fishery samples. Ten length frequency and three detailed samples were used to generate the TS giving a mean size of 27.2 cm and a mean weight of 175 g (Figure 17B).
- Maturity analyses showed that 88% of the fish were Stage 5 “maturing” condition and 9% of the fish were in the Stage 6 “ripe and running” condition (Figure 3B).
- The initial analysis resulted in a biomass of 7,011t using the standard TS for the survey area of 690 km².
- The biomass was adjusted to 7,190t after edits to the files and using the detailed samples to generate the TS. Analysis by depth layer showed that 20% of the biomass was in the 0-10 m depth zone off the bottom (Figure 18B).

Scots Bay Acoustic Survey #6: August 30, 2014

- Three acoustic survey vessels participated, resulting with six transects within the survey box.
- Figure 19B shows the tracks of the vessels and the location of the fishery samples. Six length frequency and two detailed samples were used to generate the TS giving a mean size of 26.5 cm and a mean weight of 155 g (Figure 20B).
- Maturity analyses showed that 27% of the fish were Stage 5 “maturing” condition and 11% of the fish were in the Stage 6 “ripe and running” condition (Figure 3B).
- The initial analysis resulted in a biomass of 9,533t using the standard TS for the survey area of 700 km².

- The biomass was adjusted to 9,142t after edits to the files and using the two detailed samples to generate the TS. Analysis by depth layer showed that 23% of the biomass was in the 0-10 m depth zone off the bottom (Figure 20B).

2014 Scots Bay Acoustic Surveys Summary

The six structured surveys used in the biomass estimate were conducted between June 21 and August 30, 2014. In all instances, there was sufficient biological sampling from catches to calculate the TS for use in estimating the total biomass. The 2014 Scots Bay acoustic survey total SSB estimate from the five structured surveys within the survey box area (inbox) was 226,122t (with CIF). The total biomass estimate for areas surveyed outside of the standard survey box in the Scots Bay area was 4,808t from surveys. The final 2014 Scots Bay acoustic survey estimate for all areas was 230,930t with CIF (Table 4B).

German Bank

The German Bank herring purse seine fishery has been a major component of the summer fishery with catches since 1985, ranging from 9,000t to 36,000t during the overall fishery period of early May to late October (Power et al. 2010). As in the recent years, catches of spawning herring were occurring in localized groups seen in both the northern and southern (more southern than previous years) portions of the standard survey area on German Bank in 2013 (9,960t within the survey area) and to a lesser extent in 2014 (8,430t within the survey box).

In 2013, five surveys covering the survey box on German Bank occurred between August 19 and October 14 and two additional “mini” surveys on October 5 and October 21 (Table 2A). The mini surveys were excluded from the biomass totals because they were within 10 days of a previous survey. The time interval between surveys ranged from 12 to 15 days, and a total of 52 vessel nights of surveying were completed for the German Bank area (Table 3A). In addition to the acoustic recordings, visual observations from the sounder were recorded at 5-10 minute intervals on deck sheets for all vessels.

Five acoustic surveys were again conducted on German Bank during the 2014 season between August 12 and October 6 (Table 2B). Two additional surveys also occurred on September 11 and September 24 (Table 2B). These surveys were excluded from the biomass totals because they occurred within 10 days of another survey. The time interval between surveys ranged from 10 to 18 days, and a total of 46 vessel nights of surveying were completed for the German Bank area (Table 3B). As in 2013, in addition to the acoustic recordings, visual observations from the sounder were recorded at 5-10 minute intervals on deck sheets for some vessels.

In both 2013 and 2014, fish samples for maturity indicated that mature spawning herring (Stages 5-6) dominated samples collected (Figures 24A and 24B). Immature juvenile herring were collected in the spawning box area by the CCGS *Alfred Needler* between July 29 and August 14 in 2013 (Figure 24A). There was a corresponding decrease in the mean length for those dates (Figure 25A). Pre-spawning herring of less than 23 cm (which is the approximate size of 50% maturity for first spawning in this stock) account for less than 10% of the total sample except between July 31 and August 13; and between September 19 and October 4. Similarly, in 2014, there was a high percentage of Stages 1-2 “immature” fish and herring of less than 23 cm in length collected between May 14 and August 4 (Figure 24B and 25B). A high frequency of “immature” or less than 23 cm in length was not seen throughout the remainder of the sampling season from May 14 and September 29 (Figure 24B and 25B). Overall pre-spawning were infrequent in 2013 and 2014 but were occasionally high, indicating there was a mixture of juvenile and adult fish available on the grounds on some occasions. Detail HDPS outputs from each survey are provided in the Appendix.

2013 German Bank Acoustic Surveys

Five structured surveys were conducted between August 19 and October 14 during the 2013 spawning season in German Bank compared to six done in 2012 (Table 3A). The surveys were separated by a minimum of 12 days and covered the survey area. Two additional "mini" surveys conducted on October 5 and October 21 were excluded from the biomass totals because they were within 10 days of a previous survey.

German Bank Acoustic Survey #1: August 19, 2013

- Eight acoustic survey vessels participated in this survey with 12 transects within the survey box and four outside. Figure 29A shows the tracks of the vessels and the location of the fishery samples.
- 13 length frequency and one detailed sample were collected near the August 19 acoustic survey with a mean length of 27.1 cm and a mean weight of 162 g (Figure 30A). However, since no significant difference between the detailed sample data from August 20 and those on September 4 and 5, the data was combined in the calculation of TS.
- Maturity analyses showed that 31% of the fish were Stage 5 "maturing" condition and 63% of the fish were in the Stage 6 "ripe and running" condition (Figure 24A).
- The initial estimate using the standard TS was 54,087t. The final estimate was adjusted to 53,509t after edits to the files and using sample generated TS, including one sample from each of August 20, September 4 and 5.
- Analysis by depth layer for transects within the survey box area showed 23.9% of the total area backscattering strength (Sa) was found within the first 20 m off bottom (Figure 31A).

German Bank Acoustic Survey #2: September 3, 2013

- This survey was conducted by eight acoustic vessels completing 14 transects and identifying one main area of fish aggregation (Figure 32A). There was acoustic interference in the recordings of the *Duel Venture* while the *Sealife II* had a hardware failure and was unable to participate, resulting in a gap in the transect spacing.
- There were 11 fishery samples available for September 4 and two detailed samples giving a mean length of 27.0 cm and a mean weight of 158 g (Figure 33A).
- Maturity analyses showed that 23% of the fish were Stage 5 "maturing" condition and 74% of the fish were in the Stage 6 "ripe and running" condition (Figure 24A).
- Initial analysis was resulted in an estimate of 133,470t biomass for the entire survey area using standard TS. Analysis following edits and revised sample TS resulted in a total biomass of 118,088t within the area surveyed. The inbox area coverage of 646 km^2 gave a biomass of 112,241t and the outbox area of 142 km^2 a biomass estimate of 5,847t.
- Layer analysis showed 89.8% of the total area backscattering strength (Sa) was found within the first 20 m off bottom (Figure 34A).

German Bank Acoustic Survey #3: September 17, 2013

- Nine acoustic survey vessels participated in this survey with 14 transects within the survey box and four outside. Figure 35A shows the tracks of the vessels and the location of the fishery samples.
- Seven length frequencies and three detailed samples taken on September 4, 5 and 28 were used to generate the TS with a mean length of 24.4 cm and a mean weight of 110 g (Figure 36). Samples indicate that approximately 19.5% of the biomass was made up of juveniles.
- Maturity analyses showed that 23% of the fish were Stage 5 "maturing" condition and 74% of the fish were in the Stage 6 "ripe and running" condition (Figure 24A).
- The initial estimate using the standard TS was 55,695t. The final estimate was adjusted to 37,906t after edits to the files, using sample generated TS and adjusting for juveniles.

- Analysis by depth layer for transects within the survey box area showed that 89.6% of the total area backscattering strength (Sa) was found within the first 20 m off bottom (Figure 37).

German Bank Acoustic Survey #4: September 29, 2013

- Seven acoustic survey vessels participated in this survey with 14 transects within the survey box and three outside. Tracks started within the box and ended outside the box. Figure 38A shows the tracks of the vessels and the location of the fishery samples.
- Four length frequencies and three detailed samples taken on September 4, 5 and 28 were used to generate the TS with a mean length of 25.1 cm and a mean weight of 127 g (Figure 39A).
- Maturity analyses showed that 23% of the fish were Stage 5 "maturing" condition and 74% of the fish were in the Stage 6 "ripe and running" condition (Figure 24A).
- The initial estimate using the standard TS was 57,465t. The final estimate was adjusted to 48,419t after edits to the files and using sample generated TS.
- Analysis by depth layer for transects within the survey box area showed 91.4% of the total area backscattering strength (Sa) was found within the first 20 m off bottom (Figure 40A).

German Bank "mini" Acoustic Survey #4a: October 5, 2013

- This "mini" survey was conducted by 10 acoustic vessels in the southern end of the survey box covering only a small portion of the box (Figure 38B). Transects started inside and ended outside the box. Although the lines were mostly straight only one boat encountered significantly high biomass. A couple of boats did not complete straight lines.
- The initial estimate using the standard TS was 36,481t over a survey area of 140 km^2. However, because this survey was conducted too close to the date of the previous one done on September 29, it was excluded from the total biomass estimate for German Bank.

German Bank Acoustic Survey #5: October 14, 2013

- Six acoustic survey vessels participated in this survey with 10 transects within the survey box and two outside. The vessel *Leroy & Barry II* left its transect to document a school of fish that was actually across the original transect. Given this, some edits were made to account for fish it would have encountered had it stayed on the transect. Figure 41A shows the tracks of the vessels and the location of the fishery samples.
- One length frequency and three detailed samples taken on September 4, 5 and 28 were used to generate the TS with a mean length of 26.7 cm and mean weight of 153 g (Figure 42).
- Maturity analyses indicated that 23% of the fish were Stage 5 "maturing" condition and 74% of the fish were in the Stage 6 "ripe and running" condition (Figure 24A).
- The initial biomass estimate of 7,559t using the standard TS was adjusted to 6,606t after edits to the files using sample generated TS.
- Analysis by depth layer for transects within the survey box area showed 30.1% of the total area backscattering strength (Sa) was found within the first 20 m off bottom (Figure 43A).

German Bank "mini" Acoustic Survey #5a: October 21, 2013

- This "mini" survey was conducted by four acoustic vessels in the southern end of the survey box covering only a small portion of the box (Figure 41B). Transects started inside and ended outside the box.
- The initial biomass estimate was 623t using the standard TS. However, because this survey was conducted too close to the date of the previous one done on October 14, it was excluded from the total biomass estimate for German Bank.

2013 German Bank Acoustic Surveys Summary

Five structured surveys conducted between August 19 and October 14 were used to determine a spawning biomass estimate of 253,921t within the survey box and 10,606t outside the box. This resulted in an overall survey biomass of 264.527t. The September 17 survey (#3) was adjusted for the presence of 16% juveniles (Table 5A).

2014 German Bank Acoustic Surveys

Five structured surveys were conducted between August 12 and October 16 during the 2014 spawning season in German Bank (Table 3B). The surveys were separated by a minimum of 10 days and covered the survey area. Two additional surveys conducted on September 11 and September 24 were excluded from the biomass totals because they were within 10 days of a previous or a later survey with a larger biomass estimate.

German Bank Acoustic Survey #1: August 12, 2014

- Eight acoustic survey vessels participated in this survey with 13 transects within the survey box and three outside. Figure 26 shows the tracks of the vessels and the location of the fishery samples. The data analyses indicate that a single transect contributed heavily to the estimate.
- Sixteen length frequency and four detailed samples were used to generate the TS with a mean length of 27.3 cm and a mean weight of 177 g (Figure 27).
- Maturity analyses showed that 65% of the fish were Stage 5 “maturing” condition and 4% of the fish were in the Stage 6 “ripe and running” condition (Figure 24B).
- The initial analysis resulted in a biomass of 52,730t using the standard TS for the survey area of 842 km².
- The biomass was adjusted to 51,496t after edits to the files and using the samples to generate the TS. Analysis by depth layer showed that 18.6% of the biomass was found within the first 20 m off bottom (Figure 28).

German Bank Acoustic Survey #2: August 25, 2014

- This survey was conducted by eight acoustic vessels completing 16 transects and identifying one main area of fish aggregation (Figure 29B). A failure in navigation of the vessel *Lady Melissa* required that its position be regenerated from deck sheets. The data analyses indicated that a single transect contributed heavily to the estimate.
- There were sixteen fishery samples available for August 25 and six detailed samples giving a mean length of 27.6 cm and a mean weight of 176 g (Figure 30B).
- Maturity analyses showed that 78% of the fish were Stage 5 “maturing” condition and 17% of the fish were in the Stage 6 “ripe and running” condition (Figure 24B).
- Initial analysis resulted in an estimate of 73,899t biomass for the entire survey area using standard TS. Analysis following edits and sample TS resulted in a total biomass of 70,385t within the area surveyed. The inbox area coverage of 646 km^2 gave a biomass of 70,290t and the outbox area of 194 km^2 a biomass estimate of 95t.
- Layer analysis showed 53.3% of the total area backscattering strength (Sa) was found within the first 20 m off bottom (Figure 31B).

German Bank Acoustic Survey #3: September 8, 2014

- Eight acoustic survey vessels participated in this survey with 13 transects within the survey box and three outside. There was a failure in the recording in one transect conducted by the vessel *Lady Janice II* resulting in a gap in that transect. The data analyses indicated that a single transect contributed heavily (~75%) to the estimate.

- Figure 32B shows the tracks of the vessels and the location of the fishery samples. Ten length frequencies and three detailed samples taken on September 8 were used to generate the TS with a mean length of 26.9 cm and a mean weight of 164 g (Figure 33B).
- Maturity analyses showed that 80% of the fish were Stage 5 “maturing” condition and 9% of the fish were in the Stage 6 “ripe and running” condition (Figure 24B).
- The initial analysis resulted in a biomass of 84,213t using the standard TS for the survey area of 840 km².
- The biomass was adjusted to 79,349t after edits to the files and using the detailed samples to generate the TS. Analysis by depth layer showed that 68% of the biomass was found within the first 20 m off bottom (Figure 34B).

German Bank Acoustic Survey #3a September 11, 2014

- Six acoustic survey vessels participated in this survey with six transects covering the entire survey box and eight only covering about one-thirds of the box in the southern end (Figure 35B). Use of sonar could also have caused a reduction in the survey biomass estimate.
- The initial estimate using the standard TS was 58,041t. The final estimate was not calculated because survey #3 had a larger biomass estimate and was conducted only three days before.

German Bank Acoustic Survey #4: September 24, 2014

- This survey was conducted by six acoustic vessels with six transects running the length of the box. An additional six transects in the southern end of the survey box covered only about a third of the length of the box (Figure 38C). Although the lines were mostly straight only one boat encountered significantly high biomass.
- The initial estimate using the standard TS was 11,274t over a survey area of 232 km^2. However, because this survey was conducted close to the date of the next one done on September 26 it was excluded from the total biomass estimate for German Bank.

German Bank Acoustic Survey #4a September 26, 2014

- Five acoustic survey vessels participated in this survey with 10 transects in the lower west corner of the survey box. Transects only covered about half the length of the survey box. The use of sonars on three of the vessels reduced the quality of the data. Figure 38D shows the tracks of the vessels and the location of the fishery samples.
- Eight length frequency and three detailed samples taken on September 25, 26 and 29 were used to generate the TS with a mean length of 25.9 cm and a mean weight of 304 g (Figure 39B).
- Maturity analyses showed that 52% of the fish were Stage 5 “maturing” condition and 10% of the fish were in the Stage 6 “ripe and running” condition (Figure 24B).
- The initial biomass estimate of 11,840t over a survey area of 128 km^2 using the standard TS was adjusted to 10,510t after edits to the files using sample generated TS.
- Analysis by depth layer for all transects showed 75.4% of the total area backscattering strength (Sa) was found within the first 20 m off bottom (Figure 40B).

German Bank Acoustic Survey #5: October 6, 2014

- Five acoustic survey vessels participated in this survey with 10 transects in the survey box. One transect only covered about half the length of the survey box. A very short strong echo on one of the transects added approximately 2000t to the initial estimate. It was believed to be a diving whale and was excluded from the final analysis. Figure 41C shows the tracks of the vessels during the survey.

- The initial biomass estimate of 23,249t over a survey area of 545 km^2 using the standard TS was adjusted to 21,294t after edits to the files and using the default TS since there were no samples.
- Analysis by depth layer for all transects showed 25% of the total area backscattering strength (Sa) was found within the first 20 m off bottom (Figure 43B). This distribution is not typical of spawning fish, but this could not be confirmed due to the absence of samples.

2014 German Bank Acoustic Surveys Summary

In 2014, five structured surveys conducted between August 12 and October 6 were used to determine a spawning biomass estimate of 230,252t within the survey box and 2,782t outside the box. This resulted in an overall survey biomass estimate of 233,034t.

Spectacle Buoy

The spring gillnet fishery for roe has usually occurred for a short period in June in the vicinity of Spectacle Buoy located just southwest of Yarmouth, Nova Scotia. The fishery is dependent upon the availability of fish and to some extent market conditions, and may or may not occur in any given year. In previous years, herring in this area were believed to have occurred in greater abundance in late May to early June, and it is assumed the surveys had missed the majority of fish. In 2013 and 2014, there were no reported catches (Table 6). There were also no surveys conducted in 2013 and 2014 in the Spectacle Buoy area (Table 6).

Trinity Ledge

As pointed out in Power et al. (2007), acoustic surveys of spawning herring on Trinity Ledge has been less than optimal, and it is unlikely that biomass estimates accurately reflect the abundance of fish in the area. Additionally, a major source of uncertainty in the total biomass estimate continues to be the assumption that the surveys are simply additive and a reduced biomass could be a reduced effort in surveying.

Maturity samples in 2013 indicated that there were immature fish present throughout the sampling period from June 17 to September 16 (Figure 44A). There were, however, a large percentage of Stages 3, 4 and 5 “maturing/hard” fish with two samples August 12 and 14 being composed predominantly of Stage 6 “ripe and running” fish (Figure 44A). In 2014, maturity sampling on Trinity Ledge took place between May 14 and October 16 (Figure 44B). Unlike 2013, there were very few Stage 6 “ripe and running” fish present in any sample and the samples were predominantly composed of immature fish with a few exceptions. In general, the length frequency samples (Figure 45A and Figure 45B) are aligned with the maturity samples. In 2014, the majority of samples collected are less than 23 cm indicating pre-spawning herring. In comparison in the 2013 samples, the majority of fish less than 23 cm occurred in only two samples on August 17 and September 16, respectively.

In 2013, catches amounted to 99t recorded from August 13 to September 18 (Table 6) and the total overall survey biomass estimate was 950t from two surveys conducted on August 12 (921t; see Figure 46A for transects, Figure 47 for multi-panel sample details and Figure 48A for the analysis by depth layer of transects), and September 16, 2013 (see Figure 49A for transects, and Figure 50A for the analysis by depth layer of transects). In 2014, catches amounted to 123t recorded from August 12 to September 30 (Table 6) and the total overall survey biomass estimate was 4,772t from two surveys conducted on August 26 (1,252t; see Figure 46B for transects, and Figure 48B for the analysis by depth layer of transects) and September 10 (3,520t; see Figure 49B for transects, and Figure 50B for the analysis by depth layer of transects). Tables 7A and 7B show details of the biomass estimates for the survey transects conducted in 2013 and 2014. Figure 51 shows the catches and the survey biomass estimates

from 1998 to 2014 for Trinity Ledge. Detail HDPS outputs from each survey are provided in the Appendix.

2013 Trinity Ledge Acoustic Surveys

In 2013, there were two surveys on Trinity Ledge, one on August 12 and a second on September 16. One multi-panel sample was collected on August 12.

Trinity Ledge Acoustic Survey #1 August 12, 2013

- One acoustic vessel, the *Kayla and Katrina*, completed this survey (Figure 46A). The survey was not considered optimal since the survey protocol was not followed; however, there were some parallel lines over one aggregation covering an area of 0.13 km². The initial biomass estimate was 1,025t using the standard TS.
- One multi-panel gillnet sample was collected in the nearby area by the *Kayla and Katrina* on August 12 and one commercial sample was collected on August 14 from the *Whispering Sea*. Maturity analyses showed that 8% of the fish were Stage 5 "maturing" condition and 81% of the fish were in the Stage 6 "ripe and running" condition (Figure 44A). The resulting sample generated TS with a weighted mean length 26.8 cm (Figure 47) was used to estimate the biomass after minor edits to the files giving a biomass of 921t.
- Analysis by depth layer for transects showed 93% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 48A).

Trinity Ledge Acoustic Survey #2 September 16, 3013

- One acoustic vessel, the *Kayla and Katrina*, completed this survey (Figure 49A). The survey was not considered optimal since the survey protocol was not followed, however, there were some parallel lines over three aggregations and these were used to estimate a biomass of 36t using the standard TS. After review and edits the biomass was adjusted to 29t using the standard TS since there was no multi-panel samples taken.
- Analysis by depth layer for transects showed 100% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 50A).

2014 Trinity Ledge Acoustic Surveys

In 2014, there were two acoustic surveys completed on Trinity Ledge, one on August 26 and the other on September 10. No multi-panel sample was collected.

Trinity Ledge Acoustic Survey #1 August 26

- One acoustic vessel, the *Kayla and Katrina*, completed this survey (Figure 46B). There were only four parallel lines over one aggregation covering an area of 0.14 km². The initial biomass estimate was 1,347t using the standard TS. After edits to the files and using the standard TS the biomass was estimated to be 1,252t.
- Analysis by depth layer for transects within the survey box area showed 99% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 48B).

Trinity Ledge Acoustic Survey #2 September 10

- This survey was conducted by one acoustic vessel, the *Kayla and Katrina* (Figure 49B).The vessel conducted a fine scale systematic parallel transect survey. This survey could have been improved by concentrating six equally spaced parallel lines in the school with only the outer two lines showing little to no fish. The initial biomass estimate was 3,532t using the standard TS and covering an area of 0.25 km². After edits to the files and using the standard TS the biomass was estimated to be 3,520t.
- Analysis by depth layer for transects within the survey box area showed 100% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 50B)

Browns Bank

There was no survey activity on Browns Bank in 2013 or 2014. There was limited fishery catches of 36t around Browns Bank in 2013.

Seal Island

Historically, the spawning areas around Seal Island made a significant contribution to the biomass of the Bay of Fundy/SWNS stock complex. The abundance of herring and the documentation of spawning fish in this area have been intermittent. In addition, little fishing has occurred in these shallow grounds, partly as a result of the deep purse seines that are now being employed, which are unsuitable for fishing these areas. Catches in 2013 were nearly 1t and 19t in 2014

No survey was conducted in the area in 2013 or 2014.

Bay of Fundy/Southwest Nova Scotia (SWNS) Summary

Since 1997, biomass estimates determined from acoustic surveys have been used to evaluate the status of the Bay of Fundy/SWNS component of the 4WX herring stock complex. During this time, the approach for estimating SSB has evolved to rely on structured surveys scheduled at two-week intervals. Since 1999, spawning areas were defined and survey protocols were established to make the estimates more representative of the actual SSB rather than a minimum observed value. This required a series of surveys that covered most of the spawning area on each of the spawning grounds during the defined spawning season.

The SSB for the Bay of Fundy/SWNS component of the 4WX herring stock complex in 2013 and 2014 were determined from industry based acoustic surveys of the three major spawning components: Scots Bay; Trinity Ledge; and German Bank. Historical timing of surveys and biomass estimates for Scots Bay and German Bank are presented in Figures 52 and 53. There were no structured surveys conducted outside these three major spawning areas in the Bay of Fundy/Southwest Nova Scotia component. There was, however, limited catches around Browns Bank in 2013 (36t), Seal Island in 2014 (19t), and Gannet, Dry Ledge in both 2013 and 2014 (14t and 54t, respectively). No fishing or surveying were done in 2013 or 2014 in the Spectacle Buoy area.

The 2013 and 2014 acoustic results provide estimates of herring present at the time of surveying when conducted according to the survey design. A major source of uncertainty continues to be the assumption that the surveys are simply additive. If herring do not move on and off the spawning grounds in waves with a short period of time (days) between the waves, the estimate of total SSB will be significantly biased upward due to double counting. The issue of turn-over time and potential overlap (multiple counting) was evaluated at DFO science peer review meetings in 2006/07 (DFO 2007), and the 10-14 day time period between surveys was considered reasonable at that time, but required further investigations. The investigation into turnover using tagging studies was presented by Maxner et al. (2010), which summarized the 2010 German Bank turn-over tagging experiment results. Melvin et al. (2014b) presented further data and analyses on these studies. Corrections for the spawning biomass estimates for elapsed time reduced the biomass by 22.5%. A review of this study and its result should be conducted at the next framework review on, if and how, this data should be incorporated into future assessments of the 4WX herring stock complex. Incorporation will require adjustments also be made to the reference points that utilize acoustic biomass estimates.

The SSB for Scots Bay reached a high of 216,000t in 2001, showed a major decline in 2005 (Table 8, Figure 54), likely due in part to the excessive catches of 2004 and 2005 (Power et al. 2010). Since the low in 2005, Scots Bay has shown a slight improvement increasing from

21,200t to 52,700t in 2007. In 2008, there was a substantial decline with an area estimate of 23,400t (Table 8). In 2009, the surveyed biomass increased to 87,700t, but declined again in 2010 to 54,000t. In 2011, there was a three-fold increase in the SSB to 140,700t and a further increase to 184,800t in 2012 taking the SSB to above the long term average. In 2013 there was another substantial decline with a biomass estimate of less than half of the previous year, 76,218t. The surveyed biomass, however, increased in 2014 to a new high of 230,930t (Figure 54).

The total German Bank biomass was estimated to be 264,527t in 2013 and 233,034t in 2014. Structured surveys used in the estimation covered the period from August 19 to October 14 in 2013 and August 19 to October 06 in 2014 (Table 5). Since 2011, the German Bank spawning biomass estimate has decreased at an average annual rate of 8% (22,489t; Table 8). The SSB for the last three years remain below the long term average (Figure 54).

The total spawning biomass observed on Trinity ledge decreased in 2013 (950t from 2,754t in 2012 and 7,316t in 2011), and increased five-fold in 2014 (4,772t) both of which are below the long term average (1999-2014) of 6,357t (Table 8). In both years, only two acoustic surveys were conducted by one vessel the *Katrina and Kayla*; however, several trips to search for fish were conducted but no schools of significant amounts were found.

Trinity Ledge once supported a large spawning component and fishery within the 4WX stock complex. As such, given the fact that the observed biomass is still low, any fishing on Trinity Ledge must strictly adhere to the "survey, assess, and then fish" protocol during the upcoming spawning season. This means that no fishing should occur until sufficient quantities of herring are observed to allow for removals. Alternatively, given the slow rate of recovery, consideration should also be given to complete closure until a significant increase in spawning biomass is observed.

Surveys around Spectacle Buoy are intermittent and only occur when herring are found in the area. There were three (two considered acceptable) surveys in 2010 with a biomass estimate of 1,859t and only one in 2011 with a biomass estimate of 282t. No other survey has been conducted between 2012-2014 (Table 6).

The lowest total SSB for the Bay of Fundy/SWNS spawning complex in the time series was estimated to be 264,900t in 2008 (Table 8; Figure 54). Since 1999, the total SSB has fluctuated between 264,900t and 576,700t. While the 2010 estimated biomass was the third lowest in the time series at 312,100t, the estimates in 2011 and 2012 tended upwards (448,8001t in 2011 and 476,000t in 2012) being at or above the long term average. This represents an increase of 44% from 2010 to 2011 and an increase of 16% from 2011 to 2012. A substantial decrease in the overall Bay of Fundy/SWNS stock area biomass estimate was observed in 2013 (341,694t), with the estimate returning to slightly above the long term average in 2014 (468,736t). It is evident that most of the recent fluctuation in the Bay of Fundy/SWNS spawning complex is occurring in the Scots Bay area despite the industry imposed catch restriction of 5,000t in Scots Bay. Caution should also be observed in the German Bank area as a result of a trending decline over the previous 4 years in the estimated biomass.

COASTAL NOVA SCOTIA SPAWNING COMPONENT

The shallow inshore waters of the bays and inlets along the Atlantic coast of Nova Scotia support a number of herring spawning populations. Several documents describe reports of coastal spawning in 4VWX (Clark et al. 1999; Crawford 1979). Direct knowledge of these relatively small coastal populations is limited to a few areas where there are active commercial fisheries for roe on spawning grounds. A traditional fishery for lobster bait occurs in the spring and summer of the year. In the fall, commercial roe fisheries have been conducted in three

areas of the Nova Scotia coastal stock component: Port Mouton/Little Hope; Halifax/Eastern Shore; and Glace Bay. Surveys of the spawning grounds were undertaken using the structured acoustic survey approach. No structured acoustic survey occurred in Glace Bay in 2014.

The results for each spawning area presented below are calculated only with the CIF, which is considered to provide a more accurate representation of biomass. This method of calculation has been applied since 2003 and can now be used for the consistent calculation of five year averages, which are used to establish beginning of year allocations for each area. Detail HDPS outputs from each survey are provided in the Appendix.

Little Hope/Port Mouton Surveys

2013 Little Hope/Port Mouton Acoustic Surveys

The 2013 herring gillnet fishery in Little Hope/Port Mouton area began on June 1 and extended to October 31. The total catch of 2,499t in 2013 represents an increase from the 2,150t in 2012 (Figure 56), with the majority of the catch occurring between September 16 and October 19 (Figure 57A). The catches occurred in three main areas: east of Port Mouton; southeast of Port Morton; and east of Liverpool (Figure 58A). For the acoustic surveys, the lines were not predefined by a survey design, rather were conceived based on the best coverage of the aggregations using equally spaced parallel lines. Overall in 2013, four acoustics surveys were conducted in the Little Hope/Port Mouton area between September 19 and October 21 (Table 9A). All data were downloaded from the two boats with acoustic recorders and, after editing to remove the bottom and non-herring targets, the acoustic files were cut into transects for each survey.

Given that multi-panel gillnet sampling was not used for all surveys to sample the acoustic targets in 2013, the samples that were taken closest to the survey dates were used to estimate biomass from the backscatter. Length frequency and biological samples from the commercial catch were only used to confirm the size and maturity of herring in the area (Figures 59A and 60A). Industry is encouraged to deploy multi-panel gillnets to obtain samples whenever acoustic surveys are conducted.

Little Hope Acoustic Survey #1 - September 19, 2013

- This survey was conducted by two acoustic survey vessels, the *Eagle 8* and the *Atlantic Star* on September 19 (Figure 61A). The vessels conducted a fine scale systematic parallel transect survey of multiple schools. One school was surveyed on three passes and as a result only the pass with the highest biomass estimate was used in the total biomass estimate. A biomass estimate of 15,091t using the standard TS was initially determined.
- One multi-panel gillnet sample was taken on September 19. Maturity analyses showed that 21% of the fish were Stage 5 “maturing” condition and 75% of the fish were in the Stage 6 “ripe and running” condition (Figure 59A). The resulting sample with a weighted mean length 27.2 cm was used to generate the TS (Figure 62A). The biomass estimate after minor edits to the files was 13,713t.
- Analysis by depth layer for transects within the survey box area showed 67.3% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 63A).

Little Hope Acoustic Survey #2 – September 29, 2013

- This survey was conducted by two acoustic survey vessels, the *Eagle 8* and the *Atlantic* Star on September 29 (Figure 64A). The vessels conducted a fine scale systematic parallel transect survey of multiple schools. This survey could have been better if protocol was more closely followed. In particular, the *Eagle 8* did a grid that missed the school almost entirely even with horizontal and vertical transects because the protocol was not followed.

- The initial biomass estimate using standard TS was 4,141t. Since there was no multi-panel gillnet sample collected, the sample from September 21 (Figure 62A) was used instead to generate the TS and this resulted in a biomass estimate of 3,878t. One school was surveyed twice by the *Atlantic Star* and the pass with the lower biomass was excluded from the final estimate.
- Analysis by depth layer for transects within the survey box area showed 95.8% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 66A).

Little Hope Acoustic Survey #3 – October 10, 2013

- This survey was conducted by two acoustic survey vessels, the *Eagle 8* and the *Atlantic Star* on October 10 (Figure 67A). The vessels conducted a fine scale systematic parallel transect survey of four schools. The *Eagle 8* surveyed one school many times but only one grid was considered good for the survey. The resulting biomass estimate using the standard TS was 39,629t.
- One multi-panel gillnet sample was taken on October 11 by the vessel *Fan-a-See*. Maturity analyses showed that 14% of the fish were Stage 5 “maturing” condition and 83% of the fish were in the Stage 6 “ripe and running” condition (Figure 59A). The multi-panel gillnet sample also showed that 10% of the fish in the sample were juveniles. Using the sample with a weighted mean length of 25.5 cm (Figure 68A) to generate a TS and a correction for the juveniles resulted in the biomass estimate being adjusted to 30,602t.
- Analysis by depth layer for transects within the survey box area showed 72.8% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 69A).

Little Hope Acoustic Survey #4 - October 21, 2013

- This survey was conducted by two acoustic survey vessels, the *Eagle 8* and the *Atlantic Star* on October 21 (Figure 70A). The vessels conducted a fine scale systematic parallel transect survey of four schools. Both vessels did an excellent job of surveying the aggregations. The resulting biomass estimated using the standard TS was 33,717t.
- There was no multi-panel sample taken for this survey, as a result the sample taken on October 11 was used instead since it occurred directly where one of the schools was surveyed. As in the October 10 survey (Figure 68A), this resulted in a juvenile adjustment of 10%. The adjusted biomass estimate was 26,339t.
- Analysis by depth layer for transects within the survey box area showed 67.4% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 70A).

2013 Little Hope Summary

In 2013, four acoustic surveys were conducted in the Little Hope/Port Mouton spawning box over the traditional spawning period. The standard protocol for surveying spawning herring of allowing 10-14 days between surveys was followed in order to avoid double counting that may have remained from the previous surveys. Only two multi-panel gillnet deployments were conducted in 2013 to collect representative samples of herring being surveyed to better estimate the TS; as such, each multi-panel gillnet sample estimated TS was used for two acoustic surveys. The total spawning biomass for the Little Hope area for 2013 was taken as the sum of the four surveys (Table 9A). The total spawning biomass estimate was 74,532t. This represents a substantial increase in the spawning biomass estimate over the four year low in 2012 of 12,756t (Table 13B; Figure 72).

2014 Port Mouton/Little Hope Acoustic Surveys

The 2014 herring gillnet fishery in Little Hope/Port Mouton area began on May 31 and extended to October 31. The total catch of 3,596t in 2014 represents an increase from the 2,499t in 2013

(Figure 56), with the majority of the catch occurring between September 17 and October 8 (Figure 57B). Unlike 2013, the catches occurred in one main area, east of Port Mouton, and only minimal catches occurred southeast of Port Morton and east of Liverpool (Figure 58B). Overall in 2014, four acoustics surveys were conducted in the Little Hope/Port Mouton area between September 20 and October 25. All data were downloaded from the two boats with acoustic recorders and, after editing to remove the bottom and non-herring targets, the acoustic files were cut into transects for each survey.

Given that multi-panel gillnet sampling was not used for all surveys to sample the acoustic targets in 2014, the samples that were taken closest to the survey dates were used to estimate biomass from the backscatter. Length frequency and biological samples from the commercial catch were only used to confirm the size and maturity of herring in the area (Figures 59B and 60B).

Little Hope Survey # 1 – September 22, 2014

- This survey was conducted by two acoustic survey vessels the *Eagle 8* and the *Atlantic Star* on September 20 (Figure 61B). The vessels conducted a fine scale systematic parallel transect survey of six schools. An initial biomass estimate of 25,974t using the standard TS was determined.
- Two multi-panel gillnet samples were collected (one on September 13 and one on September 25) and combined in the calculation of the TS for the acoustic survey on September 20. The resulting sample with a weighted mean length 26.9 cm was used to generate the TS (Figure 62B). Maturity analyses showed that 66% of the fish were Stage 5 “maturing” condition and 28% of the fish were in the Stage 6 “ripe and running” condition (Figure 59B). The estimate of biomass after minor edits to the files was 27,794t.
- Analysis by depth layer for all transects showed 80.4% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 63B).

Little Hope Survey # 2 – September 30, 2014

- This survey was conducted by two acoustic survey vessels, the *Eagle 8* and the *Atlantic Star* on September 30 (Figure 64B). The vessels conducted a fine scale systematic parallel transect survey of several schools. The *Atlantic Star* appeared to be chasing a school that would not settle down, which may have resulted in some potential double counting. No final line through the fish was done thus investigation of this was not possible. The initial biomass estimate using standard TS was 8,097t, excluding three schools to provide the most probable biomass while avoiding double counting.
- One multi-panel gillnet sample was taken on September 25 by the vessel *Jamie B II*. Maturity analyses showed that 69% of the fish were Stage 5 “maturing” condition and 29% of the fish were in the Stage 6 “ripe and running” condition (Figure 59B). Using the sample with a weighted mean length of 26.9 cm (Figure 65) to generate TS, the biomass estimate was 8,145t.
- Analysis by depth layer for all transects showed 56.8% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 66B).

Little Hope Acoustic Survey #3 - October 11

- This survey was conducted by two acoustic survey vessels, the *Eagle 8* and the *Atlantic Star* on October 11 (Figure 67B).The vessels conducted a fine scale systematic parallel transect survey of four schools. The survey by both vessels were good, a slight improvement could have been made by running the final confirmation line through the school of fish perpendicular to the grid rather than from corner to corner. The initial biomass estimate using the standard TS was 8,310t.

- One multi-panel gillnet sample was taken on October 11 by the vessel *Jamie B II*. Maturity analyses showed that 75% of the fish were Stage 5 “maturing” condition and 24% of the fish were in the Stage 6 “ripe and running” condition (Figure 59B). Using the sample with a weighted mean length of 27.5 cm (Figure 68B) to generate the TS, the biomass estimate was 8,505t.
- Analysis by depth layer for all transects showed 56.9% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 69B).

Little Hope Acoustic Survey #4 - October 25

- This survey was conducted by two acoustic survey vessels, the *Eagle 8* and the *Atlantic Star* on October 25 (Figure 70B).The vessels conducted a fine scale systematic parallel transect survey of five schools of fish. The survey by both vessels was good; a slight improvement could have been made by running at least six lines through each school even if a couple zero lines were completed. The initial biomass estimate using the standard TS was 4,178t.
- The one multi-panel gillnet sample taken on October 11 by the vessel *Jamie B II* used to generate the TS in Survey #3 was used again for this survey. After review and edits the biomass was adjusted to 3,633t.
- Analysis by depth layer for all transects showed 59.1% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 71B).

2014 Little Hope Summary

There were four acoustic surveys in the Little Hope area in 2014. Three multi-panel gillnet deployments were conducted in support of the four acoustic surveys. The total spawning biomass estimate was 46,077t, which is approximately 28,000t less than in 2013 but is still above the five year average of 37,664t (Table 13B; Figure 72).

Halifax/Eastern Shore Fishery and Surveys

2013 Eastern Shore Acoustic Surveys

The 2013 herring gillnet fishery in the Eastern Shore fishing area began on September 24 and ended on October 11 with total landings of 1,390t compared with 771t in 2012 (Table 13A; Figures 73, 74A and 75A). Most catches occurred between September 24 and October 5 (Figure 74A). Once again, this was primarily a herring roe fishery with catches reported from four main cluster areas: two near Halifax Harbour approaches (one south and one southeast) and two southwest of Jeddore Head (Figure 75A). In 2013, four surveys were completed between September 24 and October 14 (Table 10A).

For the acoustic surveys, the lines were not predefined by a survey design, rather were conceived based on the best coverage of the aggregations using equally spaced parallel lines. The data were downloaded from the either one or two of the three acoustic boats with acoustic recorders, *Bradley K, TBS* and *Miss Owls Head*. Sampling was poor in 2013 with only two multi-panel gillnet samples collected for one of the four surveys. The maturity samples showed a high proportion of ripe and running (Stage 6) fish at 97% at the time of sample collection (Figure 76A). Size distribution from the commercial fishery is shown in Figure 77A.

Halifax/Eastern Shore Acoustic Survey #1 – September 24, 2013

- The first survey for the 2013 season was conducted by one acoustic survey vessel, the *Miss Owls Head* (Figure 78A). One school was observed and surveyed. The survey could have been better if the lines were parallel, straight and of equal length.
- No multi-panel gillnet sample was taken so the standard TS was used in the biomass estimate. The initial estimate was 843t and after edits was adjusted to 788t.

- Analysis by depth layer for all transects showed 80.4% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 80A).

Halifax/Eastern Shore Acoustic Survey #2 – September 28, 2013

- The second survey for the 2013 season was conducted by two acoustic survey vessels, *Miss Owls Head* and the *Bradley K* on September 28. Four separate schools were surveyed using parallel fine scale systematic parallel transects (Figure 81A). The survey could have been slightly more effective if the lines of the *Miss Owls Head* were a bit tighter (6 or more, parallel, straight, equal length). This survey was just four days after the previous one, but since these schools appear in different areas than the one surveyed on September 24, the biomass was counted towards the total estimate. The resulting biomass estimate using the standard TS was 4,950t.
- The two multi-panel gillnet samples that were taken from one of the schools were pooled. Maturity analyses showed that 3% of the fish were Stage 5 "maturing" condition and 97% of the fish were in the Stage 6 "ripe and running" condition (Figure 76A). The weighted mean length of herring (28.3 cm) from the multi-panel net with panel mesh sizes from 1⅞" to 2¾" was used for the calculation of TS (Figure 82A). The resulting biomass estimate was adjusted to 4,534t.
- Analysis by depth layer for all transects showed 99.2% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 83A).

Halifax/Eastern Shore Acoustic Survey #3 – October 4, 2013

- This survey was conducted by two acoustic survey vessels, the *Miss Owls Head* and the *TBS* on October 4 (Figure 84A). The vessels conducted a fine scale systematic parallel transect survey of two separate schools of herring. The TBS did four lines in one orientation and then four in the other orientation giving two surveys of the same school. It would have been better to do six lines in one orientation and then two verification lines in the perpendicular orientation. The *Miss Owls Head* had surveyed a school in the same area on September 25, however, given that about 10 days had elapsed the October 4 survey was considered to be valid.
- The initial biomass estimate using standard TS was 1,361t. Since there was no multi-panel sample the standard TS was used giving a final estimate of 1,354t. This final estimate includes one of the two passes the TBS conducted on the same school; the pass with the higher biomass was used in the final estimate.
- Analysis by depth layer for all transects showed 93.8% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 86A).

Halifax/Eastern Shore Acoustic Survey #4 – October 14

- This survey was conducted by one acoustic survey vessel, the *Bradley K* on October 14 (Figure 87A). The vessel conducted a fine scale systematic parallel transect survey of a single school of herring. The survey started in the center of the school and then went to each side which is not the optimum survey methodology. One transect had a 60% influence on the overall biomass estimate meaning that most of the fish were recorded on just one transect.
- The initial biomass estimate was 194t using the standard TS. Since there was no multi-panel sample, the standard TS was used to generate the final estimate of 194t.
- Analysis by depth layer for all transects showed 99.2% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 89A).

Halifax/Eastern Shore Acoustic Survey Summary for 2013

The total spawning biomass for the Eastern Shore area for 2013 was taken as the sum all the surveys. The surveys that were within the 10 day window were counted only because there was no overlap in locations and were reasonably far apart. This approach could possibly lead to over estimation of biomass. Only one of the surveys was supported by multi-panel gillnet deployment to collect representative samples of herring being surveyed to better estimate the TS. The total spawning biomass estimate was 6,870t with the CIF(Table 10A). This represents an increase from the 2012 estimate of 3,668t, the lowest observed biomass since surveys started in 1998 for this area.

2014 Eastern Shore Acoustic Surveys

The 2014 herring gillnet fishery in the Eastern Shore fishing area began on September 17 and extended to October 12. The total catch of 1,163t in 2014 represents a slight decrease from the 1,390t in 2013 (Figure 73), with the majority of the catch occurring between October 5 and October 9 (Figure 74B). Similar to 2013, the catches occurred primarily southwest of Jeddore Head and in a pair of clusters south and southeast of Halifax Harbour. Overall in 2014, six acoustics surveys were conducted in the Eastern Shore fishing area between September 16 and October 10 (Table 10B). All data were downloaded from the two boats with acoustic recorders and, after editing to remove the bottom and non-herring targets, the acoustic files were cut into transects for each survey.

For the acoustic surveys, the lines were not predefined by a survey design, rather were conceived based on the best coverage of the aggregations using equally spaced parallel lines. Sampling was significantly better in 2014 with a total of six multi-panel gillnet samples collected for the six acoustic surveys. With the exception of survey #3, the acoustic surveys were separated by less than six days from the previous one. In order to avoid double counting only schools that appeared to be in different areas and/or separated by enough time were used in the final estimate. Maturity analyses showed that the majority of the fish were in either the Stage 5 “maturing” condition or the Stage 6 “ripe and running” condition (Figure 76B). Only one sample captured any juveniles with approximately 13% on September 20. These findings were supported by the size distribution from the commercial fishery as shown in Figure 77B, with 12.7% of the sampled fish less than 23 cm.

Halifax/Eastern Shore Acoustic Survey #1 – September 16, 2014

- This survey was conducted by one acoustic survey vessel, the *Bradley K* on the morning of September 17 (Figure 78B). The vessel conducted a fine scale systematic parallel transect of one school of fish. The survey could have been improved by working from one side of the school to the other as opposed to starting in the center of the school and then going to each side. The initial biomass estimate using the standard TS was 2,459t.
- Two multi-panel gillnet samples were collected near to this September 16 acoustic survey, one on September 17 and one on September 20. Maturity analyses showed that 56% of the fish were in the Stage 5 “maturing” condition and 30% of the fish were in the Stage 6 “ripe and running” condition (Figure 76B). Using the sample with a weighted mean length of 28.5 cm (Figure 79) to generate the TS, the biomass estimate was 2,387t.
- Analysis by depth layer for all transects showed 100% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 80B).

Halifax/Eastern Shore Acoustic Survey #2 – September 19, 2014

- This survey was conducted by two acoustic survey vessels, the *Bradley K* and the *Miss Owls Head* on the morning of September 19 (Figure 78C). The vessels conducted a fine scale systematic parallel transect of six schools of fish. The initial biomass estimate using

the standard TS was 2,531t. Since the *Miss Owls Head* surveyed the same school as the school surveyed on September 16, that school was dropped from the biomass estimate for September 19. Also, since the school surveyed by the *Miss Owls Head* and the one done on the September 16 survey were less than one km apart, the September 19 survey school was dropped from the biomass estimate.

- The same two multi-panel gillnet samples used for Survey #1 were also used to generate the TS for this survey (Figure 79). After edits and the exclusions of the biomass surveyed by the *Miss Owls Head*, the final biomass estimate was 1,779t.
- Analysis by depth layer for transects within the survey box area showed 92.9% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 80C).

Halifax/Eastern Shore Acoustic Survey #3 – October 1, 2014

- This survey was conducted by one acoustic survey vessel, the *Bradley K* on the night of October 1 (Figure 81B). The vessel conducted a fine scale systematic parallel transect of one school of herring. The system was connected to the ships inverter which caused a significant amount of noise. The initial biomass estimate using the standard TS was 279t.
- One multi-panel gillnet sample were collected near to this October 1 acoustic survey on October 2 by the vessel the Bradley K. Maturity analyses showed that 71% of the fish were Stage 5 “maturing” condition and 26% of the fish were in the Stage 6 “ripe and running” condition (Figure 76B). Using the sample with a weighted mean length of 29.0 cm (Figure 82B) to generate the TS, the biomass estimate was 305t.
- Analysis by depth layer for all transects showed 92.5% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 83B).

Halifax/Eastern Shore Acoustic Survey #4 – October 7, 2014

- This survey was conducted by two acoustic survey vessels, the *Bradley K* and the *Miss Owls Head* on October 7 (Figure 84B). The vessels conducted a fine scale systematic parallel transect of one school of herring. The two vessels surveyed the school of fish approximately four hours apart. The initial biomass estimate using the standard TS for the higher biomass estimate was 3,890t.
- One multi-panel gillnet sample was collected directly from the survey school of fish on October 7 by the vessel the *Miss Owls Head*. Maturity analyses showed that 50% of the fish were Stage 5 “maturing” condition and 49% of the fish were in the Stage 6 “ripe and running” condition (Figure 76B). Using the sample with a weighted mean length of 29.4 cm (Figure 85) to generate TS, the biomass estimate was 3,983t.
- Analysis by depth layer for all transects showed 99% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 86B).

Halifax/Eastern Shore Acoustic Survey #5 – October 9, 2014

- This survey was conducted by one acoustic survey vessel, the *Bradley K* on October 9 (Figure 87B). The vessel conducted a fine scale systematic parallel transect survey of one school of herring. The initial biomass estimate using the standard TS was 486t. The school surveyed on October 1 (initial biomass estimate: 279t) was 2.2 km away from the school surveyed on October 9 (initial biomass estimate: 486t) was accepted, however, there is a possibility that it was the same school surveyed on the two dates.
- One multi-panel gillnet sample was collected directly from the survey school of fish on October 9 by the vessel the *Bradley K*. Maturity analyses showed that 89% of the fish were Stage 5 “maturing” condition and 10% of the fish were in the Stage 6 “ripe and running” condition (Figure 76B). Using the sample with a weighted mean length of 28.6 cm (Figure 88A) to generate the TS, the biomass estimate was 490t.

- Analysis by depth layer for all transects showed 97.2% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 89B).

Halifax/Eastern Shore Acoustic Survey #6 – October 10, 2014

- This survey was conducted by one acoustic survey vessel, the *Miss Owls Head* on October 10 (Figure 87C). The vessel conducted a fine scale systematic parallel transect survey of one school of fish. A grounding problem on the power caused significant noise in the data. A biomass estimate of 617t using the standard TS was initially determined.
- One multi-panel gillnet sample was collected for this acoustic survey on October 11. The resulting sample with a weighted mean length of 28.5 cm was used to generate the TS (Figure 88B). Maturity analyses showed that 70% of the fish were Stage 5 "maturing" condition and 29% of the fish were in the Stage 6 "ripe and running" condition (Figure 76B). The estimated biomass after minor edits to the files was 642t.
- Analysis by depth layer for all transects showed 72.9% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 89C).

Halifax/Eastern Shore Acoustic Survey Summary for 2014

There were six acoustic surveys in the Halifax/Eastern Shore area in 2014. There was a vast improvement as six multi-panel gillnet samples were collected in support of the six acoustic surveys. The estimated total spawning biomass increased in 2014 to 9,586t, which is near the five year average of 10,664t but well below the long term average of 1998 to 2014 of 28,857t.

A major concern or source of uncertainty is the assumption that the surveys are simply additive. If herring do not move 'on to' and 'off of' the spawning grounds in waves, the estimate of total SSB will be significantly biased upward due to double counting. Another major issue, which was addressed at the 2007 Herring framework review (DFO 2007), is the use of these estimates as absolute measures of biomass due to the many uncertainties, especially with TS.

Although no spawning surveys were conducted between Liverpool and Chebucto Head, commercial landings during the spawning season in 2013 and 2014 were reported from the area (Table 11, Figure 91). Further investigation of the area is required to determine if herring are spawning in the area or just in transit to other spawning grounds.

Glace Bay Fishery and Surveys

2013 Glace Bay Acoustic Surveys

There was one only acoustic survey conducted in the Glace Bay survey box on September 11 (Figure 92). The survey was done by the acoustic survey vessel *Miracle Lady* on two separate schools of herring. No multi-panel sample was collected and as a result the standard TS was used. The initial and final biomass estimate was 50t.

Data from the CCGS *Alfred Needler* surveys conducted July 29 - 31 indicated that most of the herring in the area were Stage 1 to Stage 4 (Figure 95A).

Analysis by depth layer for transects within the survey box area showed 100% of the total area backscattering strength (Sa) was found within the first 10 m off bottom (Figure 93).

2014 Glace Bay Acoustic Surveys

There was no acoustic survey conducted in the Glace Bay survey box in 2014. Data from the CCGS *Alfred Needler* surveys conducted August 8 - 11 indicated that most of the herring in the area were Stage 1 "immature" to Stage 5 "maturing/hard", with the majority being Stage 4 "maturing/hard" (Figure 95B).

Glace Bay Summary

There was one acoustic survey in the Glace Bay area in 2013 and none conducted in 2014. The total spawning biomass for the Glace Bay area for 2013 was 50t, which is in close agreement with the stock's trend since 2006 that has not risen above 500t. Similarly, there has not been a significant fishery in the area since 2006 when the landings were equal to 85t (Table 13B; Figure 94).

Bras d'Or Lakes Fishery and Surveys

There has been no survey activity in the Bras d'Or Lakes area since 2001. There has been no fisheries catches since 2003 (Table 13A).

Overall Coastal Nova Scotia Spawning Component

Spawning biomass has fluctuated annually in the Little Hope/Port Mouton area since the beginning of the acoustic surveys in 1998. The spawning biomass estimate which was at a five-year low in 2012 (12,756t) had a nearly six-fold increase in 2013 (73,992t) before decreasing in 2014 (46,077t; Figure 72; Table 13B). The 2014 biomass estimate, however, was still above the long term average since 1998 of 29,354t. The Halifax/Eastern Shore area has also shown variability in SSB, but has remained at a spawning biomass estimate for the area of below 10,000t since 2011 (Table 13; Figure 90). Landings have been much steadier, being close to the allocation limits in each of the last five years in the Little Hope/Port Mouton area. Landings in the Halifax/Eastern Shore area, however, represent the trend of a reduced biomass with landings well below the allocation since 2010 (Table 13A). For the Glace Bay area, there have been essentially no landings since 2005, partly due to availability and partly due to markets. Annual surveys in the area could not find any significant aggregations of spawning herring since about the same time (Figure 94, Tables 13A and 13B). Small catches (93t in 2013 and 39t in 2014) are also being taken along the coast from Liverpool to Chebucto Head (Table 11; Figure 91).

Offshore Scotian Shelf Component

Fleet activity/catch in the spring/early summer fishery on the offshore banks of the Scotian Shelf has varied between 1,000-20,000t since 1996 (Figure 96). In 2013, fishing occurred from May 20 to June 12 with a total catch of 1,466t being reported. In 2014, fishing occurred on one day May 25 with a 23t catch reported. The total catch for 2013 and 2014 is well below the long term average, since 1996, of 6,983t and the catch in 2014 set a new low. Fishery samples in 2013 and 2014 showed that the majority of fish were either Stages 3, 4 or 5 "maturing/hard" fish (predominantly Stage 3; Figures 97A and 97B). There were also a large percentage of Stage 8 "recovering" fish in both 2013 and 2014, and a small percentage of Stages 1 and 2 "immature" fish in 2013 (Figures 97A and 97B). Length frequency samples also indicate that most of the fish in the 2013 and 2014 were larger than 23cm (Figures 98A and 98B). No acoustic biomass estimates were available from the Scotian Shelf in 2013 and 2014. In the fall of 2014, industry conducted searches for herring aggregations but failed to find spawning schools. There continues to be a need for herring research on the Scotian Shelf in the fall.

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TABLES

Table 1. Summary of the number of surveys undertaken in 2013 and 2014 examined in the estimation of spawning stock biomass (SSB) for the Atlantic herring 4VWX stock and coastal component complexes.

Spawning Grounds	Number of Surveys	
	2013	2014
Offshore Banks	0	0
Scots Bay	7	6
German Bank	5 (+2)	5 (+2)
Spectacle Buoy	0	0
Trinity Ledge	2	2
Little Hope	3	4
Eastern Shore	4	6
Glace Bay	1	0
Total	22	23

Table 2A. Summary of completed herring acoustic surveys undertaken in 2013 with interval (days) between surveys on the same grounds, number of boats with acoustic systems, and the number of mapping boats (without acoustic systems using deck sheets only).

No.	Survey Date	Location of Survey	Interval (days)	Acoustic Boats	Mapping Boats	Total No. Boats
1	22-Jun-13	Scots Bay #1	0	7	0	7
2	06-Jul-13	Scots Bay #2	14	8	0	8
3	21-Jul-13	Scots Bay #3	15	10	0	10
4	03-Aug-13	Scots Bay #4	12	9	0	9
5	17-Aug-13	Scots Bay #5	14	6	0	6
6	31-Aug-13	Scots Bay #6	14	4	0	4
7	14-Sep-13	Scots Bay #7	14	4	0	4
8	12-Aug-13	Trinity Ledge #1	0	1	0	1
9	16-Sep-13	Trinity Ledge #2	34	1	0	1
10	19-Aug-13	German Bank #1	0	8	0	8
11	03-Sep-13	German Bank #2	14	8	0	8
12	17-Sep-13	German Bank #3	14	9	0	9
13	29-Sep-13	German Bank #4	12	7	0	7
13a	05-Oct-13	German Bank #4a*	6	10	0	10
14	14-Oct-13	German Bank #5	9	6	0	6
14a	21-Oct-13	German Bank #5a*	7	4	0	4
1	19-Sep-13	Little Hope #1	0	2	0	2
2	29-Sep-13	Little Hope #2	10	2	0	2
3	10-Oct-13	Little Hope #3	11	2	0	2
3a	17-Oct-13	Mapping Boats Only	7	0	3	3
4	21-Oct-13	Little Hope #4	11	2	0	2
1	24-Sep-13	Eastern Shore #1	0	1	0	1
2	28-Sep-13	Eastern Shore #2	4	2	0	2
3	04-Oct-13	Eastern Shore #3	10	2	0	2
4	14-Oct-13	Eastern Shore #4	10	1	0	1
1	11-Sep-13	Glace Bay #1	0	1	0	1
Total number of survey boat nights				117	3	120

* Excluded from analysis due to number of days between surveys.

Table 2B. Summary of completed herring acoustic surveys undertaken in 2014 with interval (days) between surveys on the same grounds, number of boats with acoustic systems, and the number of mapping boats (without acoustic systems using deck sheets only).

No.	Survey Date	Location of Survey	Interval (days)	Acoustic Boats	Mapping Boats	Total No. Boats
1	21-Jun-14	Scots Bay #1	0	7	0	7
2	08-Jul-14	Scots Bay #2	17	7	0	7
3	19-Jul-14	Scots Bay #3	11	6	0	6
4	02-Aug-14	Scots Bay #4	13	8	0	8
5	16-Aug-14	Scots Bay #5	14	5	0	5
6	30-Aug-14	Scots Bay #6	14	3	0	3
7	26-Aug-14	Trinity Ledge #1	0	1	0	1
8	10-Sep-14	Trinity Ledge #2	14	1	0	1
9	12-Aug-14	German Bank #1	0	8	0	8
10	25-Aug-14	German Bank #2	13	8	0	8
11	08-Sep-14	German Bank #3	13	8	0	8
11a	11-Sep-14	German Bank #3a*	3	6	0	6
12	24-Sep-14	German Bank #4*	13	6	0	6
12a	26-Sep-14	German Bank #4a	2	5	0	5
13	06-Oct-14	German Bank #5	10	5	0	5
1	20-Sep-14	Little Hope #1	0	2	0	2
2	30-Sep-14	Little Hope #2	10	2	0	2
3	11-Oct-14	Little Hope #3	11	2	0	2
4	25-Oct-14	Little Hope #4	14	2	0	2
1	16-Sep-14	Eastern Shore #1	0	1	0	1
2	19-Sep-14	Eastern Shore #2	3	2	0	2
3	01-Oct-14	Eastern Shore #3	12	1	0	1
4	07-Oct-14	Eastern Shore #4	6	2	0	2
5	09-Oct-14	Eastern Shore #5	2	1	0	1
6	10-Oct-14	Eastern Shore #6	9	1	0	1
Total number of survey boat nights				99	0	99

* Excluded from analysis due to number of days between surveys.

Table 3A. Summary of 2013 fish sampled by survey date and location with TS estimate from samples and TS estimate for a 28 cm herring using the length/weight equation.

Date of Survey	Location of survey	Interval (days)	Number of Length Samples	Number of Fish Measured	Number Len/Wt Fish	Mean Length (mm)	Mean Weight (gm)	Target Strength dB/kg	Wt 28 cm Fish (gm)	TS 28 cm Fish dB/kg
22-Jun-13	Scots Bay #1	0	21	3820	147	272	157	-35.149	171	-35.285
06-Jul-13	Scots Bay #2	14	14	2641	100	274	165	-35.307	176	-35.420
21-Jul-13	Scots Bay #3	15	19	3533	190	272	162	-35.300	177	-35.439
03-Aug-13	Scots Bay #4	12	17	3248	52	269	154	-35.183	175	-35.385
17-Aug-13	Scots Bay #5	14	8	1526	25	265	157	-35.404	184	-35.598
31-Aug-13	Scots Bay #6	14	6	1169	54	267	159	-35.396	185	-35.627
14-Sep-13	Scots Bay #7	14	0	0	0	280*	180	-35.960	180	-35.960
12-Aug-13	Trinity Ledge #1	0	1	123	123	268	157	-35.740	176	-35.874
16-Sep-13	Trinity Ledge #2	34	0	0	0	280*	180	-35.960	180	-35.960
19-Aug-13	German Bank #1	0	13	2562	156	271	162	-35.329	178	-35.470
03-Sep-13	German Bank #2	14	11	2197	128	270	158	-35.267	176	-35.422
17-Sep-13	German Bank #3	14	7	1499	155	244	117	-34.813	175	-35.396
29-Sep-13	German Bank #4	12	4	776	155	251	127	-34.935	175	-35.396
14-Oct-13	German Bank #5	15	1	231	155	267	153	-35.197	175	-35.396
19-Sep-13	Little Hope #1	0	1	88	178	272	160	-35.249	174	-35.368
29-Sep-13	Little Hope #2	10	1	88	178	272	160	-35.249	174	-35.368
10-Oct-13	Little Hope #3	11	1	220	245	255	129	-34.901	176	-35.402
21-Oct-13	Little Hope #4	11	1	220	245	255	129	-34.901	176	-35.402
11-Sep-13	Glace Bay #1	0	0	0	0	280*	180	-35.960	180	-35.960
24-Sep-13	Eastern Shore #1	0	0	0	0	280*	180	-35.960	180	-35.960
28-Sep-13	Eastern Shore #2	4	2	216	216	283	182	-35.452	175	-35.391
04-Oct-13	Eastern Shore #3	6	0	0	0	280*	180	-35.960	180	-35.960
14-Oct-13	Eastern Shore #4	10	0	0	0	280*	180	-35.960	180	-35.960

Note: values used for 50kHz system when no sampling was available. Further adjustments also made for frequency of systems used.
* Standard length, weight, target strength.

Table 3B. Summary of 2014 fish sampled by survey date and location with TS estimate from samples and TS estimate for a 28 cm herring using the length/weight equation.

Date of Survey	Location of survey	Interval (days)	Number of Length Samples	Number of Fish Measured	Number Len/Wt Fish	Mean Length (mm)	Mean Weight (gm)	Target Strength dB/kg	Wt 28 cm Fish (gm)	TS 28 cm Fish dB/kg
21-Jun-14	Scots Bay #1	0	3	598	133	275	166	-35.305	176	-35.407
08-Jul-14	Scots Bay #2	17	16	2980	226	257	134	-34.946	180	-35.502
19-Jul-14	Scots Bay #3	11	19	3752	213	270	160	-35.305	180	-35.515
02-Aug-14	Scots Bay #4	13	20	3937	178	275	176	-35.573	187	-35.679
16-Aug-14	Scots Bay #5	14	10	1889	152	272	175	-35.623	192	-35.784
30-Aug-14	Scots Bay #6	14	6	1190	38	265	155	-35.343	187	-35.677
26-Aug-14	Trinity Ledge #1	0	0	0	0	280*	180	-35.960	180	-35.960
10-Sep-14	Trinity Ledge #2	14	0	0	0	280*	180	-35.960	180	-35.960
12-Aug-14	German Bank #1	0	16	3074	311	273	177	-35.644	192	-35.794
25-Aug-14	German Bank #2	13	16	3036	360	276	176	-35.555	186	-35.646
08-Sep-14	German Bank #3	13	10	1920	250	269	164	-35.474	188	-35.698
26-Sep-14	German Bank #4a	18	8	1468	109	259	140	-35.114	185	-35.628
06-Oct-14	German Bank #5	10	0	0	0	280*	180	-35.960	180	-35.960
20-Sep-14	Little Hope #1	0	4	293	293	269	167	-35.520	188	-35.703
30-Sep-14	Little Hope #2	10	2	89	89	269	168	-35.554	190	-35.742
11-Oct-14	Little Hope #3	11	2	93	93	255	140	-35.254	191	-35.777
25-Oct-14	Little Hope #4	14	2	245	245	255	129	-34.901	176	-35.402
16-Sep-14	Eastern Shore #1	0	2	254	254	278	182	-35.621	186	-35.664
19-Sep-14	Eastern Shore #2	3	2	254	254	278	182	-35.621	186	-35.664
01-Oct-14	Eastern Shore #3	12	1	93	93	290	221	-36.096	204	-36.046
07-Oct-14	Eastern Shore #4	6	3	315	314	288	205	-35.814	188	-35.696
09-Oct-14	Eastern Shore #5	2	3	315	314	288	205	-35.814	188	-35.696
10-Oct-14	Eastern Shore #6	1	3	315	314	288	205	-35.814	188	-35.696

Note: values used for 50kHz system when no sampling was available. Further adjustments also made for frequency of systems used.
* Standard length, weight, target strength.

Table 4A. Summary of the 2013 Scots Bay spawning ground acoustic survey data and associated biomass estimates for the standard survey box area (inbox) and for outside the survey box (outbox).

Location/Type	Date	Target Strength (dB/kg)	Area (km²)	Weighted Sa (dB/m²)	Density (kg/m²)	Biomass (t)	Standard Error (t)	SE %
Scots Bay (inbox)	22-Jun-13	-35.40	626	-52.25	0.021	12,923	6,321	49
	06-Jul-13	-35.47	626	-55.85	0.009	5,736	1,589	28
	20-Jul-13	-35.39	626	-52.70	0.019	11,622	3,934	34
	03-Aug-13	-35.25	626	-54.49	0.012	7,447	2,103	28
	17-Aug-13	-35.39	626	-52.23	0.021	12,961	2,808	22
	31-Aug-13	-35.42	626	-52.37	0.020	12,634	5,875	47
	14-Sep-13	-35.59	450	-56.57	0.008	3,589	1,203	34
Scots Bay total for standard survey area (inbox)						66,912	10,307	15
Scots Bay (outbox)	22-Jun-13	-35.22	120.00	-60.91	0.003	322	125	39
	06-Jul-13	-35.42	277.00	-56.03	0.009	2,362	1338	57
	20-Jul-13	-35.42	208.00	-63.34	0.002	328	75	23
	03-Aug-13	-35.29	238.00	-55.32	0.010	2,312	1062	46
	17-Aug-13	-35.43	122.00	-53.02	0.018	2,107	629	30
	31-Aug-13	-35.40	47.00	-51.04	0.027	1,283	906	71
	14-Sep-13	-35.58	35.00	-53.29	0.017	592	306	52
Scots Bay total for non-standard survey area (outbox)						9,306	1,963	21
Scots Bay overall total all survey areas						76,218	10,492	14

Table 4B. Summary of the 2014 Scots Bay spawning ground acoustic survey data and associated biomass estimates for the standard survey box area (inbox) and for outside the survey box (outbox).

Location/Type	Date	Target Strength (dB/kg)	Area (km²)	Weighted Sa (dB/m²)	Density (kg/m²)	Biomass (t)	Standard Error (t)	SE %
Scots Bay (inbox)	21-Jun-14	-35.42	795	-46.75	0.072	57,552	11,137	19
	08-Jul-14	-35.04	788	-43.62	0.136	106,927	50,819	48
	19-Jul-14	-35.33	696	-49.83	0.036	24,748	6,934	28
	02-Aug-14	-35.69	788	-51.42	0.026	20,565	8,126	40
	16-Aug-14	-35.66	690	-55.46	0.010	7,190	1,919	27
	30-Aug-14	-35.37	700	-54.20	0.013	9,142	3,214	35
Scots Bay total for standard survey area (inbox)						226,122	53,242	24
Scots Bay (outbox)	21-Jun-14	-35.46	129.00	-55.25	0.010	1341	358	27
	08-Jul-14	-35.08	131.00	-55.62	0.009	1,134	397	35
	19-Jul-14	-35.31	42.00	-58.43	0.005	205	113	55
	02-Aug-14	-35.74	131.00	-61.97	0.002	311	124	40
	16-Aug-14	-35.68	50.00	-57.60	0.006	321	138	43
	30-Aug-14	-35.38	44.00	-50.06	0.034	1,497	1148	77
Scots Bay total for non-standard survey area (outbox)						4,808	1,285	27
Scots Bay overall total all survey areas						230,930	53,257	23

Table 5A. Summary of the 2013 German Bank spawning ground acoustic survey results and SSB biomass estimates for the standard survey box area (inbox) and for outside the survey box (outbox).

Location/Type	Date	Target Strength (dB/kg)	Area (km²)	Weighted Sa (dB/m²)	Density (kg/m²)	Biomass (t)	Standard Error (t)	SE %
German Bank (inbox)	19-Aug-13	-35.42	646	-46.27	0.082	53,174	15,875	30
	03-Sep-13	-35.31	646	-42.91	0.174	112,241	66,714	59
	17-Sep-13	-35.02	646	-46.61	0.069	37,623	25,455	57
16% juvenile adjustment	29-Sep-13	-34.97	595	-46.23	0.075	44,502	30,572	69
	14-Oct-13	-35.30	646	-55.35	0.010	6,381	1,829	29
German Bank inbox total						253,921	79,301	31
German Bank (outbox)	19-Aug-13	-35.40	188	-62.89	0.002	335	175	52
	03-Sep-13	-35.30	142	-49.16	0.041	5,847	1,974	34
	17-Sep-13	-34.92	152	-61.47	0.002	283	144	43
16% juvenile adjustment	29-Sep-13	-35.00	235	-52.78	0.017	3,917	2,527	65
	14-Oct-13	-35.30	188	-64.53	0.001	225	100	45
German Bank outbox total						10,606	3,216	30
German Bank overall						264,527	79,367	30

Table 5B. Summary of the 2014 German Bank spawning ground acoustic survey results and SSB biomass estimates for the standard survey box area (inbox) and for outside the survey box (outbox).

Location/Type	Date	Target Strength (dB/kg)	Area (km²)	Weighted Sa (dB/m²)	Density (kg/m²)	Biomass (t)	Standard Error (t)	SE %
German Bank (inbox)	12-Aug-14	-35.76	646	-46.82	0.078	50,644	26,520	52
	25-Aug-14	-35.65	646	-45.29	0.109	70,290	43,471	62
	08-Sep-14	-35.49	646	-44.65	0.122	78,540	55,689	71
	26-Sep-14	-35.17	110	-45.64	0.090	9,870	3,509	36
	06-Oct-14	-35.52	524	-49.51	0.040	20,906	8,510	41
German Bank inbox total						230,252	76,020	33
German Bank (outbox)	12-Aug-14	-35.66	196	-59.28	0.004	852	602	71
	25-Aug-14	-35.59	194	-68.70	0.000	95	59	62
	08-Sep-14	-35.58	194	-59.39	0.004	808	701	87
	26-Sep-14	-35.11	18	-49.60	0.036	640	0	0
	06-Oct-14	-35.51	21	-52.85	0.018	388	0	0
German Bank outbox total						2,782	926	33
German Bank overall						233,034	76,026	33

Table 6. Catch dates, catch, and acoustic survey biomass for the Spectacle Buoy and Trinity Ledge herring fishery from 1998-2014. Survey biomass calculated with CIF. 'n/s' indicates no survey and a dash (-) indicates data cannot be calculated.

Year	Spectacle. Buoy catches and surveys				Trinity Ledge Survey Box catches and surveys					Overall Stock Gillnet Catch(t)
	Start Day	End Day	Catch t	Survey SSB t*	Start Day	End Day	Catch t	Survey SSB t*	Exploitation Catch/SSB	
1998	10-May-98	30-Jun-98	484	n/s	24-Aug-98	21-Sep-98	1,668	n/s	n/s	2,153
1999	10-May-99	16-Jul-99	355	n/s	12-Aug-99	15-Sep-99	1,257	3,885	32%	1,612
2000	11-Jun-00	14-Jun-00	80	n/s	30-Aug-00	12-Sep-00	682	621	110%	814
2001	11-Jun-01	10-Jul-01	699	1,110	21-Aug-01	26-Sep-01	781	14,797	5%	1,576
2002	15-May-02	01-Jul-02	137	n/s	02-Sep-02	30-Sep-02	204	8,096	3%	378
2003	04-Jun-03	06-Jun-03	69	1,420	21-Aug-03	18-Sep-03	361	12,117	3%	439
2004	17-Jun-04	15-Jul-04	5	n/s	02-Sep-04	15-Sep-04	229	12,022	2%	229
2005	09-Jun-05	11-Jul-05	124	290	05-Sep-05	20-Sep-05	427	10,701	4%	570
2006	03-Jun-06	22-Jun-06	2	n/s	23-Aug-06	21-Sep-06	647	16,076	4%	719
2007	07-May-07	22-Jun-07	243	310	27-Aug-07	20-Sep-07	1,042	3,113	33%	1,334
2008	29-May-08	19-Jun-08	6	0	21-Aug-08	25-Sep-08	7	516	1%	15
2009	11-Jun-09	25-Jun-09	0.2	n/s	01-Sep-09	11-Sep-09	102	1,575	6%	117
2010	02-Jun-10	19-Jun-10	0	1,859	09-Aug-11	24-Sep-10	145	2,405	6%	204
2011	22-Jun-11	29-Jun-11	1	282	09-Aug-11	20-Sep-11	598	7,316	8%	638
2012	31-May-12	31-May-12	0	n/s	31-May-12	18-Sep-12	177	2,754	6%	471
2013	31-May-13	31-May-13	0	n/s	13-Aug-13	18-Sep-13	99	950	10%	1,270
2014	31-May-14	31-May-14	0	n/s	12-Aug-14	30-Sep-14	123	4,772	3%	1,661
Spectacle Buoy Average			130	753	**Gillnet Average**		503	6,357	-	835

* Survey SSB calculated with Calibration Integration Factor after 2003 inclusive.

Table 7A. Biomass estimation for the 2013 Trinity Ledge acoustic surveys. Survey biomass was calculated with CIF.

Location	Date	Mean Length (mm)	Target Strength (dB/kg)	Area (km²)	Weighted Sa (dB/m²)	Density (kg/m²)	Biomass (t)	Standard Error (t)	SE %
Trinity Ledge #1	12-Aug-13	27	-35.700	0.10	-27.200	7.081	921	197	21
Trinity Ledge #2	16-Sep-13	28	-36.000	0.10	-41.100	0.308	29	11	38
Trinity Ledge total for 2013							949	197	21

Table 7B. Biomass estimation for the 2014 Trinity Ledge acoustic surveys. Survey biomass was calculated with CIF. A dash (-) indicates data cannot be calculated.

Location	Date	Mean Length (mm)	Target Strength (dB/kg)	Area (km²)	Weighted Sa (dB/m²)	Density (kg/m²)	Biomass (t)	Standard Error (t)	SE %
Trinity Ledge #1	26-Aug-16	-	-35.960	0.10	-26.50000	8.939	1,252	1,395	111
Trinity Ledge #2	10-Sep-14	-	-35.959	0.25	11.48603	14.080	3,520	1,013	29
Trinity Ledge total for 2014							4,772	1,724	36

Table 8. Summary of the minimum observed SSB for each of the surveyed spawning grounds in the Bay of Fundy/SWNS component of the 4WX stock complex. Total SSB rounded to nearest 100t and all data calculated with the CIF. 'n/s' indicates no survey and a dash (-) indicates no data for that category.

Location	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average 2005-2010	Average 1999-2014
Scots Bay (inbox)	45,909	185,498	216,000	129,300	123,000	115,000	21,200	31,600	50,500	23,300	81,600	42,300	105,600	143,500	66,900	226,100	41,750	100,463
Scots Bay (outbox)	-	-	-	-	-	-	-	-	2,200	100	6,100	11,700	35,100	41,300	9,300	4,800	5,025	13,824
Scots Bay total	45,909	185,498	216,000	129,300	123,000	115,000	21,200	31,600	52,700	23,400	87,700	54,000	140,700	184,800	76,200	230,900	45,100	107,375
German Bank (inbox)	495,360	333,940	257,300	416,200	348,800	392,000	268,600	290,500	495,400	238,600	395,900	234,700	289,000	278,300	253,900	230,300	320,617	326,172
German Bank (outbox)	-	-	-	-	-	-	-	4,900	4,000	2,400	1,700	19,100	11,500	10,100	10,600	2,800	6,420	7,458
German Bank total	495,360	333,940	257,300	416,200	348,800	392,000	268,600	295,400	499,400	241,000	397,600	253,800	300,500	288,400	264,500	233,000	325,967	330,367
Trinity Ledge	4,061	1,336	14,800	8,900	12,100	12,000	10,700	16,100	3,100	500	1,600	2,400	7,300	2,800	900	4,800	5,733	6,462
Spec Buoy (spring)	-	-	1,100	-	1,200	n/s	600	n/s	300	0	-	1,900	300	n/s	n/s	n/s	700	769
Spec Buoy (fall)	-	-	87,500	-	-	-	-	30	-	-	-	-	-	-	-	-	30	43,765
Overall Stock Area	545,330	520,774	576,700	554,400	485,100	519,000	301,100	343,130	555,500	264,900	486,900	312,100	448,800	476,000	341,700	467,300	377,272	449,917
Seal Island	-	-	3,900	1,200	11,900	-	-	10,000	-	-	-	-	1,500	-	-	-	10,000	5,694
Browns Bank	-	-	45,100	-	-	-	-	7,700	-	-	-	-	-	-	-	-	7,700	26,400
Total All Areas	545,330	520,774	625,700	555,600	497,000	519,000	301,100	360,830	555,500	264,900	486,900	312,100	450,300	476,000	341,700	467,300	380,222	454,997
OVERALL SE (t)	89,024	70,347	30,539	65,978	86,276	79,366	82,593	57,484	132,719	38,284	94,294	39,863	60,406	44,705	80,057	92,851	74,206	71,548
OVERALL SE (%)	16	14	5	12	17	15	27	16	24	14	19	13	13	9	23	20	19	16

Table 9A. The 2013 herring acoustic surveys for Little Hope/Port Mouton with survey biomass and final total for the area (calculated with CIF).

Location	Date	Average TS (dB/kg)	Stratum Area (km²)	Weighted Mean Sa (dB/m²)	Biomass Density (kg/m²)	Strata Biomass (t)	Standard Error (t)	Standard Error %
Little Hope #1	19-Sep-13	-35.70	17.3	-36.71	0.793	13,713	3,694.33	27
Little Hope #2	29-Sep-13	-35.96	6.2	-37.70	0.631	3,878	1,489.00	38
Little Hope #3	10-Oct-13	-35.35	17.8	-32.53	1.914	30,602	5,324.54	16
Little Hope #4	21-Oct-13	-35.96	24.7	-34.61	1.363	26,339	995.53	3
Final 2013 Surveys		-35.74	65.9	-34.62	1.294	74,532	6,723.61	9

Note: October 10 and 21 estimates adjusted for juveniles.

Table 9B. The 2014 herring acoustic surveys for Little Hope/Port Mouton with survey biomass and final total for the area (calculated with CIF).

Location	Date	Average TS (dB/kg)	Stratum Area (km²)	Weighted Mean Sa (dB/m²)	Biomass Density (kg/m²)	Strata Biomass (t)	Standard Error (t)	Standard Error %
Little Hope #1	20-Sep-14	-35.97	33.8	-37.15	0.763	25,794	1,783.41	7
Little Hope #2	30-Sep-14	-36.00	4.4	-33.33	1.851	8,145	2,655.93	33
Little Hope #3	11-Oct-14	-36.13	9.0	-36.38	0.944	8,505	605.45	7
Little Hope #4	25-Oct-14	-35.96	5.8	-37.99	0.626	3,633	1,010.96	28
Final 2014 Surveys		-36.02	53.0	-36.62	0.869	46,077	3,409.27	7

Table 10A. The 2013 Halifax/Eastern Shore herring acoustic survey results with survey biomass and final total for the area (calculated with CIF).

Location/Date	Average TS (dB/kg)	Stratum Area (km²)	Weighted Mean Sa (dB/m²)	Biomass Density (kg/m²)	Strata Biomass (t)	Standard Error (t)	Standard Error %
Eastern Shore #1 (24 Sept)	-35.96	0.48	-33.81	1.641	788	71	9
Eastern Shore #2 (28 Sept)	-35.90	1.33	-30.58	3.409	4,534	222	5
Eastern Shore #3 (4 Oct)	-35.96	1.15	-35.25	1.178	1,354	776	57
Eastern Shore #4 (14 Oct)	-35.96	0.78	-42.00	0.249	194	121	62
Final all 2013 Surveys	-35.95	3.74	-33.30	1.837	6,870	819	12

Table 10B. The 2014 Halifax/Eastern Shore herring acoustic survey results with survey biomass and final total for the area (calculated with CIF).

Location/Date	Average TS (dB/kg)	Stratum Area (km²)	Weighted Mean Sa (dB/m²)	Biomass Density (kg/m²)	Strata Biomass (t)	Standard Error (t)	Standard Error %
Eastern Shore #1 (16 Sept)	-36.22	0.41	-28.57	5.823	2,387	653	27
Eastern Shore #2 (19 Sept)	-35.96	0.62	-31.62	2.884	1,779	487	0
Eastern Shore #3 (1 Oct)	-36.44	0.27	-35.91	1.129	305	104	34
Eastern Shore #4 (7 Oct)	-36.33	0.53	-27.57	7.516	3,983	1,086	27
Eastern Shore #5 (9 Oct)	-36.23	0.51	-36.40	0.961	490	151	31
Eastern Shore #6 (10 Oct)	-36.22	0.13	-29.28	4.941	642	270	42
Final all 2014 Surveys	-36.23	2.47	-30.34	3.885	9,587	1,396	15

Table 11. The 2000-2014 Lunenburg Box area (Liverpool to Chebucto Head for statistical districts 22-26) catch and effort with start and end dates, total catch, number of sets, number of days with landings and number of active vessels with landings in these districts. Note set data available from 2006 onwards only; from 2000-2005 (grey cells) only catch by day available.

Year	Min. Day	Max. Day	Day Range	Catch	No. Sets	No. Days	No. Vessels
2000	01-May-00	14-Oct-00	167	27	46	34	11
2001	18-May-01	13-Oct-01	149	21	54	37	10
2002	05-May-02	12-Oct-02	161	29	84	48	15
2003	07-Jun-03	21-Oct-03	137	48	44	33	12
2004	13-Jun-04	30-Nov-04	171	32	34	22	12
2005	30-Jun-05	31-Oct-05	124	140	58	20	11
2006	03-May-06	30-Nov-06	212	64	134	53	18
2007	23-Jun-07	26-Nov-07	157	21	72	42	13
2008	04-May-08	06-Nov-08	187	47	106	44	14
2009	23-May-09	30-Nov-09	192	182	121	40	15
2010	30-Apr-10	12-Oct-10	166	164	80	31	15
2011	31-May-11	31-Oct-11	154	142	94	25	16
2012	24-May-12	31-Oct-12	161	34	52	22	9
2013	17-Aug-13	15-Oct-13	60	93	76	18	6
2014	15-Sep-14	31-Oct-14	47	39	24	12	7
Average			150	72	72	32	12

Table 12. The 2013 herring acoustic surveys for Glace Bay (using standard TS with CIF; no samples available).

Location/Date	Average TS (dB/kg)	Stratum Area (km²)	Weighted Mean Sa (dB/m²)	Biomass Density (kg/m²)	Strata Biomass (t)	Standard Error (t)	Standard Error %
Glace Bay #1 - 11 Sept	-36.96	1.18	-49.70	0.0423	50	15	30
Final all 2013 Surveys	-36.96	1.18	-49.70	0.0423	50	15	30

Table 13A. Landings (t) by spawning area for coastal Nova Scotia from 1996-2014 with last 5-year (grey cells) and overall averages. '-' indicates not applicable.

Location		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Avg. Catch Last 5 years	Avg. Catch All Years
Little Hope/ Port Mouton	Catch	-	490	1,170	2,920	2,040	2,900	3,980	4,500	1,300	2,240	3,140	1,510	1,108	3,731	3,106	2,576	2,150	2,499	3,596	2,785	2,498
	Allocation	-	-	-	-	1,495	1,170	1,410	2,248	3,028	3,162	3,952	4,008	2,944	2,172	2,454	2,094	2,188	2,387	3,577	-	-
Halifax/ Eastern Shore	Catch	1,280	1,520	1,100	1,630	1,350	1,900	3,330	2,700	4,200	3,450	3,350	3,720	2,348	5,885	2,302	908	771	1,390	1,163	2,070	2,331
	Allocation	-	-	-	-	1,425	1,313	1,403	1,952	3,638	3,802	4,323	5,367	5,103	3,857	4,373	4,188	2,920	2,427	1,959	-	-
Glace Bay	Catch	-	170	1,730	1,040	834	1,204	3,058	1,905	1,481	626	85	45	12	4	11	0	7	2	1	4	679
Bras d'Or Lakes	Catch	170	160	120	31	56	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	29
Total		1,450	1,450	2,340	4,120	5,621	7,200	8,487	13,181	13,309	13,647	13,280	14,850	14,650	11,515	15,649	12,246	9,766	8,036	8,577	10,265	10,865

Table 13B. Acoustic survey SSB (t) by spawning area for coastal Nova Scotia from 1996-2014, with last 5-year (grey cells) and overall averages (with CIF). Note that no surveys were conducted prior to 1998. 'n/s' indicates no survey. Data from 1998-2002 without CIF. Cells with thick black borders includes mapping surveys which estimated biomass based on visual sounder estimates; cells with bolded values include mapping and acoustic surveys. Last, data prior to 2003 calculated with the CIF are not available and estimates of exploitation were not made for these years.

Location	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	SSB Ave. Last 5 years	SSB Ave. All Years
Little Hope/ Port Mouton	14,100	15,800	5,200	21,300	56,000	**53,100**	22,500	44,700	24,100	2,800	14,500	36,600	26,700	28,796	12,756	74,532	46,077	37,664	29,386
Halifax/ Eastern Shore	8,300	20,200	**10,900**	16,700	**41,500**	92,600	28,400	36,950	68,900	28,300	30,300	54,200	27,700	5,498	3,668	6,870	9,586	10,664	28,857
Glace Bay	n/s	2,000	n/s	21,200	7,700	31,500	n/s	3,180	n/s	240	500	100	8	51	n/s	50	n/s	52	6,048
Bras d'Or Lakes	n/s	530	70	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	300

Table 13C. Exploitation estimates (%) for coastal Nova Scotia spawning components from 1998-2014, with last 5-year and overall averages (with CIF). Exploitation estimates for Bras d'Or Lakes are not available. '-' indicates not applicable. Data from 2998-2002 without CIF. Cells with thick black borders includes mapping surveys which estimated biomass based on visual sounder estimates; cells with bolded values include mapping and acoustic surveys. Last, data prior to 2003 calculated with the CIF are not available and estimates of exploitation were not made for these years.

Location	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average Last 5 years	Average All Years
Little Hope/Port Mouton	8%	18%	39%	14%	7%	**8%**	6%	5%	13%	54%	8%	10%	12%	9%	17%	3%	8%	10%	14%
Halifax/Eastern Shore	13%	8%	12%	11%	8%	3%	15%	9%	5%	13%	8%	11%	8%	17%	21%	20%	12%	15%	11%
Glace Bay	-	52%	-	6%	40%	6%	-	20%	-	19%	2%	4%	-	-	-	-	-	4%	18%

FIGURES

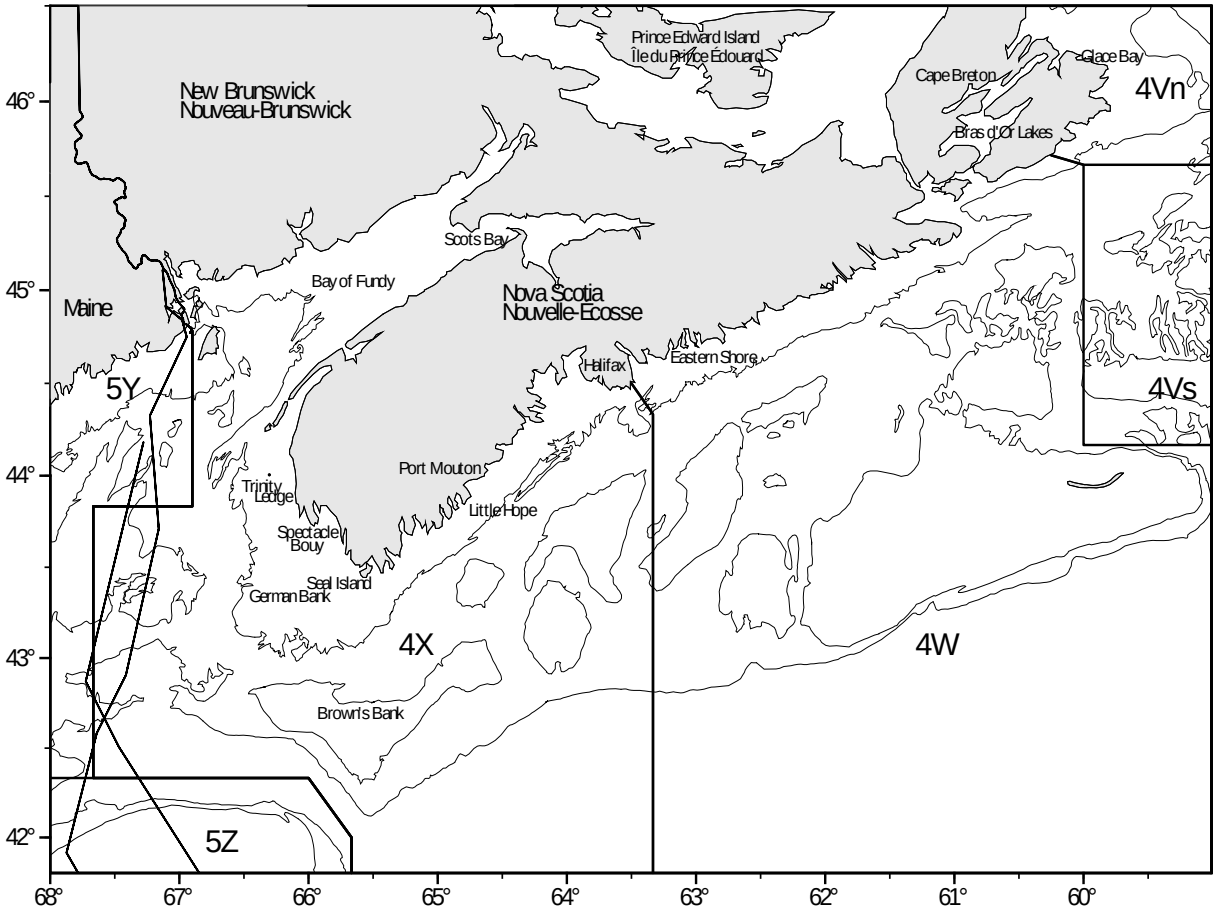

Figure 1. Map of the major spawning areas within the NAFO divisions 4WX Atlantic herring stock complex.

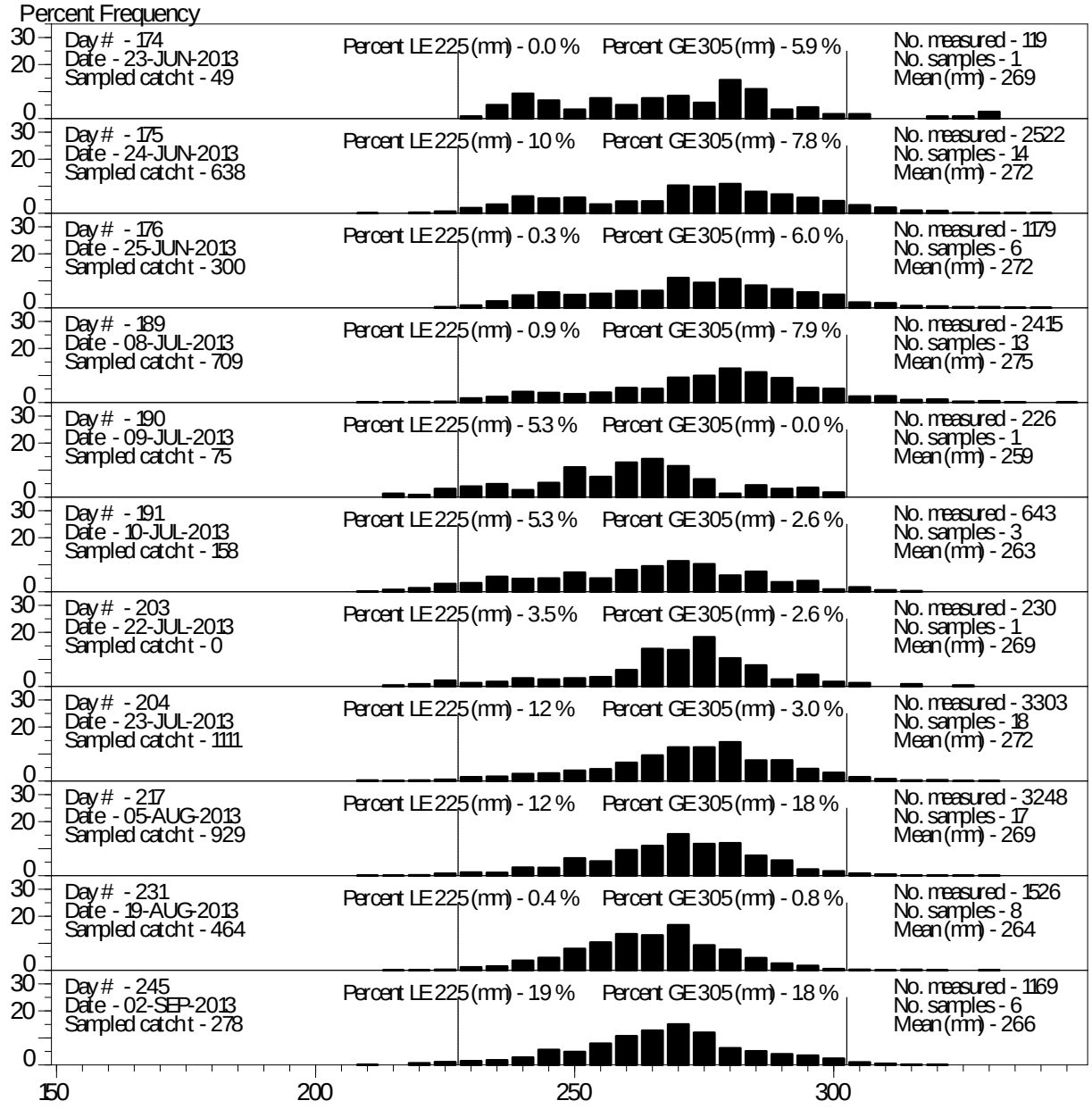

Figure 2A. Scots Bay daily herring length frequency samples collected from all landings in 2013, with proportions <=225mm and >=305mm. Length scale in millimetres with measurements grouped by half centimetre.

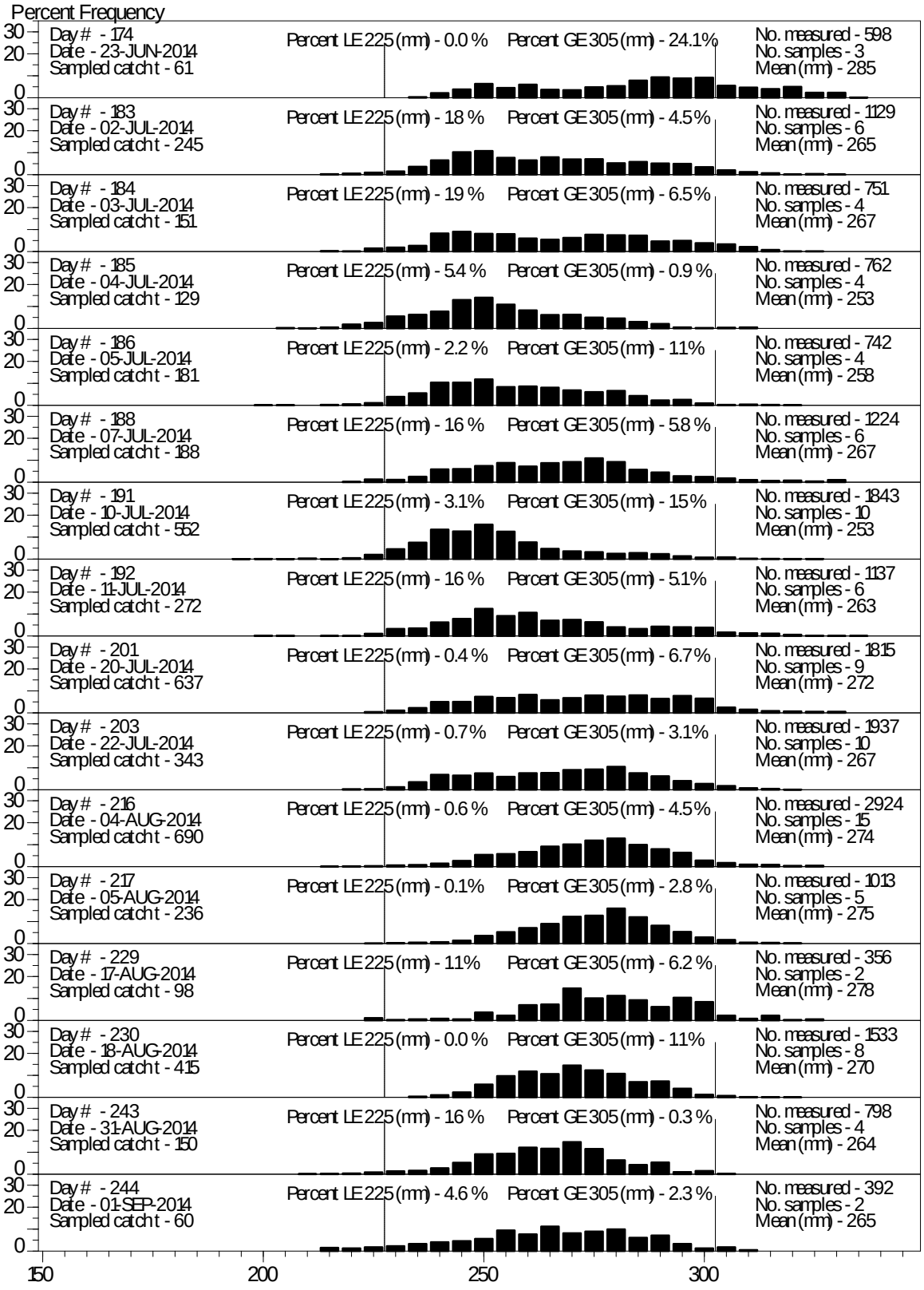

Figure 2B. Scots Bay daily herring length frequency samples collected from all landings in 2014, with proportions <=225mm and >=305mm. Length scale in millimetres with measurements grouped by half centimetre.

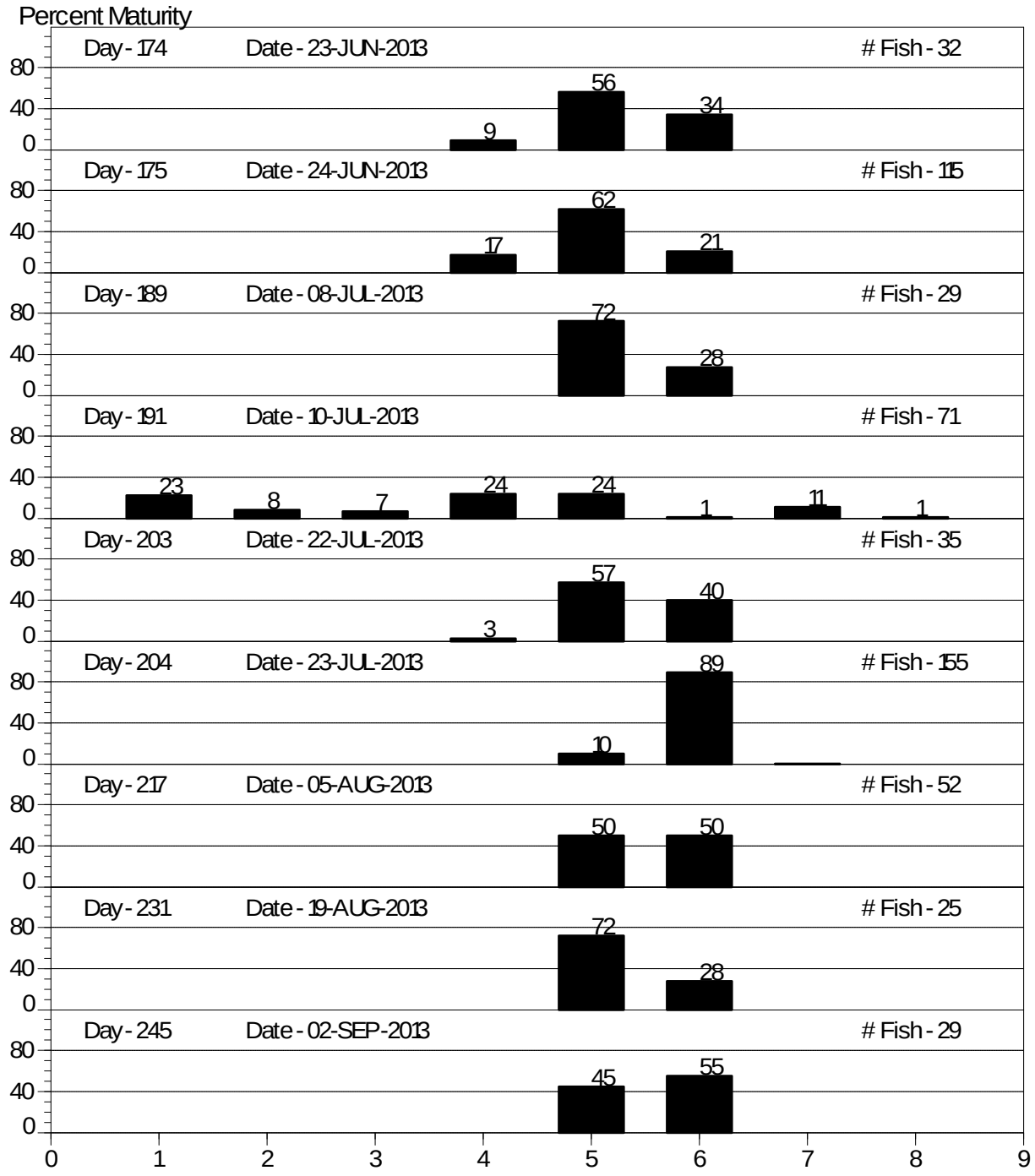

Figure 3A. Daily herring maturity samples collected from Scots Bay landings in 2013. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; 8=recovering.

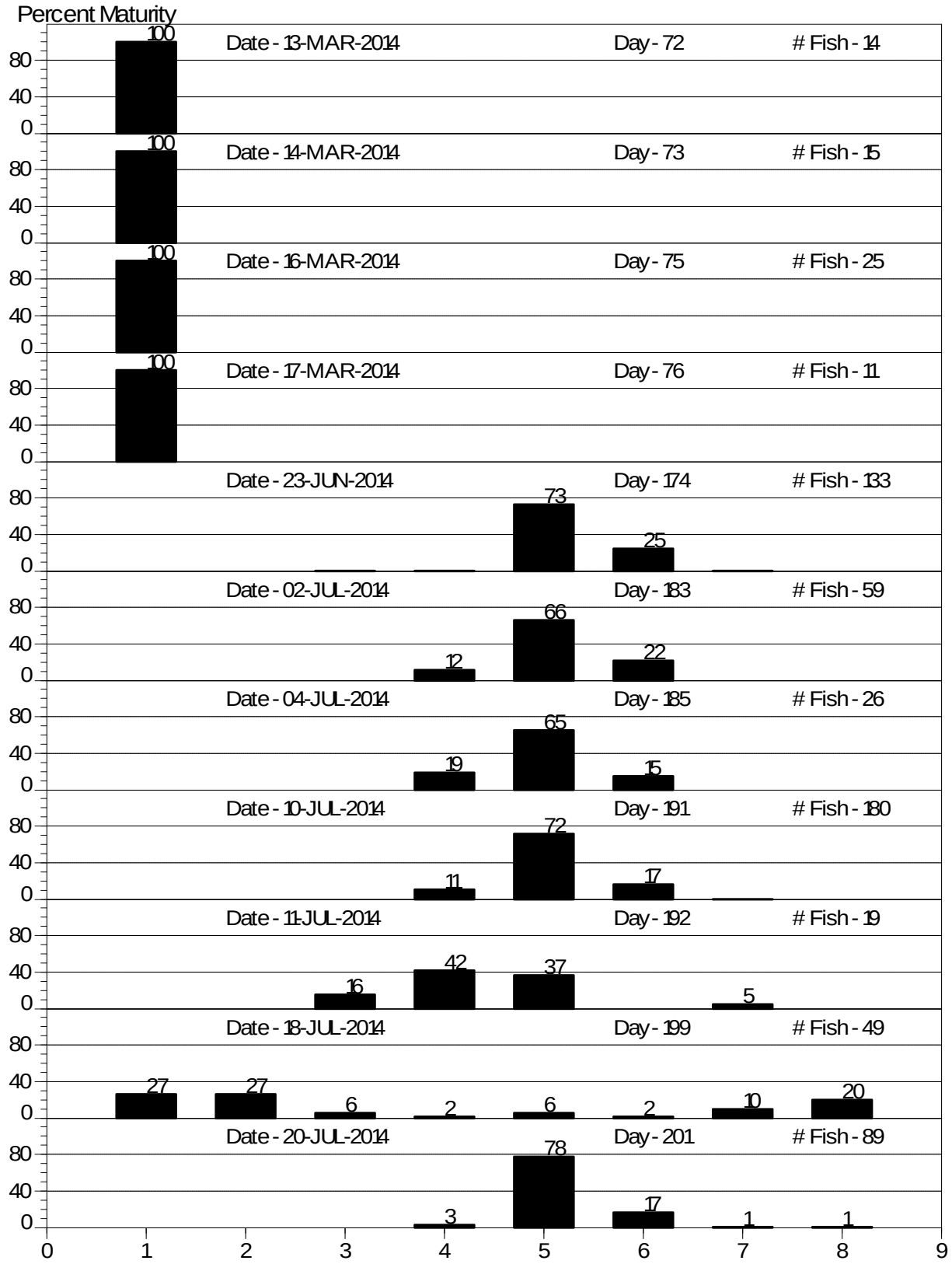

Figure 3B (Continue below). Daily herring maturity samples collected from Scots Bay landings in 2014. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; 8=recovering.

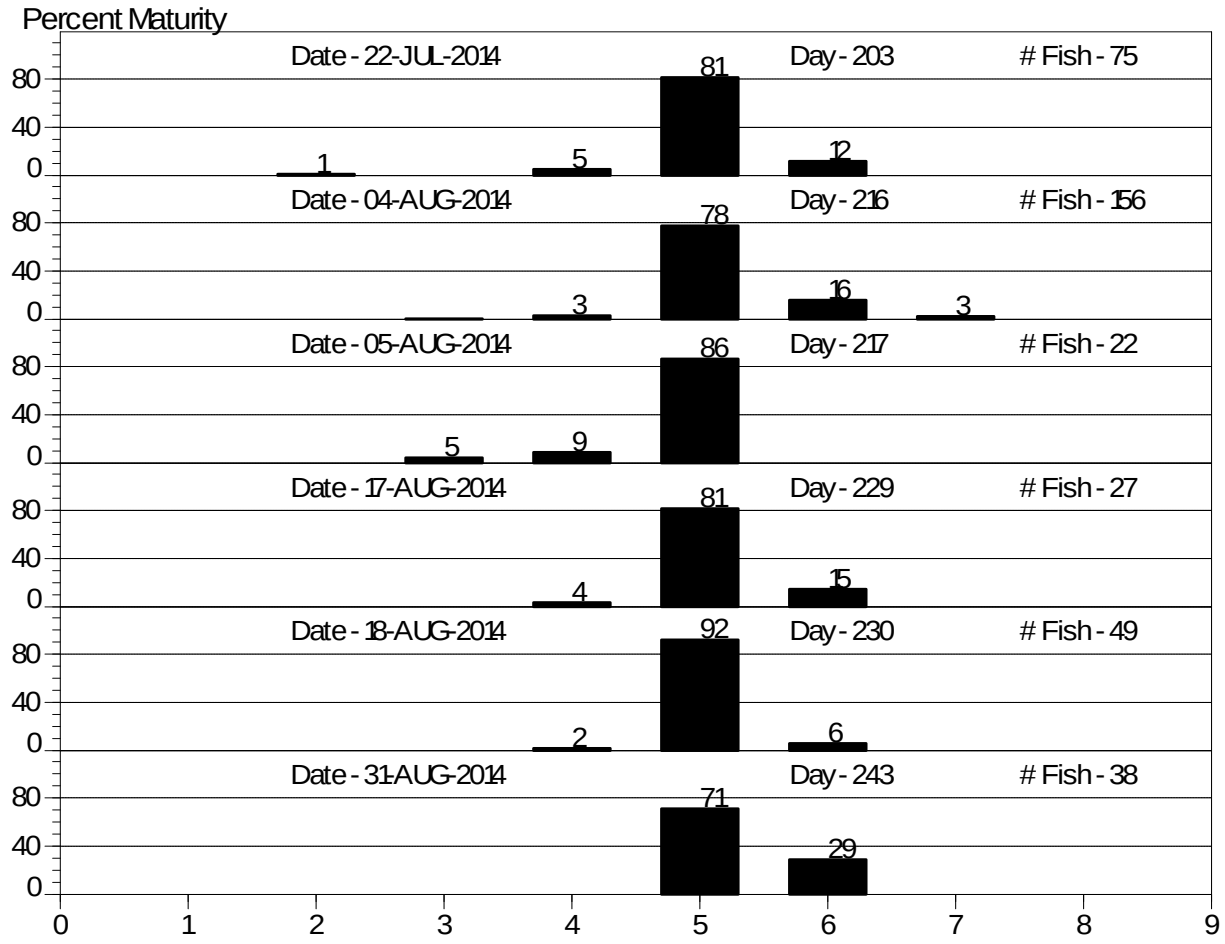

Figure 3B (Continue from above). Daily herring maturity samples collected from Scots Bay landings in 2014. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; 8=recovering.

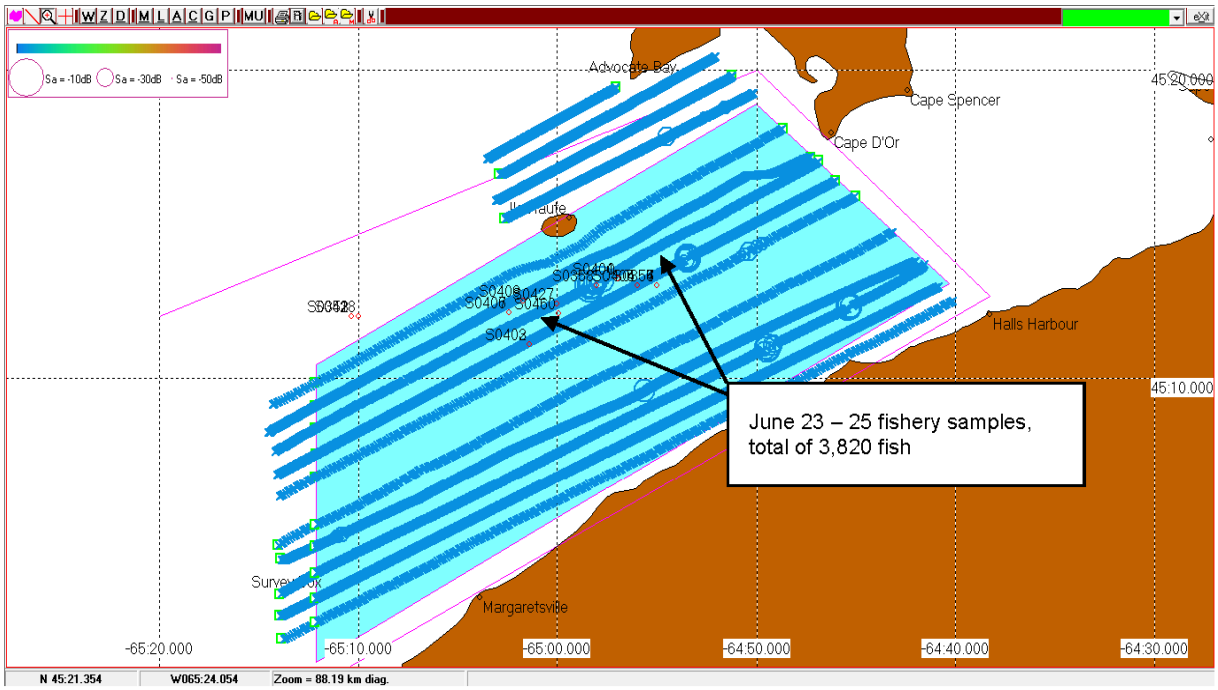

Figure 4A. Scots Bay acoustic survey (#1) on June 22, 2013, showing the main survey box (highlighted area) and transects completed with backscatter (Sa) along with locations of fishery samples.

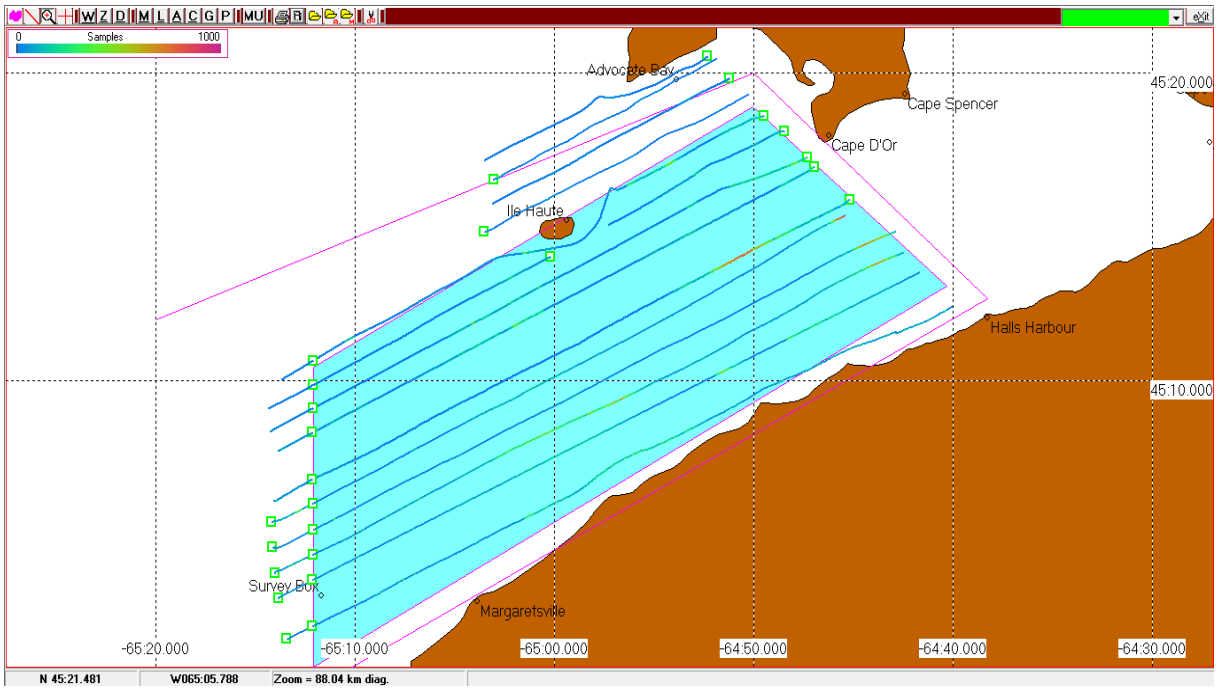

Figure 4B. Scots Bay acoustic survey (#1) on June 21, 2014, showing the main survey box (highlighted area) and transects completed.

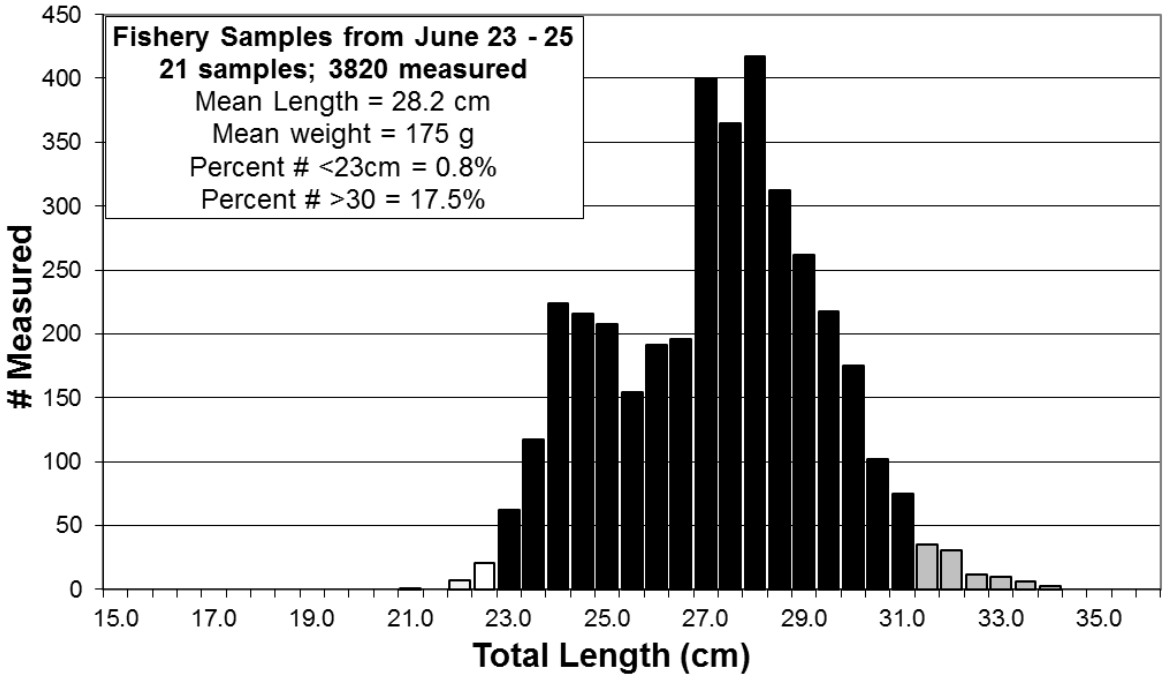

Figure 5A. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#1) on June 22, 2013, from sampling on June 23- June 25, with proportions <23cm and >30cm shown as white and grey bars.

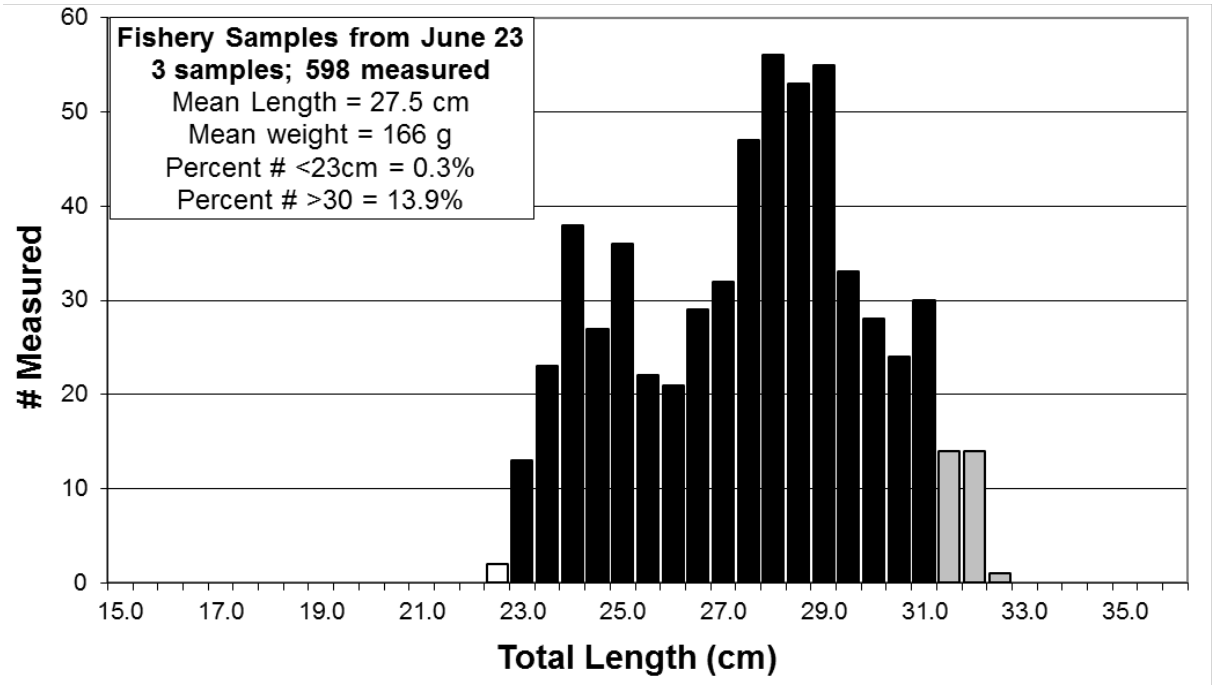

Figure 5B. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#1) on June 21, 2014, from sampling on June 23, with proportions <23cm and >30cm shown as white and grey bars.

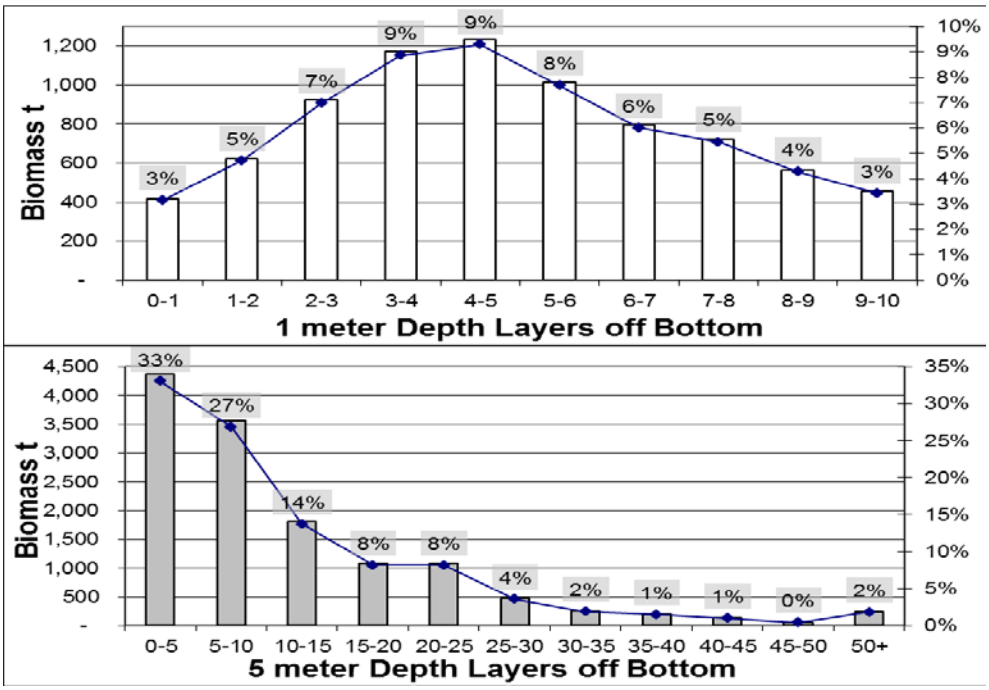

Figure 6A. Distribution of biomass by depth layer from bottom for the 2013 Scots Bay acoustic survey (#1) on June 22, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

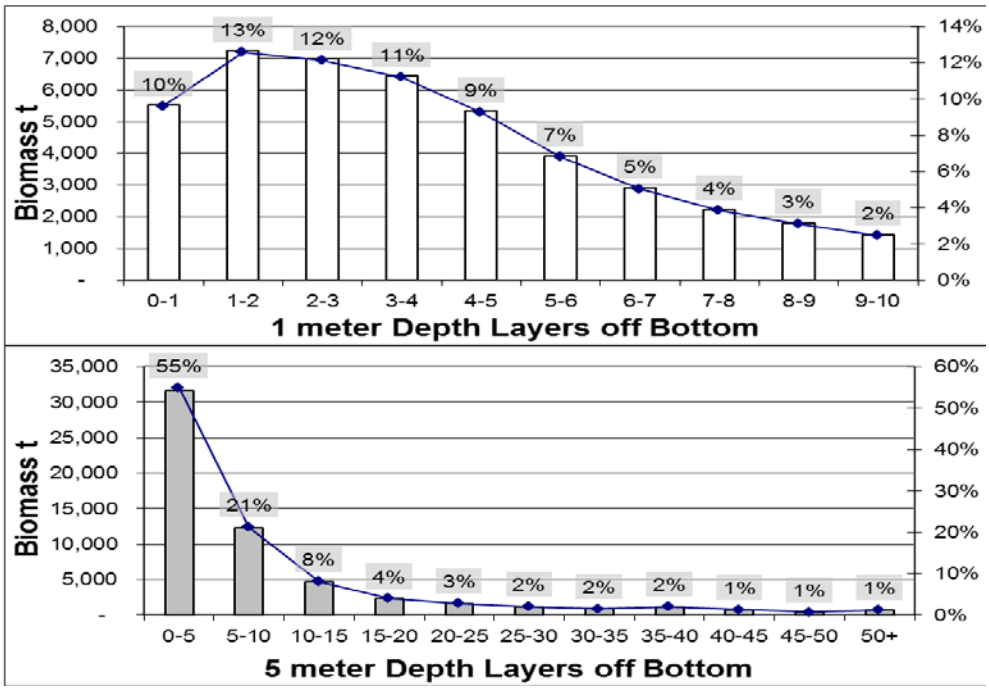

Figure 6B. Distribution of biomass by depth layer from bottom for the 2014 Scots Bay acoustic survey (#1) on June 21, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

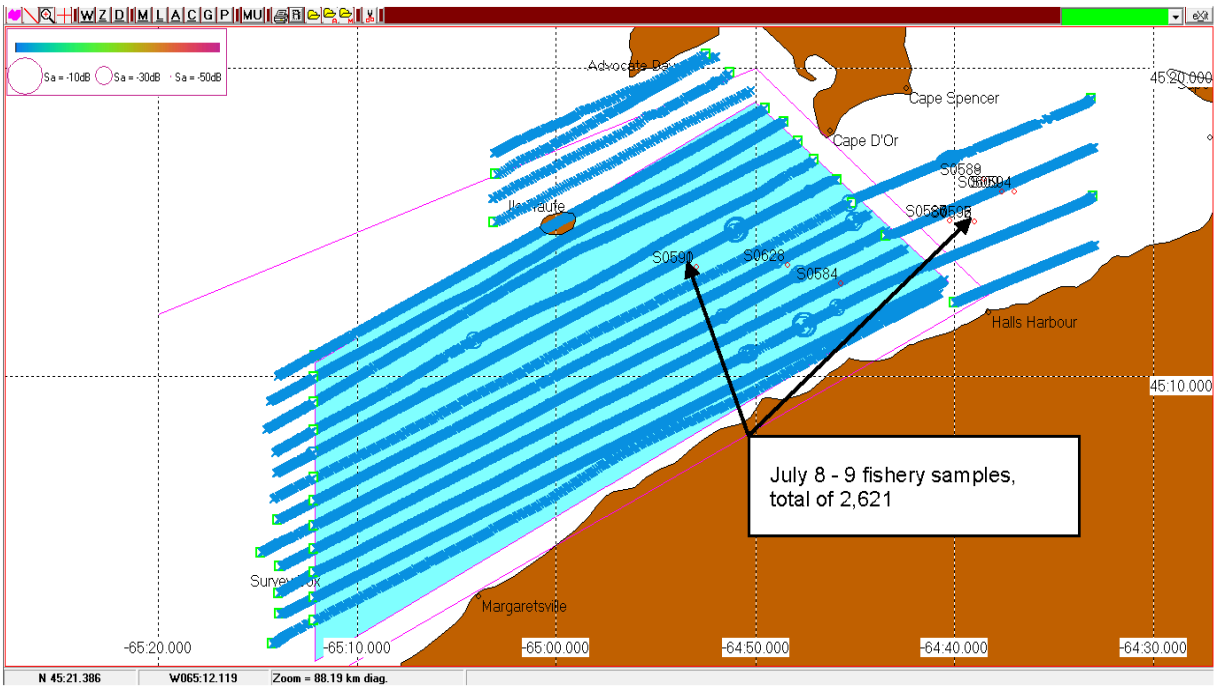

Figure 7A. Scots Bay acoustic survey (#2) on July 6, 2013, showing the main survey box (highlighted area) and transects with backscatter (Sa) along with locations for fishery samples.

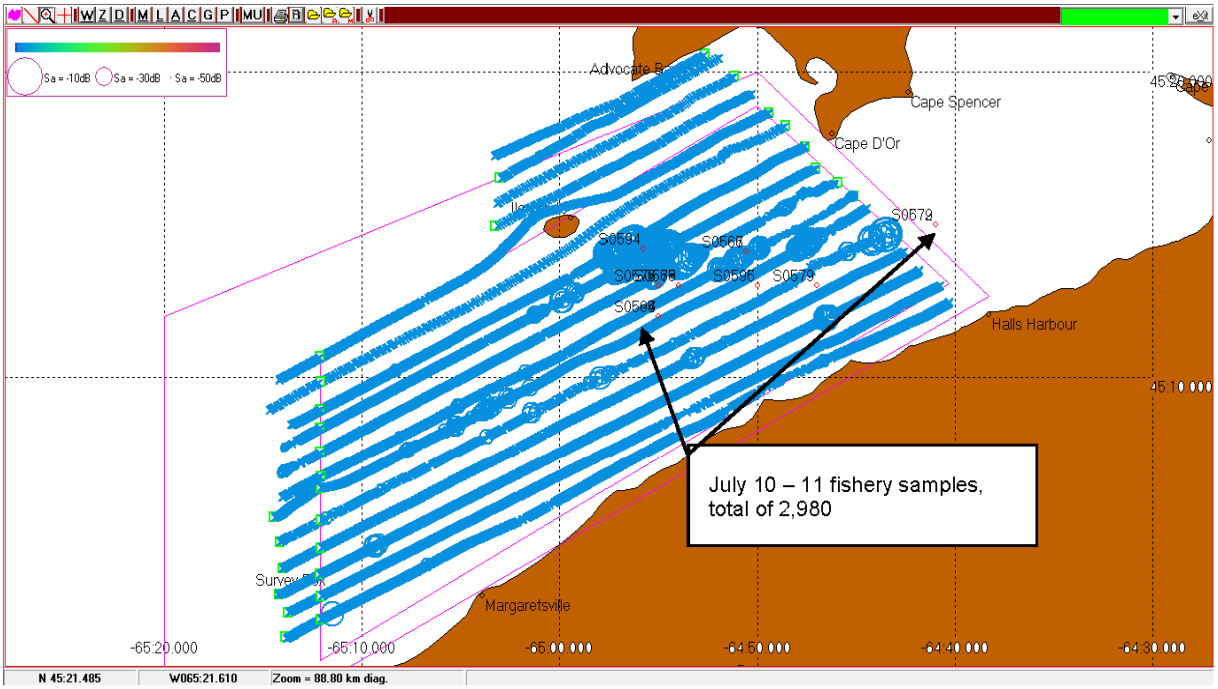

Figure 7B. Scots Bay acoustic survey (#2) on July 8, 2014, showing the main survey box (highlighted area) and transects with backscatter (Sa) along with locations for fishery samples.

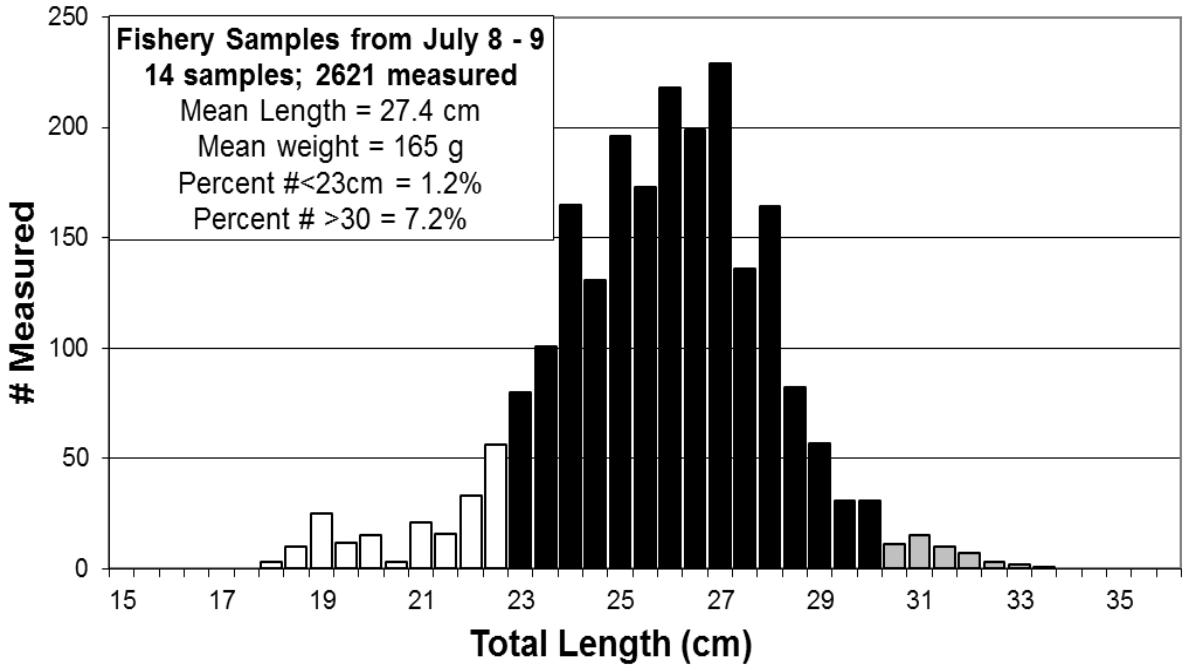

Figure 8A. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#2) on July 6, 2013, from sampling on July 8-9, with proportions <23cm and >30cm shown as white and grey bars.

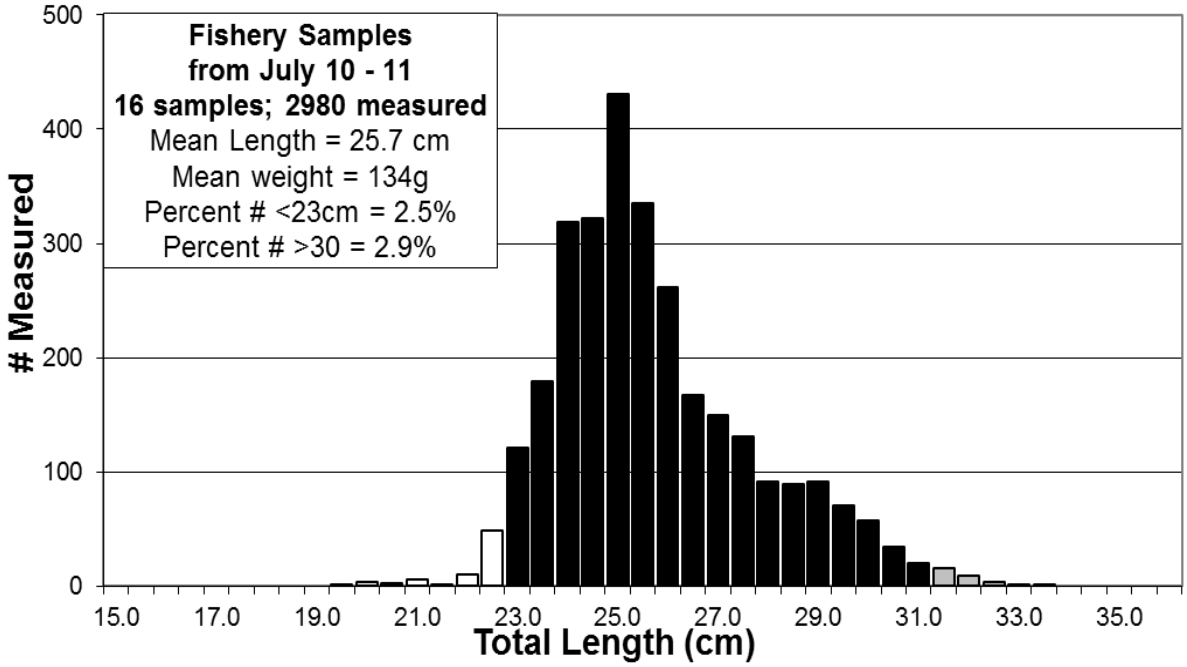

Figure 8B. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#2) on July 8, 2014, from sampling on July 10-11, with proportions <23cm and >30cm shown as white and grey bars.

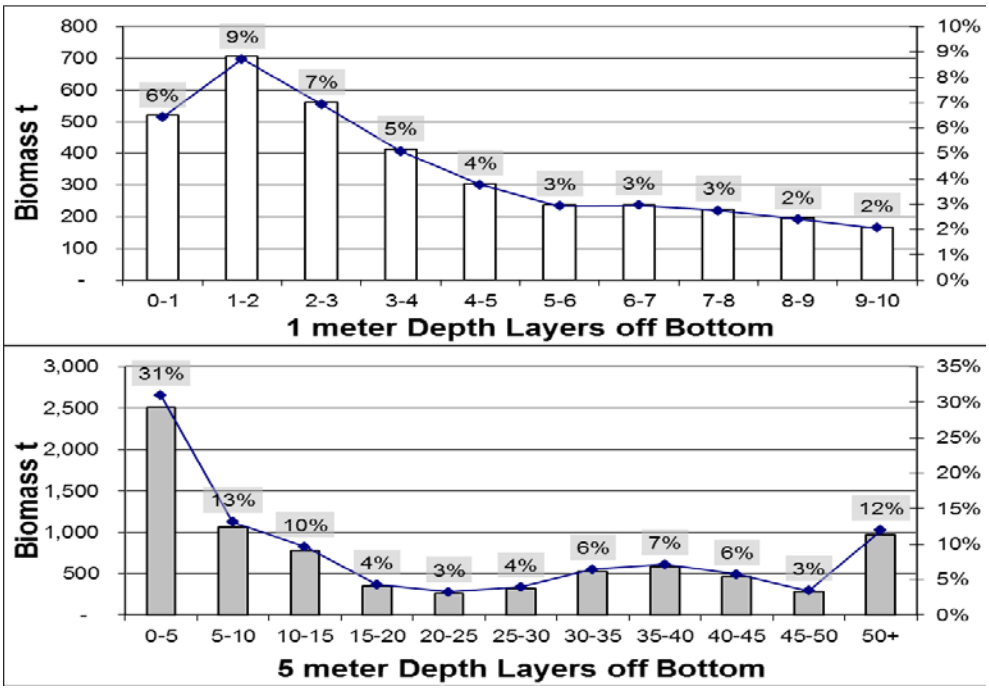

Figure 9A. Distribution of biomass by depth layer from bottom for Scots Bay acoustic survey (#2) on July 6, 2013. Biomass is histogram bars and percent is a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

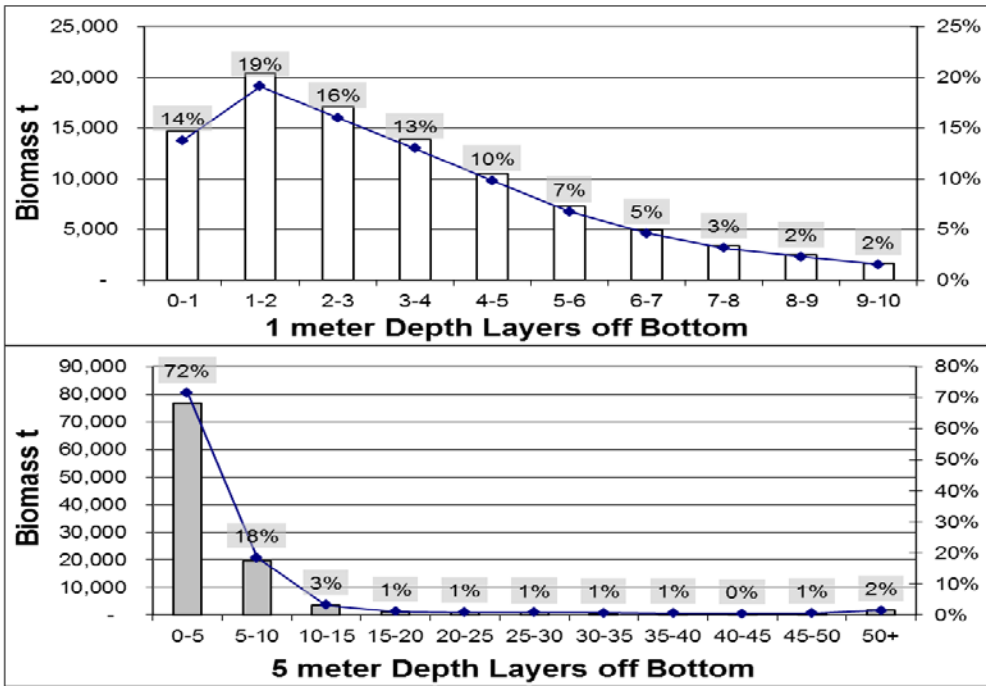

Figure 9B. Distribution of biomass by depth layer from bottom for Scots Bay acoustic survey (#2) on July 8, 2014. Biomass is histogram bars and percent is a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

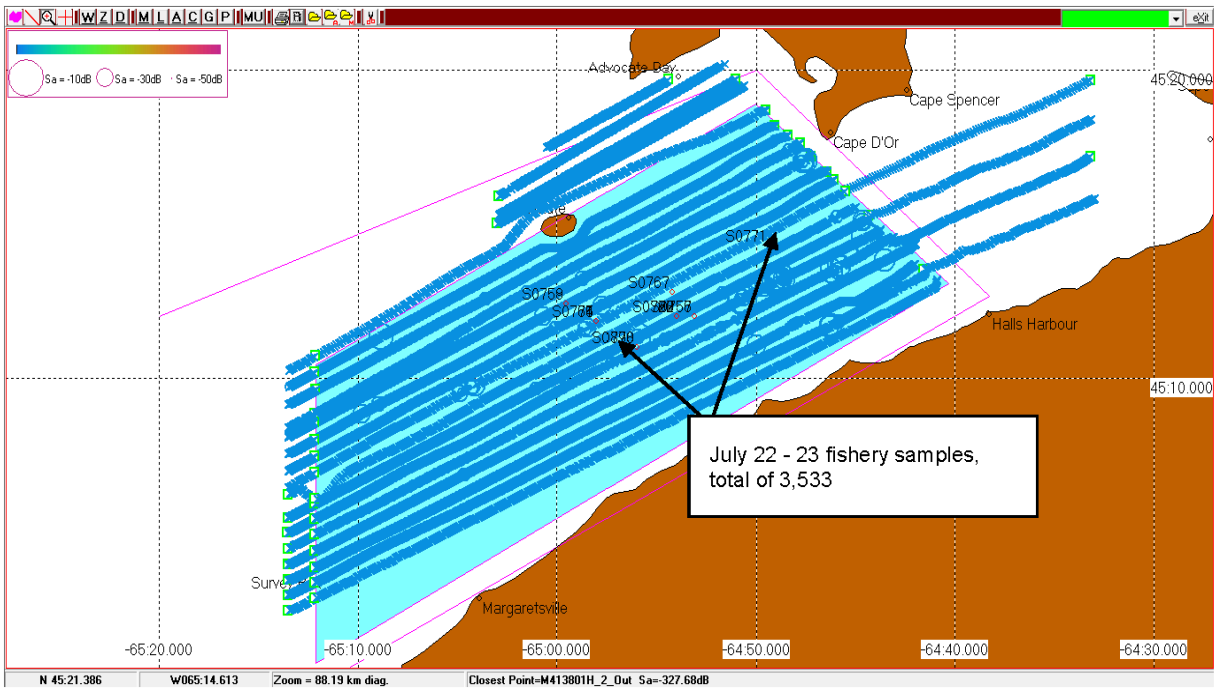

Figure 10A. Scots Bay acoustic survey (#3) on July 20, 2013, showing the main survey box (highlighted area) and transects completed with backscatter (Sa) along with locations of fishery samples.

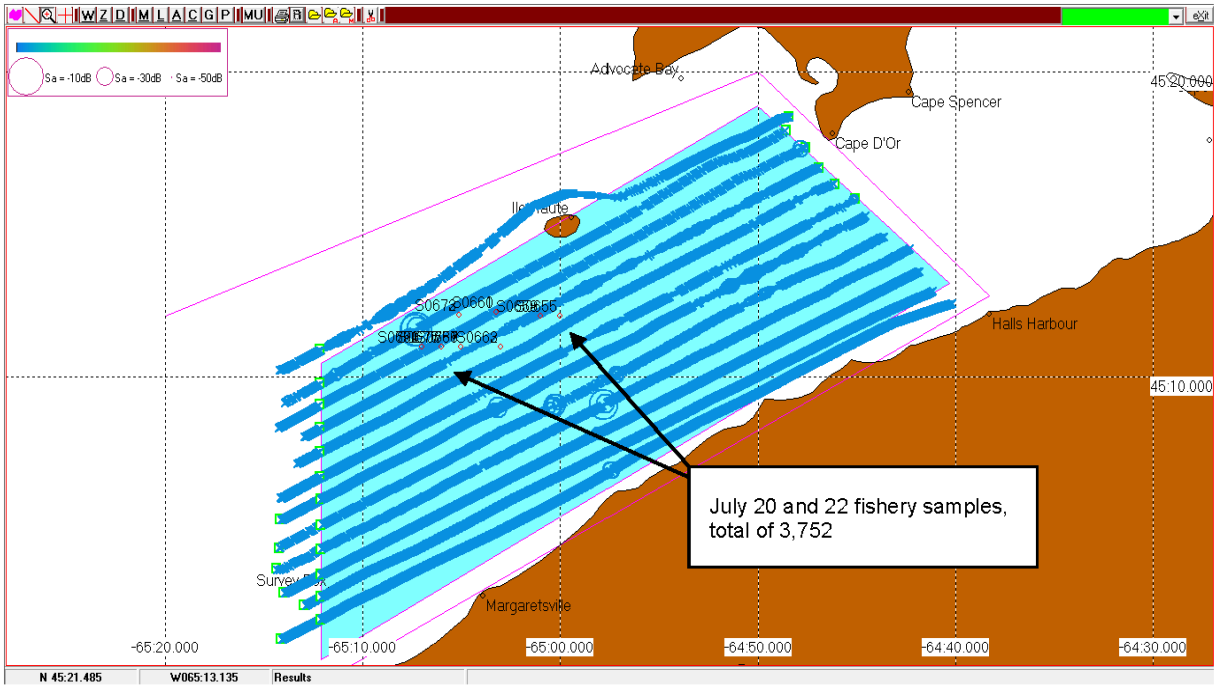

Figure 10B. Scots Bay acoustic survey (#3) on July 19, 2014, showing the main survey box (highlighted area) and transects completed with backscatter (Sa) along with locations of fishery samples.

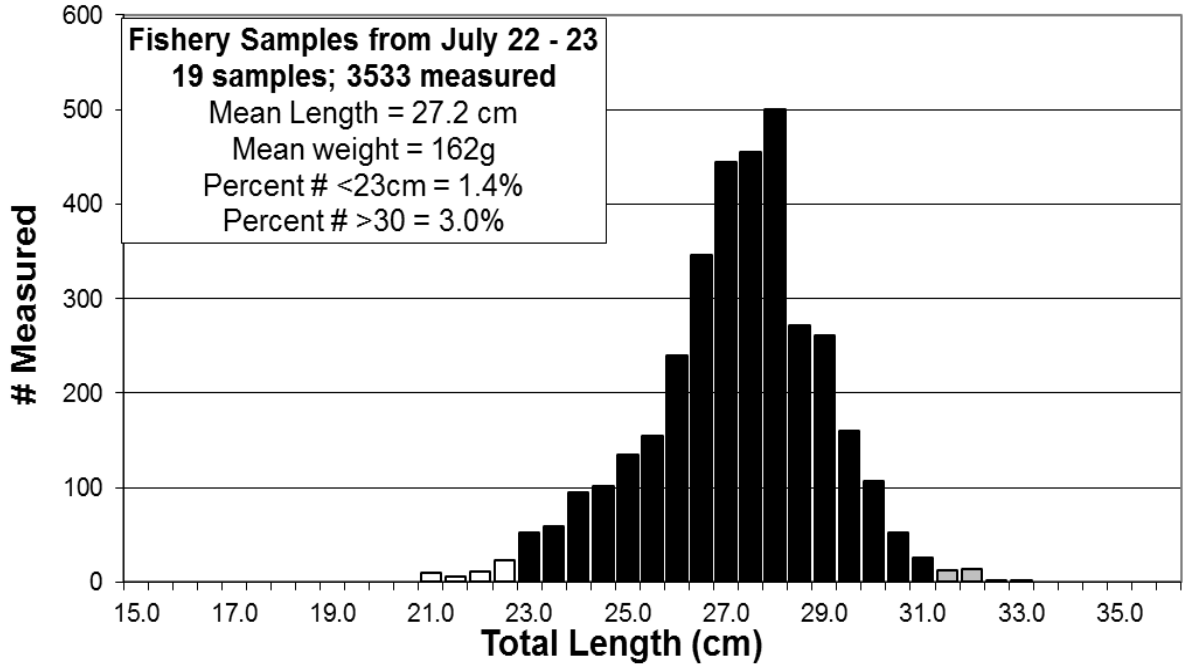

Figure 11A. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#3) on July 20, 2013, from sampling on July 22-23, with proportions <23cm and >30cm shown as white and grey bars.

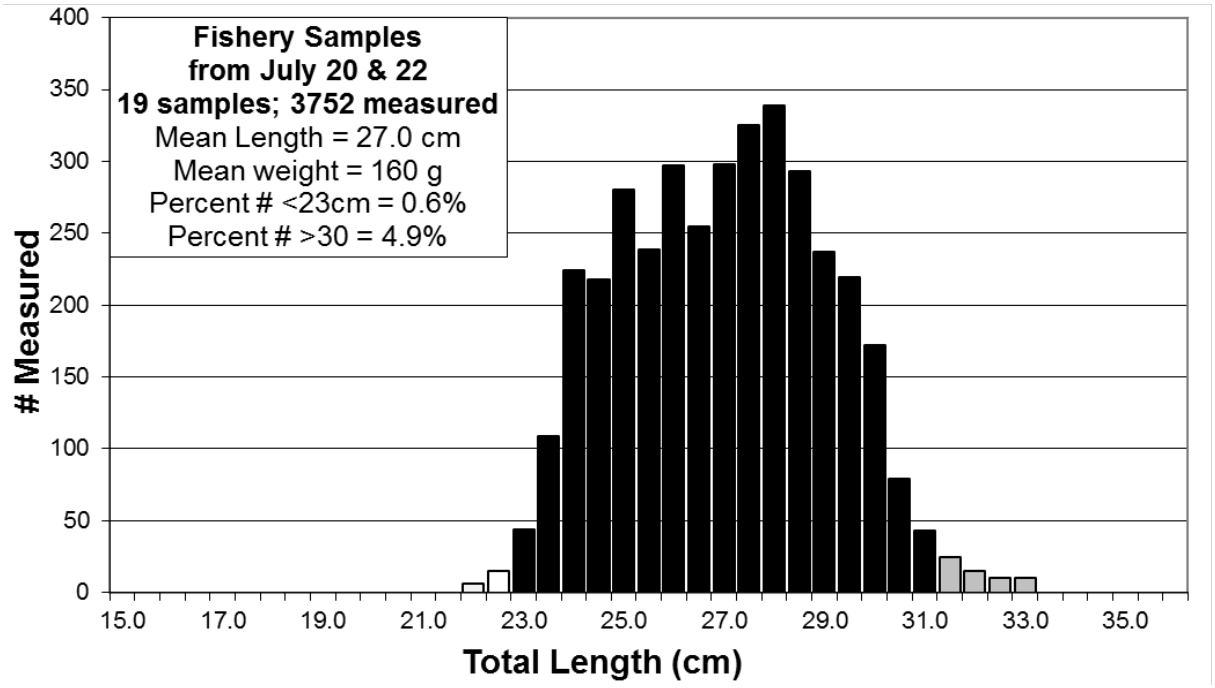

Figure 11B. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#3) on July 19, 2014, from sampling on July 20 and 22, with proportions <23cm and >30cm shown as white and grey bars.

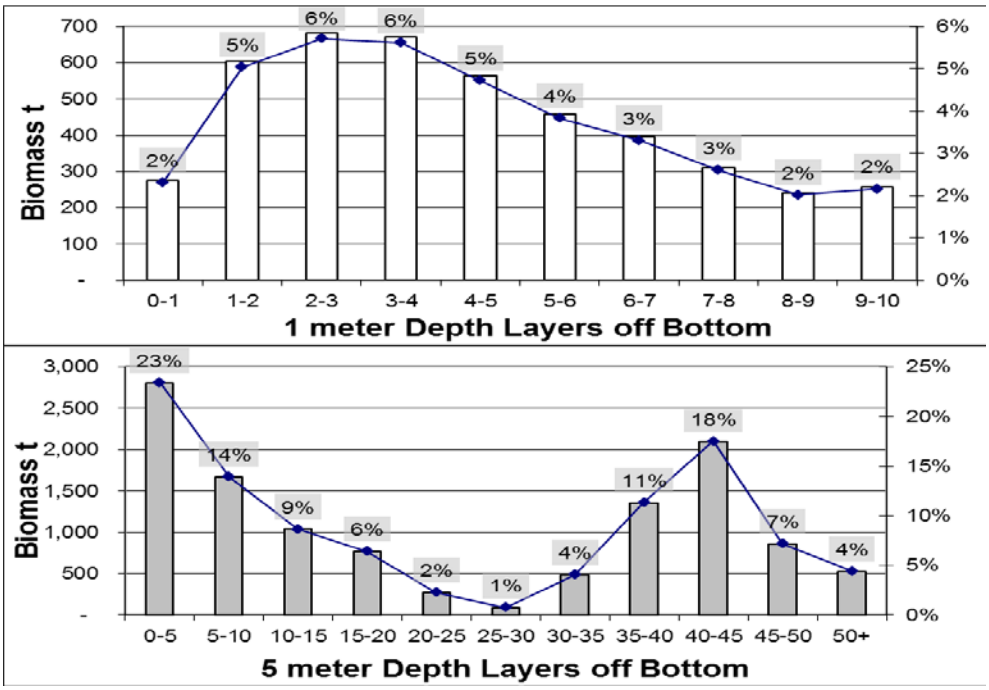

Figure 12A. Distribution of biomass by depth layer from bottom for the Scots Bay acoustic survey (#3) on July 20, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

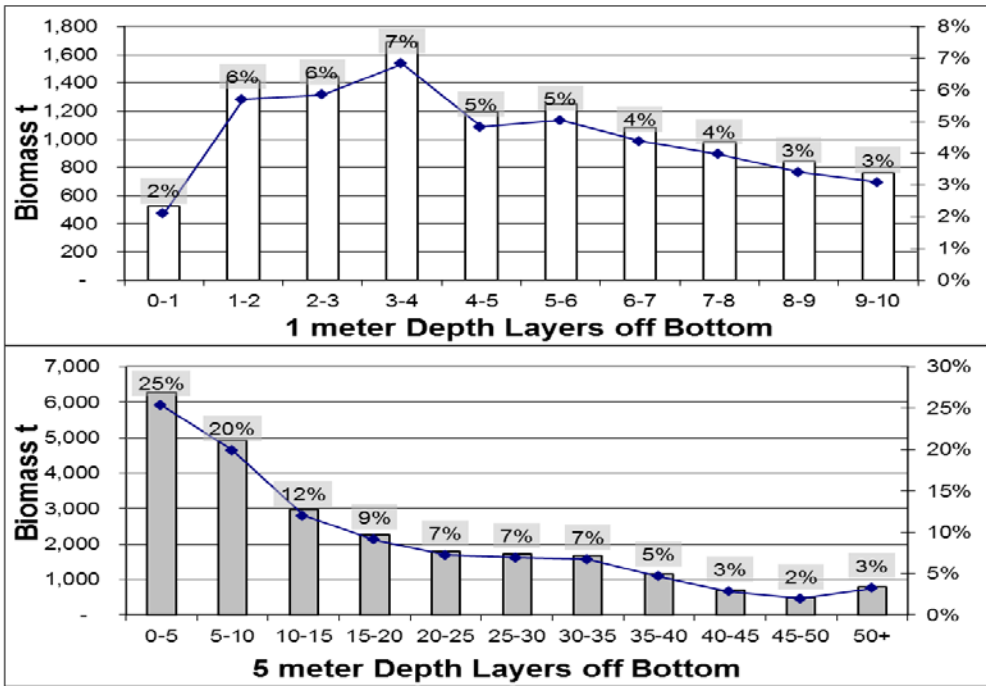

Figure 12B. Distribution of biomass by depth layer from bottom for the Scots Bay acoustic survey (#3) on July 19, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

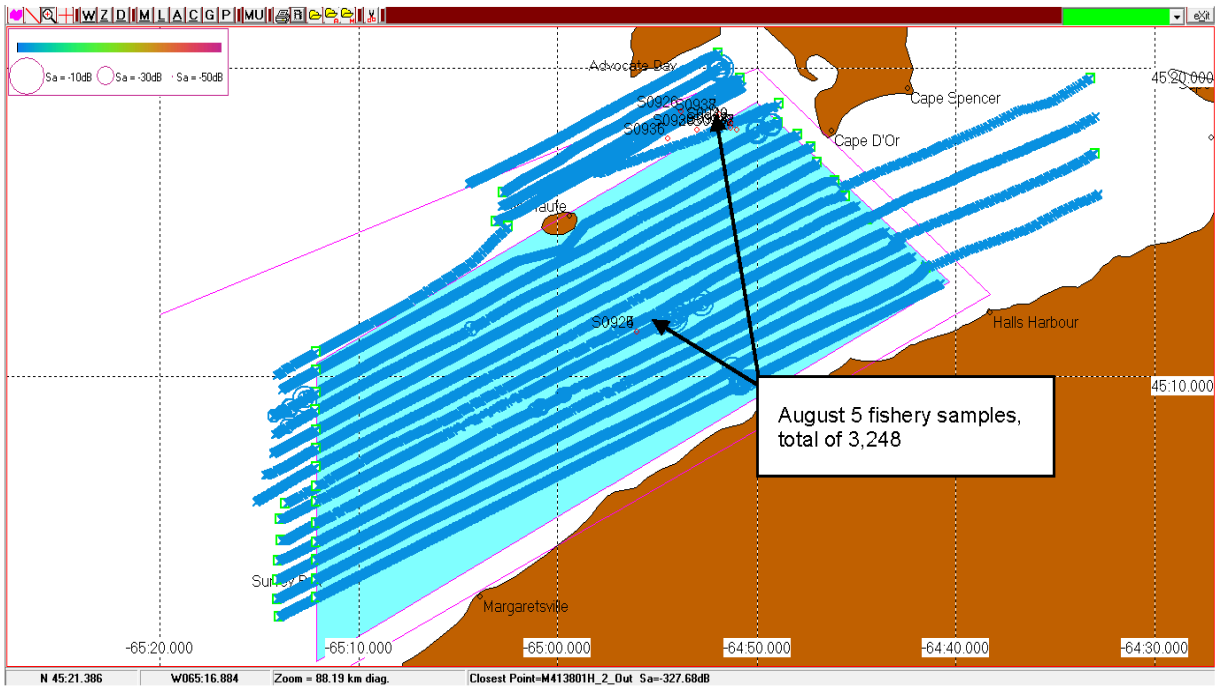

Figure 13A. Scots Bay acoustic survey (#4) on August 3, 2013, showing the main survey box (highlighted area) and transects completed with backscatter (Sa) along with locations of fishery samples.

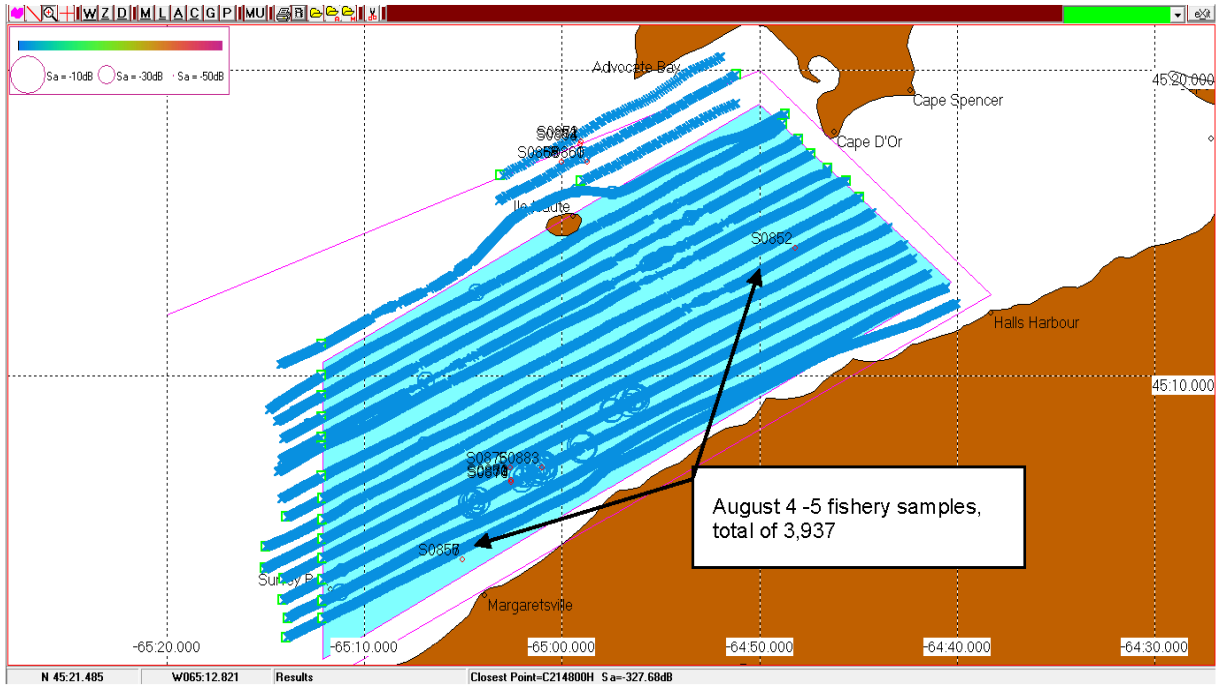

Figure 13B. Scots Bay acoustic survey (#4) on August 02, 2014, showing the main survey box (highlighted area) and transects completed with backscatter (Sa) along with locations of fishery samples.

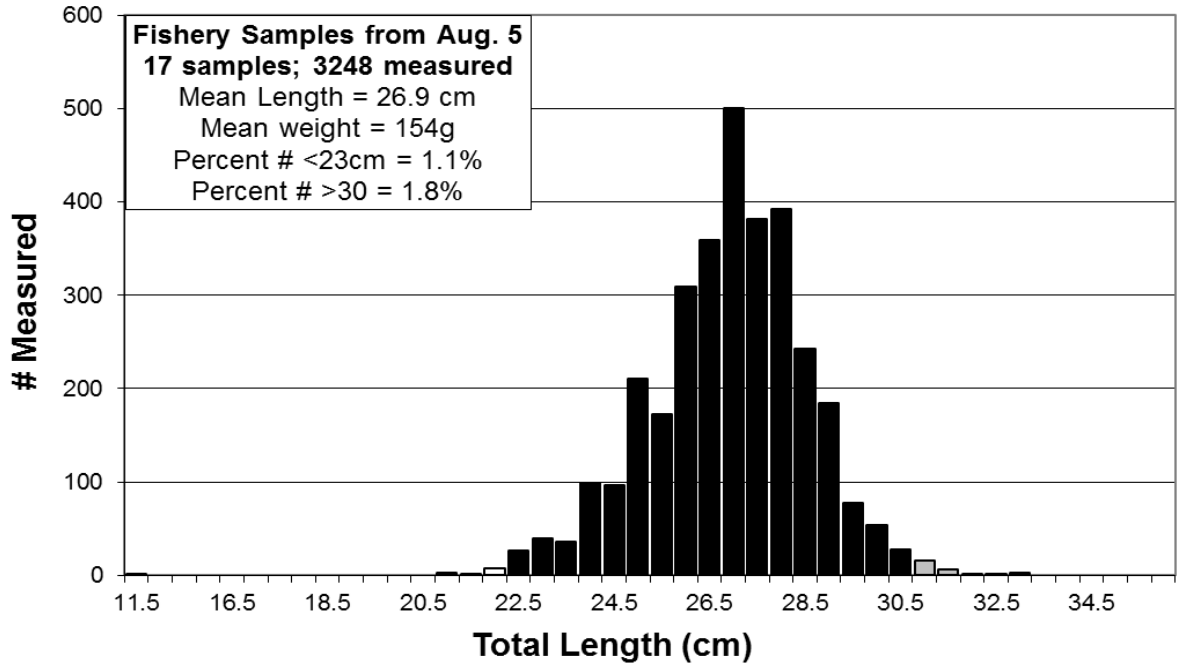

Figure 14A. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#4) on August 3, 2013, from sampling on August 5, with proportions <23cm and >30cm shown as white and grey bars.

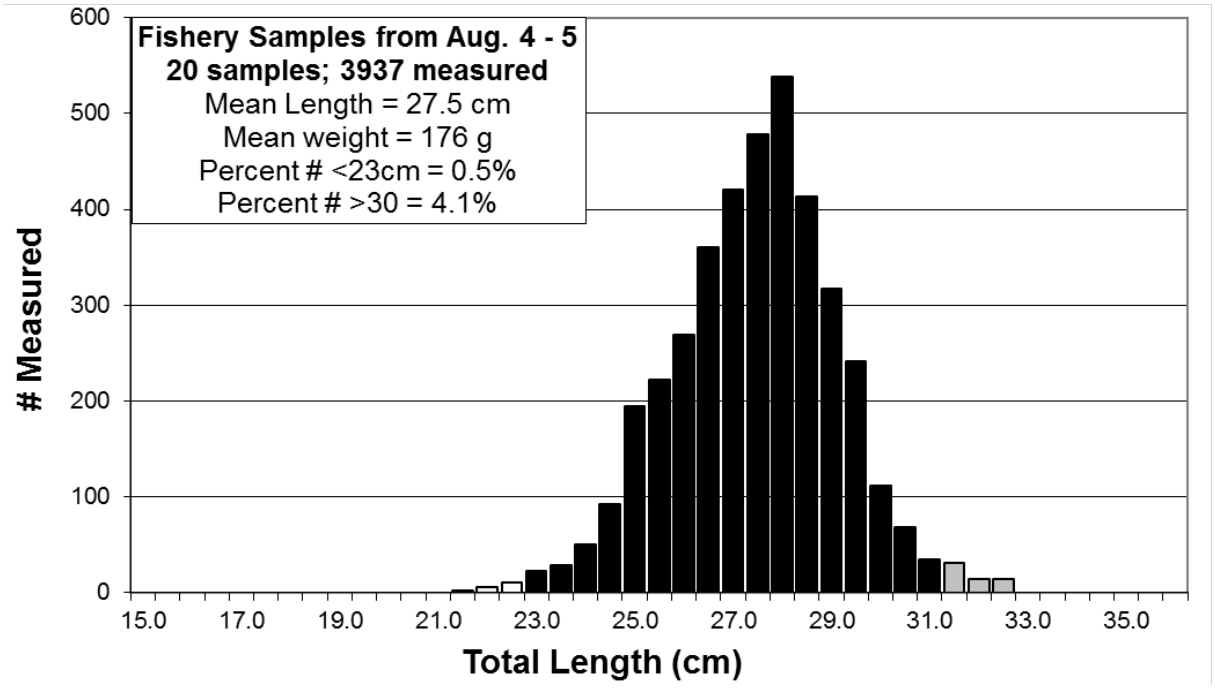

Figure 14B. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#4) on August 2, 2014, from sampling on August 4/5, with proportions <23cm and >30cm shown as white and grey bars.

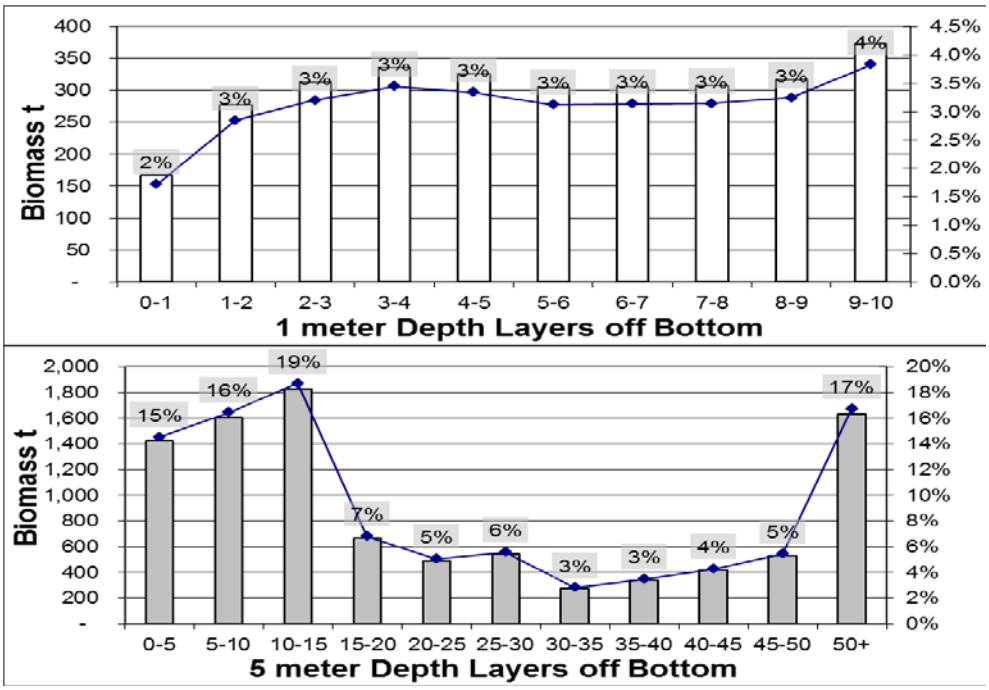

Figure 15A. Distribution of biomass by depth layer from bottom for the Scots Bay acoustic survey (#4) on August 3, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

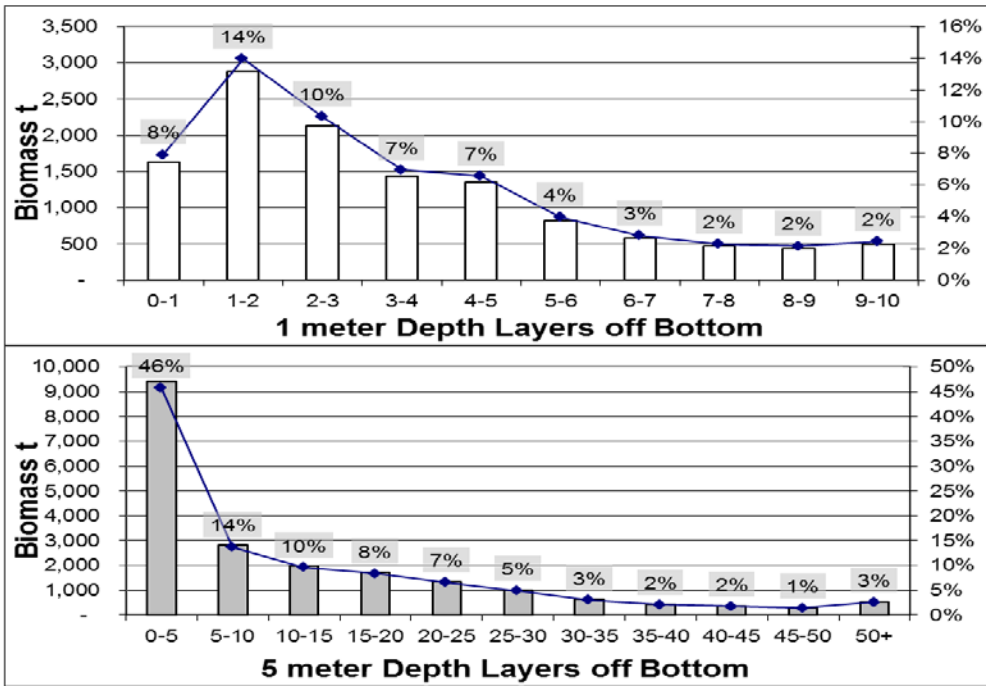

Figure 15B. Distribution of biomass by depth layer from bottom for the Scots Bay acoustic survey (#4) on August 2, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

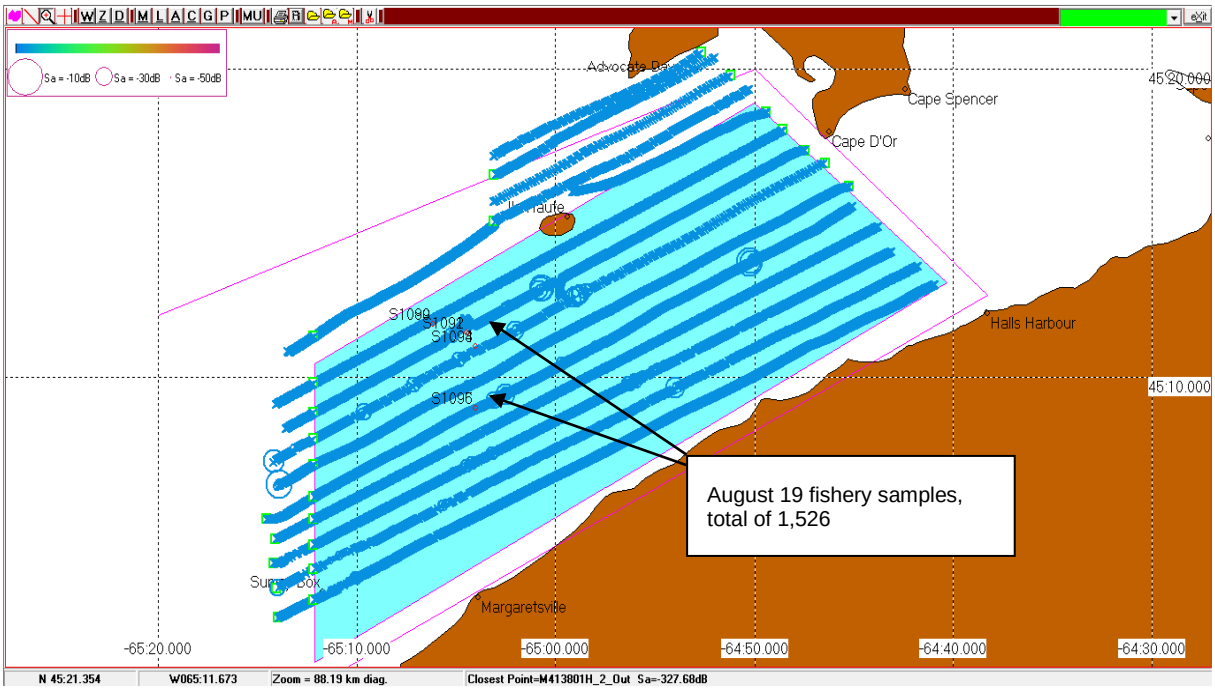

Figure 16A. Scots Bay acoustic survey (#5) on August 17, 2013, showing the main survey box (highlighted area) and transects completed with backscatter (Sa) along with locations of fishery samples.

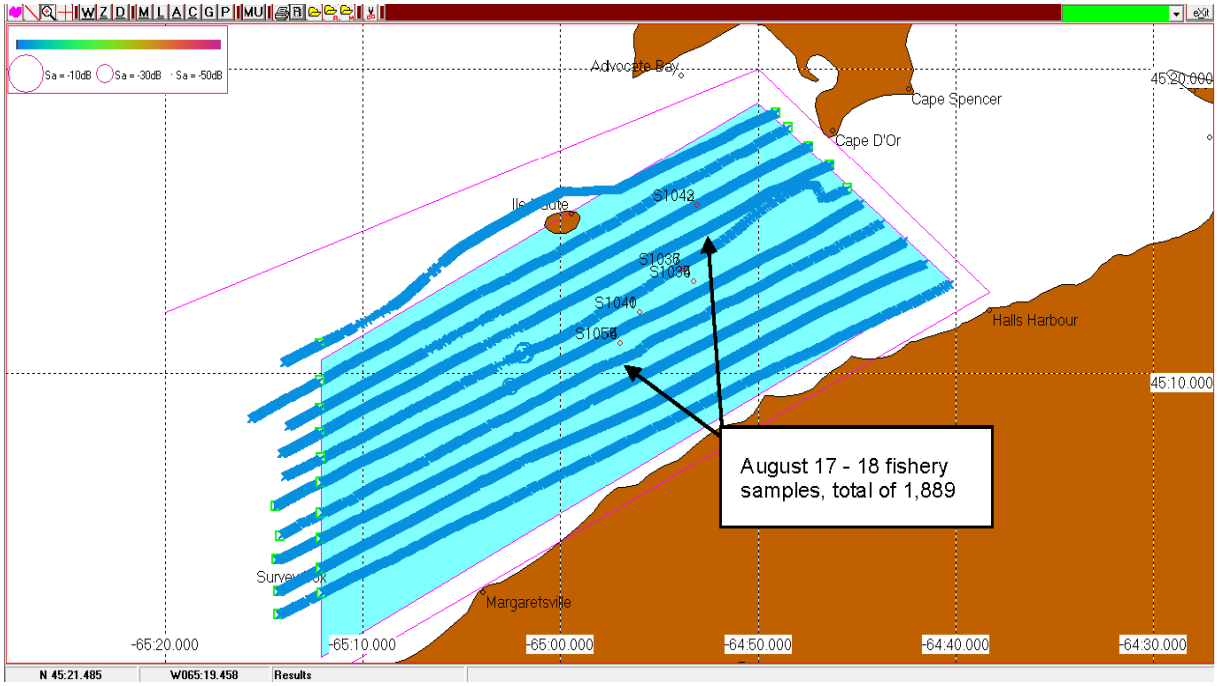

Figure 16B. Scots Bay acoustic survey (#5) on August 16, 2014, showing the main survey box (highlighted area) and transects completed with backscatter (Sa) along with locations of fishery samples.

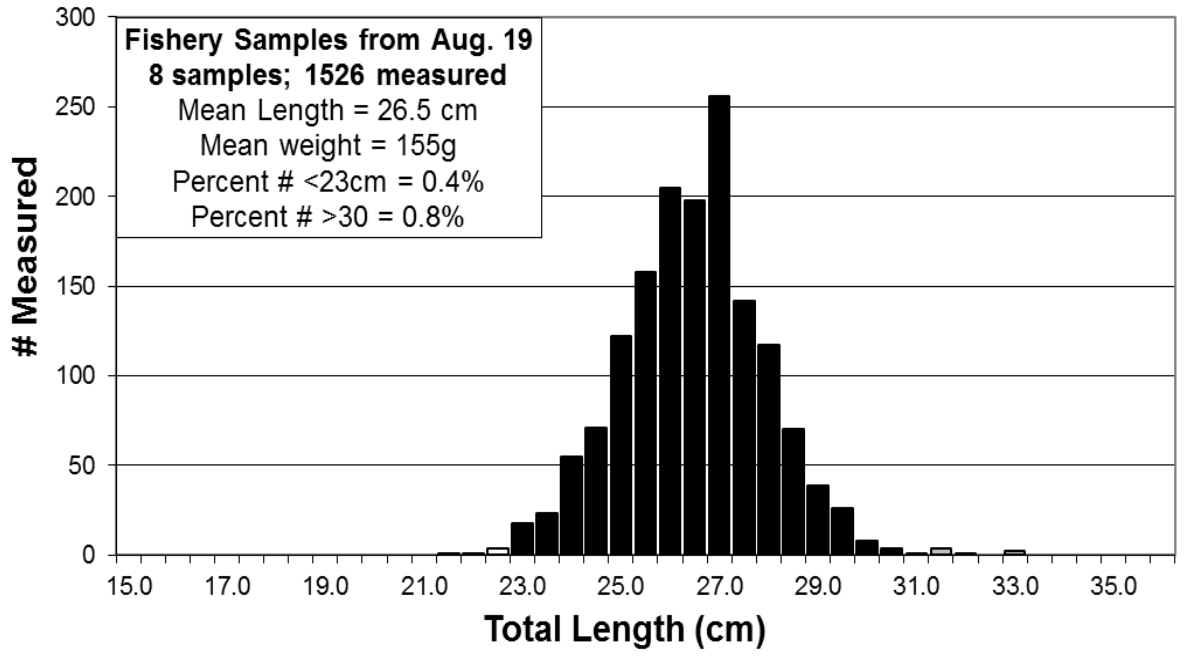

Figure 17A. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#5) on August 17, 2013, from sampling on August 19, with proportions <23cm and >30cm shown as white and grey bars.

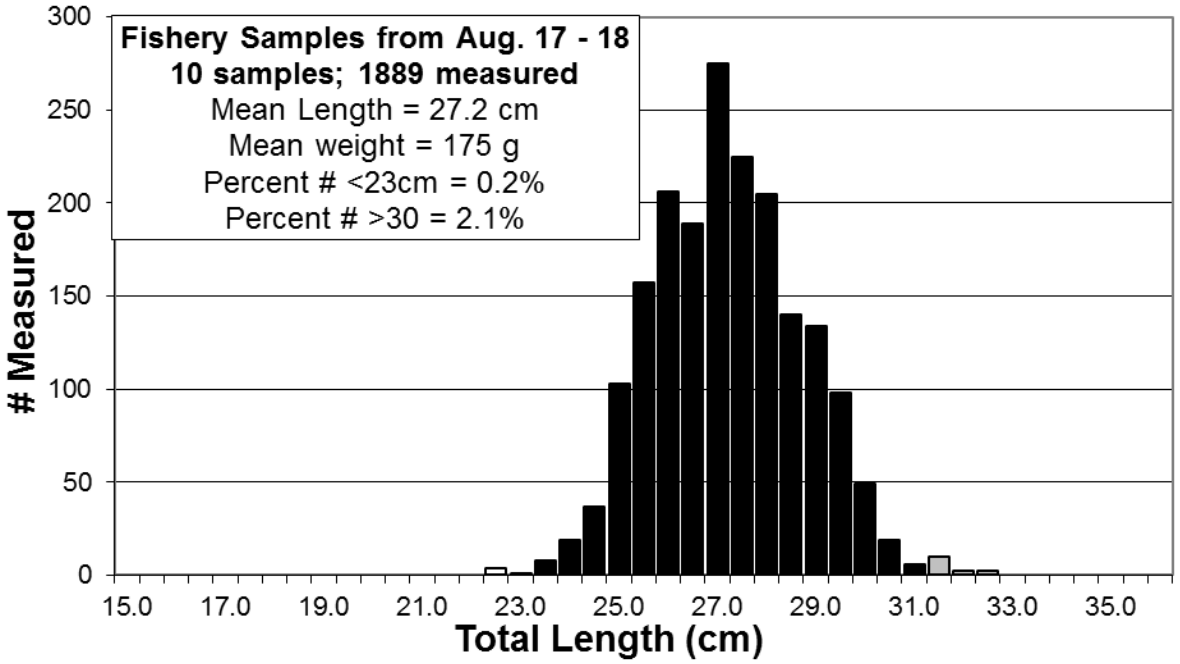

Figure 17B. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#5) on August 16, 2014, from sampling on August 17 - 18, with proportions <23cm and >30cm shown as white and grey bars.

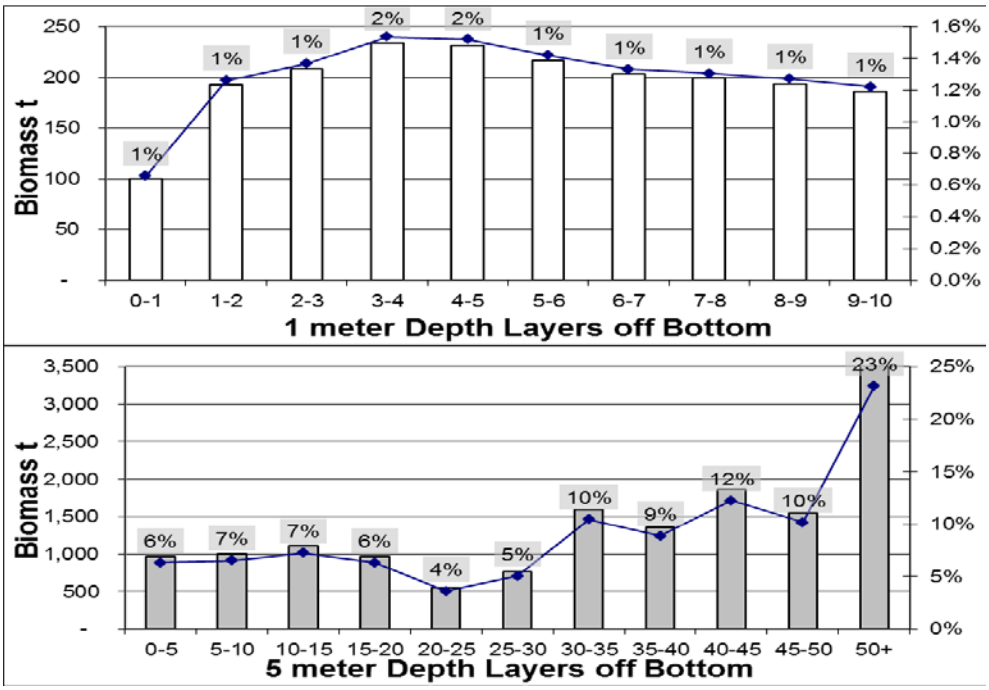

Figure 18A. Distribution of biomass by depth layer from bottom for the Scots Bay acoustic survey (#5) on August 17, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

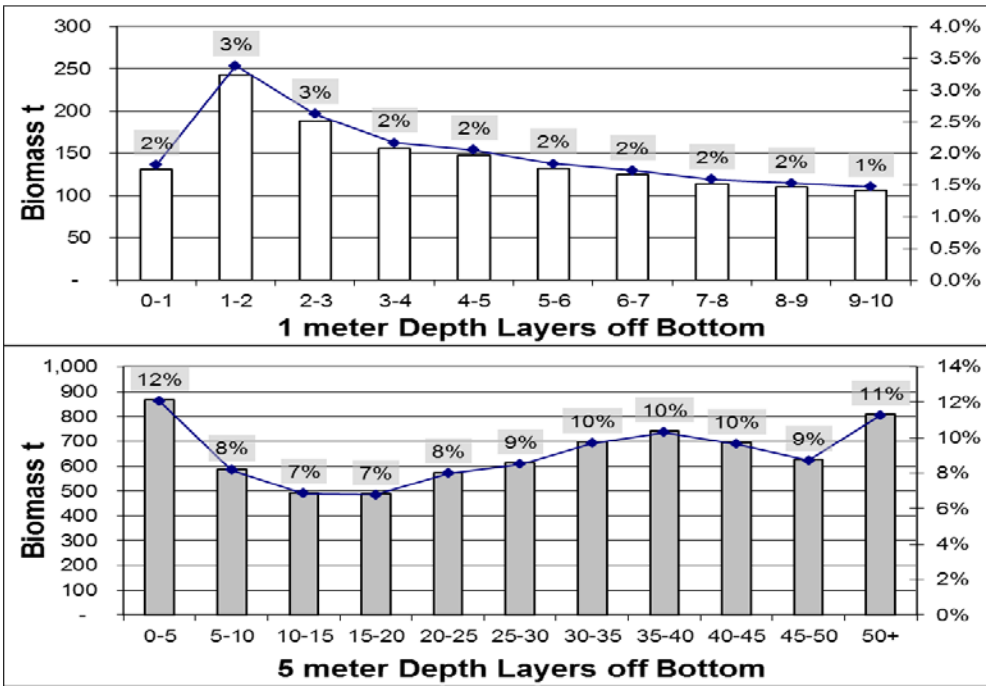

Figure 18B. Distribution of biomass by depth layer from bottom for the Scots Bay acoustic survey (#5) on August 16, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

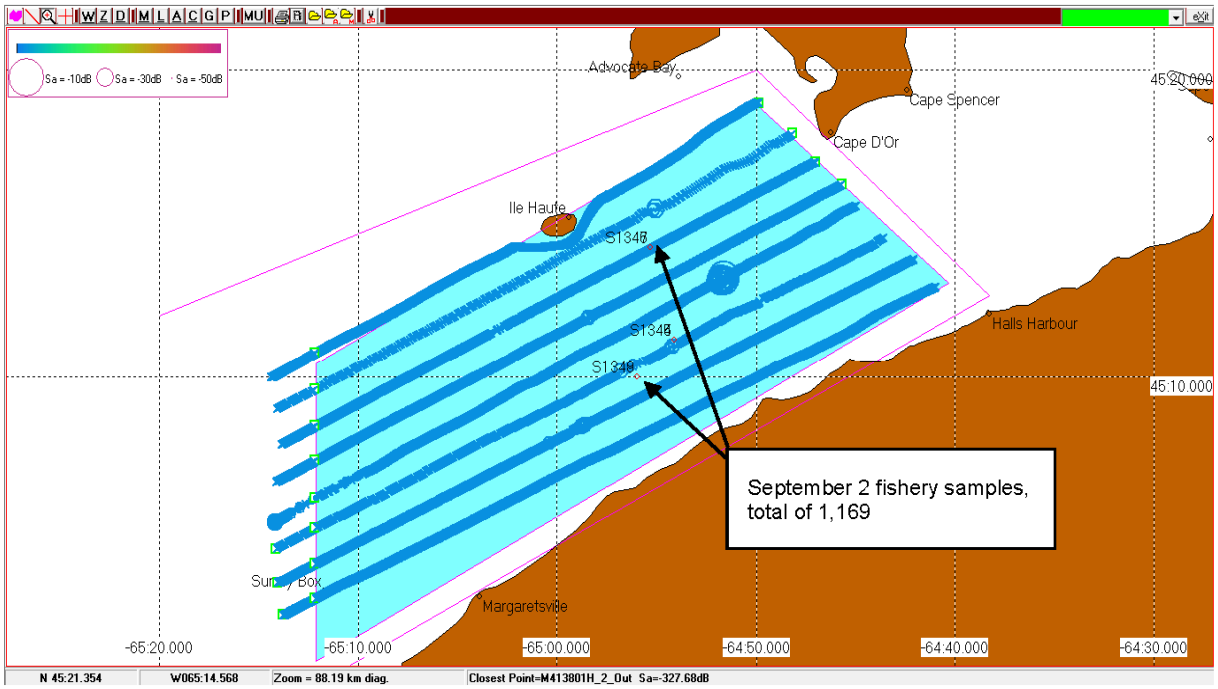

Figure 19A. Scots Bay acoustic survey (#6) on August 31, 2013, showing the main survey box (highlighted area) and transects completed with backscatter (Sa) along with locations of fishery samples.

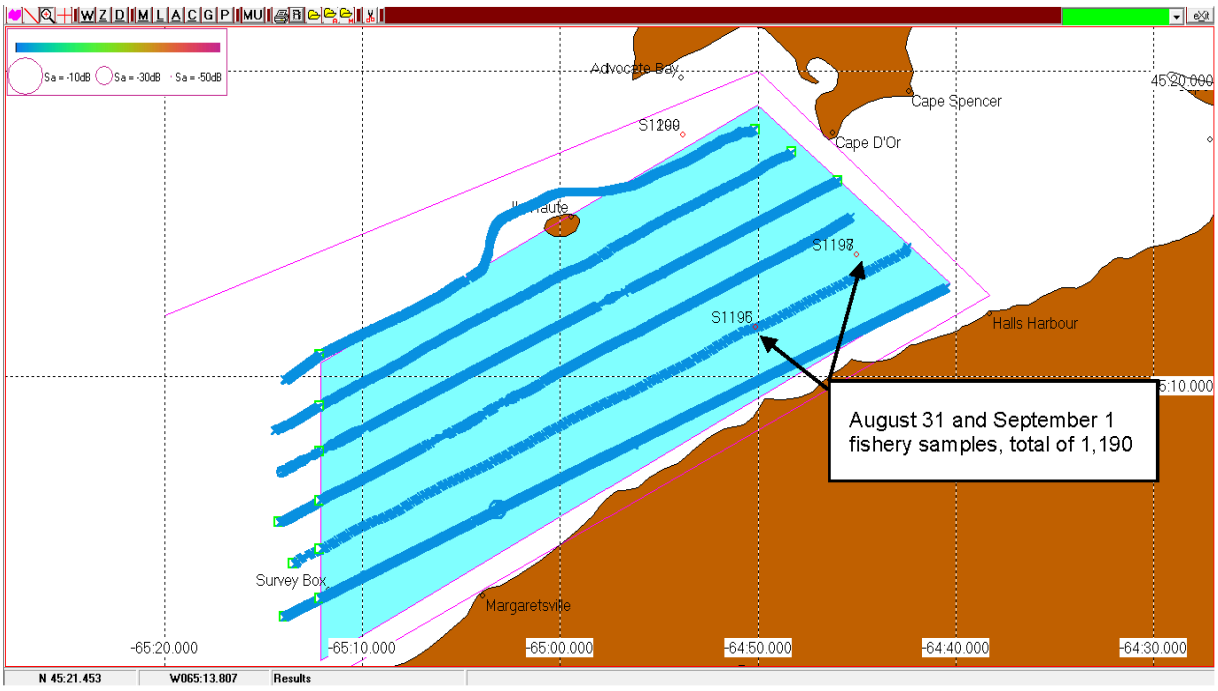

Figure 19B. Scots Bay acoustic survey (#6) on August 30, 2014, showing the main survey box (highlighted area) and transects completed with backscatter (Sa) along with locations of fishery samples.

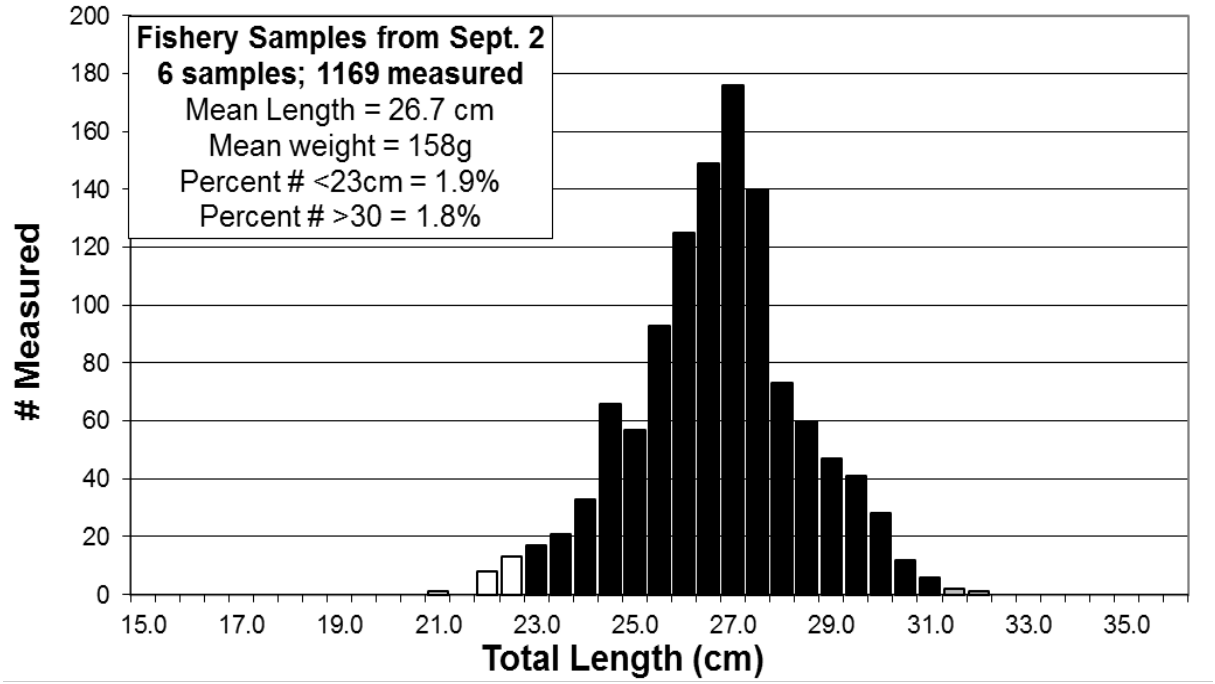

Figure 20A. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#6) on August 31, 2013, from sampling on September 2, with proportions <23cm and >30cm shown as white and grey bars. Note, there was no significant difference between the length and weight data from August 19 and September 2, so the two samples were used to generate the TS for the August 31 Survey.

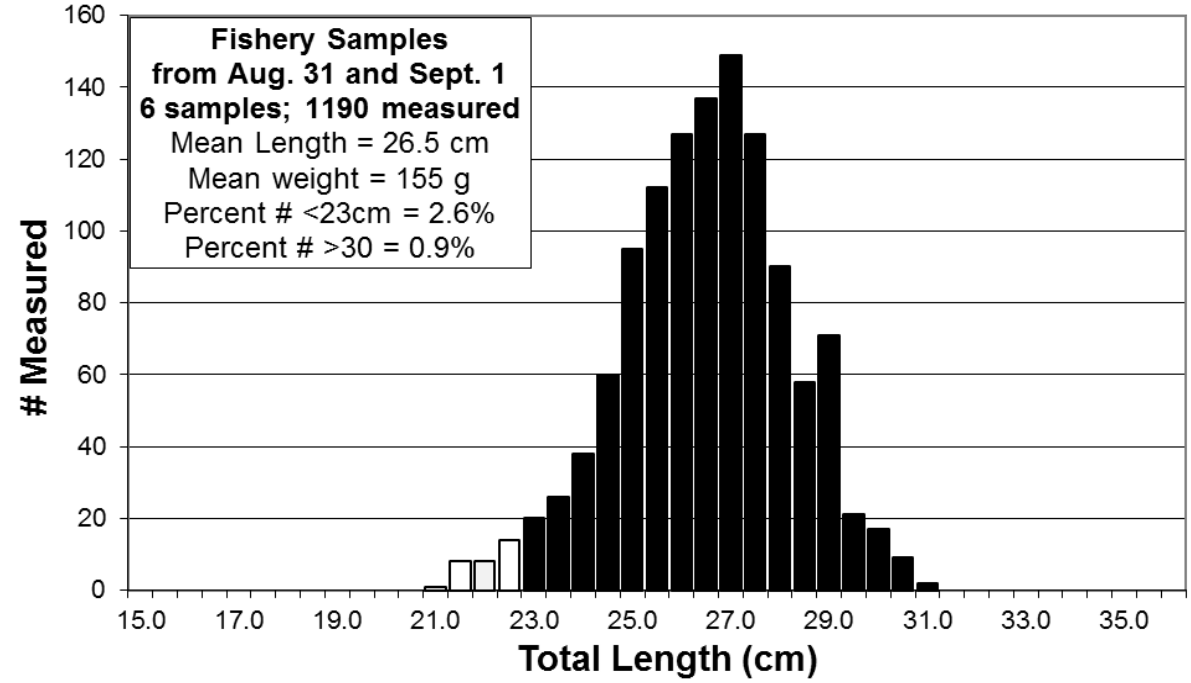

Figure 20B. Length distribution used for calculation of TS for the Scots Bay acoustic survey (#6) on August 30, 2014, from sampling on August 31 and September 1, with proportions <23cm and >30cm shown as white and grey bars.

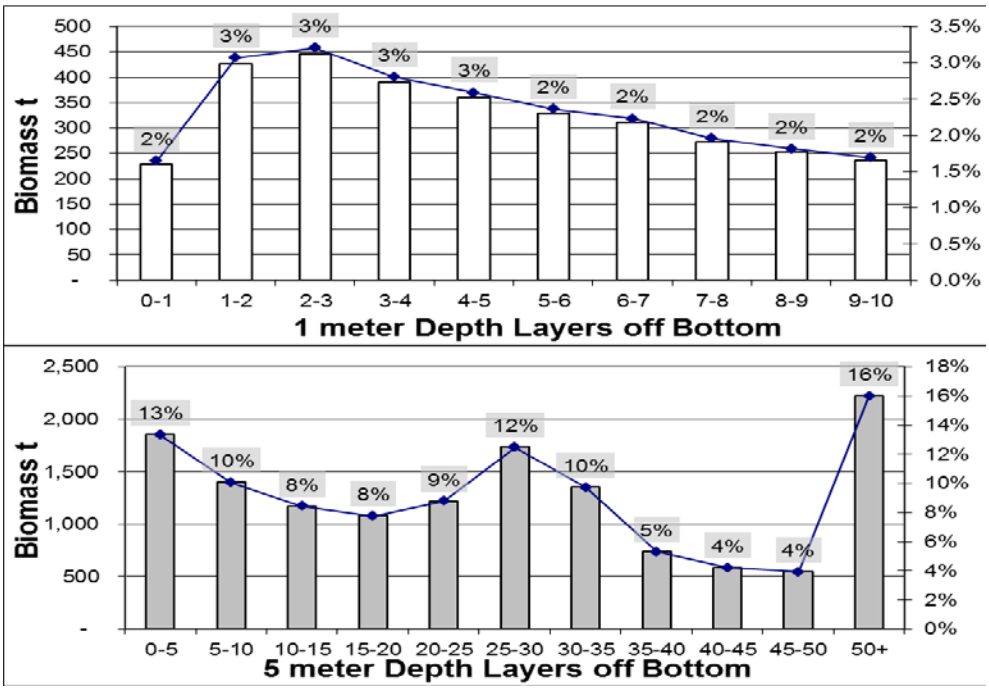

Figure 21A. Distribution of biomass by depth layer from bottom for the Scots Bay acoustic survey (#6) on August 31, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

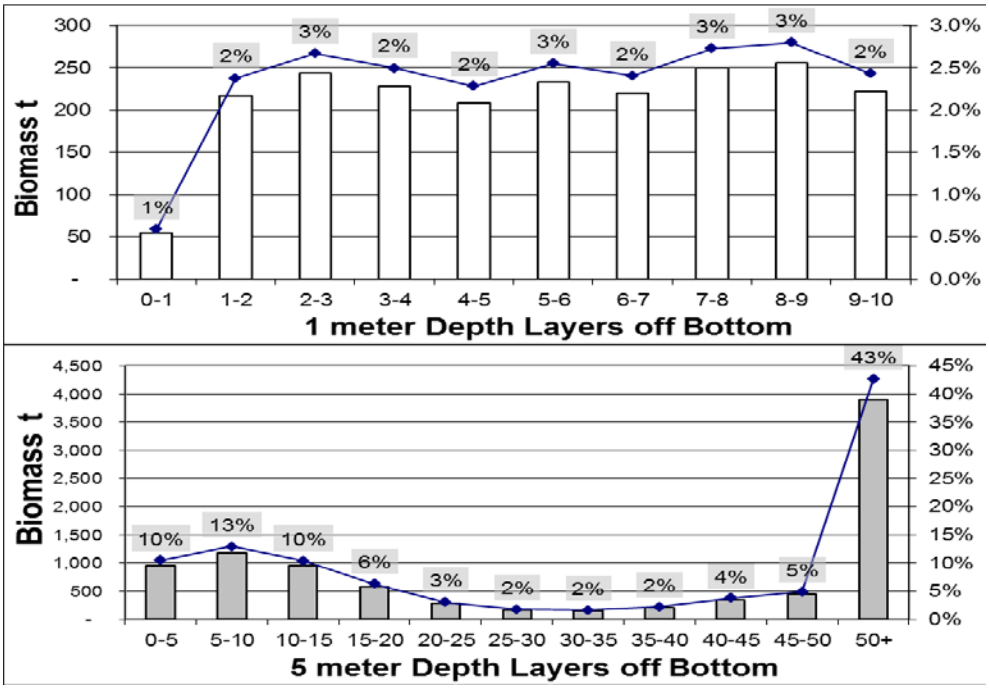

Figure 21B. Distribution of biomass by depth layer from bottom for the Scots Bay acoustic survey (#6) on August 30, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

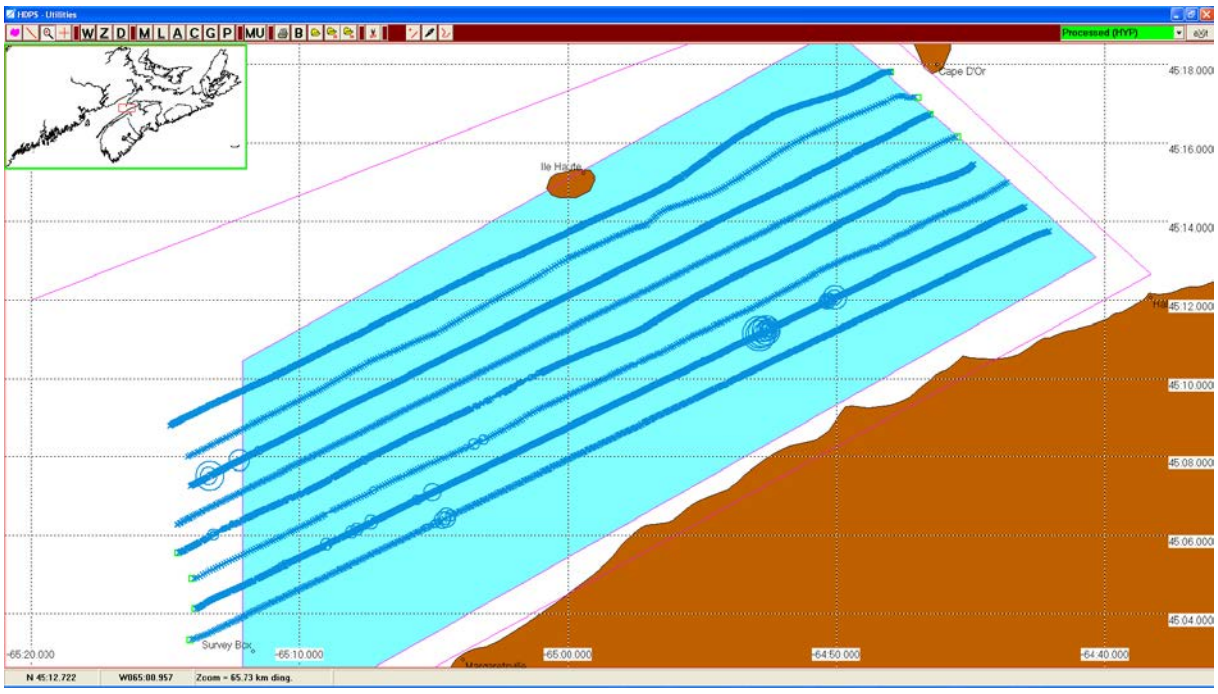

Figure 22. Scots Bay acoustic survey (#7) on September 14, 2013, showing the main survey box (highlighted area) and transects completed with backscatter (Sa). Note, there was no fishing and no samples were available for TS adjustment so the standard TS was used in the final analysis.

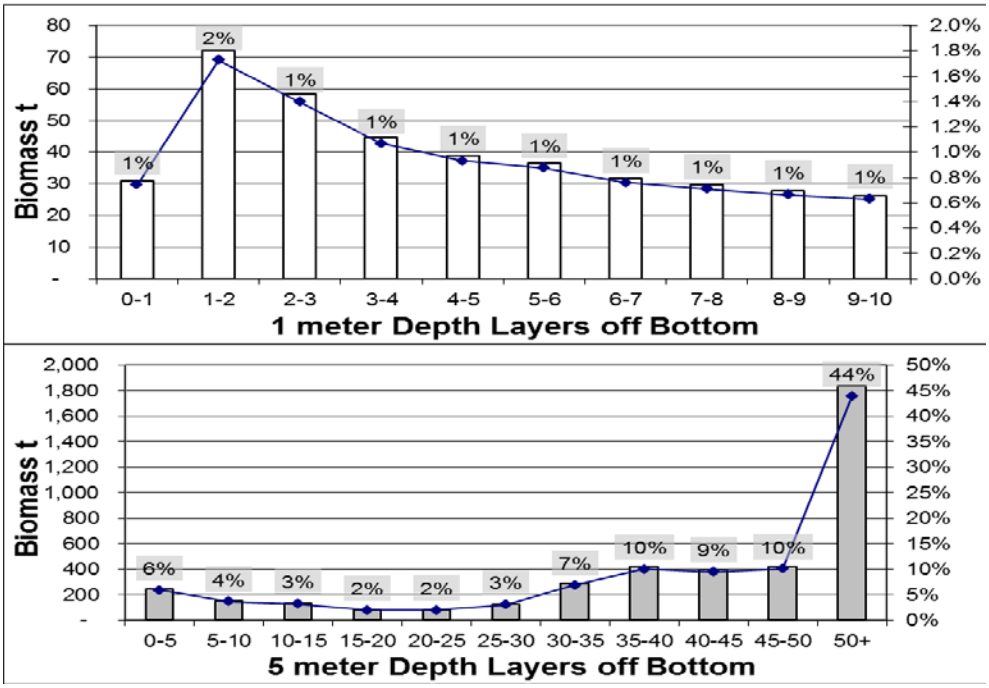

Figure 23. Distribution of biomass by depth layer from bottom for the Scots Bay acoustic survey (#7) on September 14, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

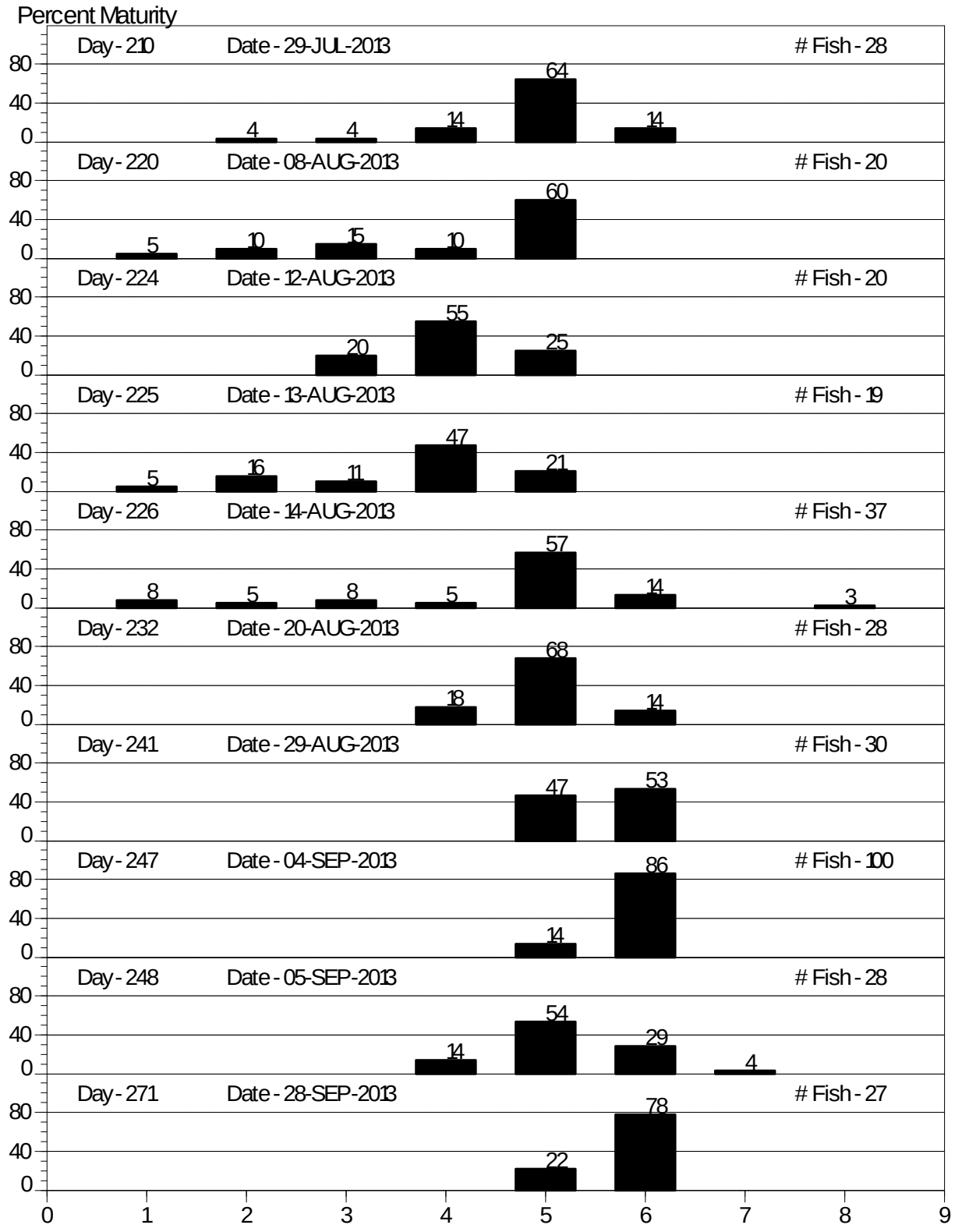

Figure 24A. Daily herring maturity samples collected from German Bank survey box area in 2013 from August 8 to September 28. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

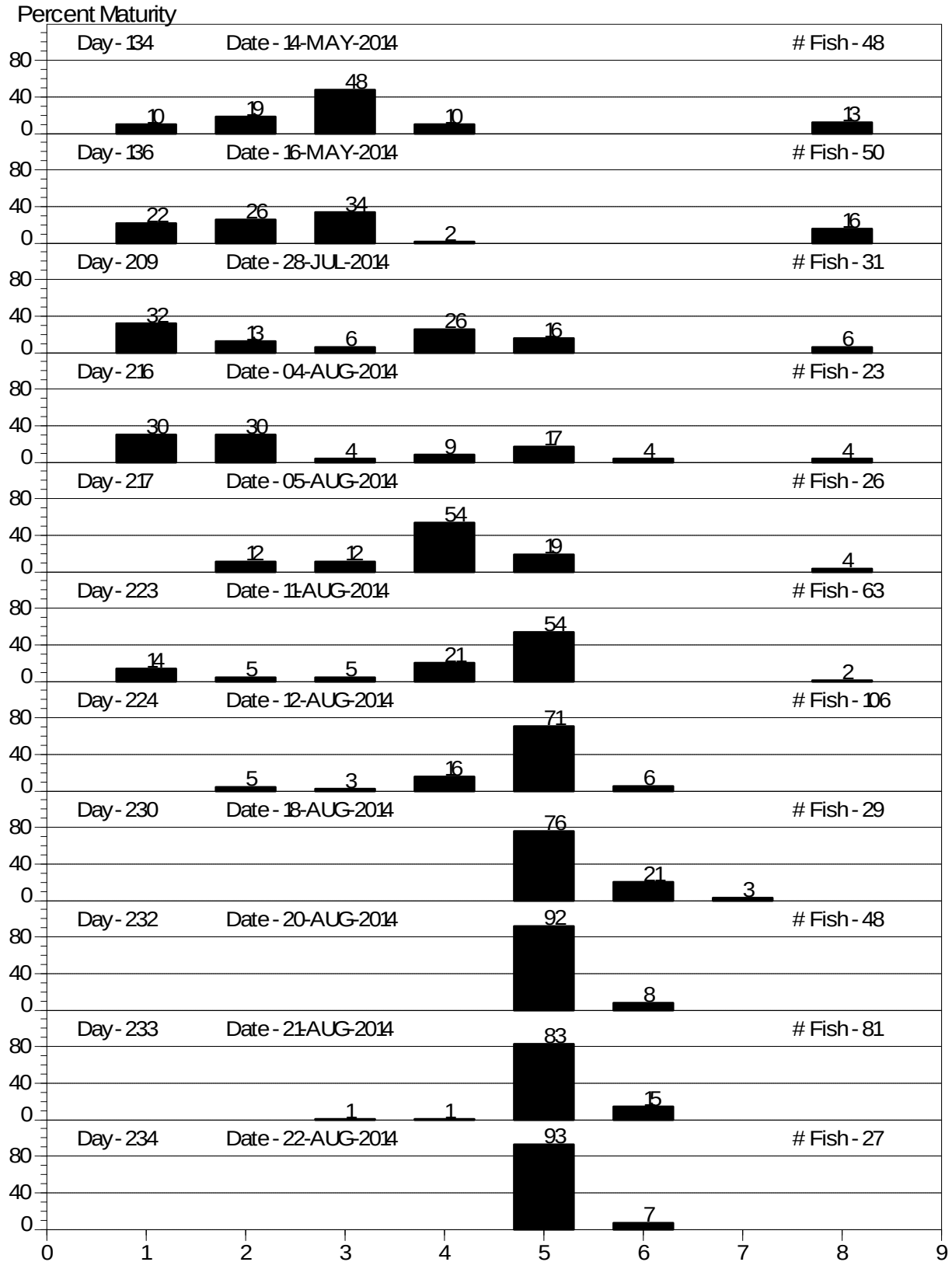

Figure 24B (Continue below). Daily herring maturity samples collected from German Bank survey box area in 2014. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

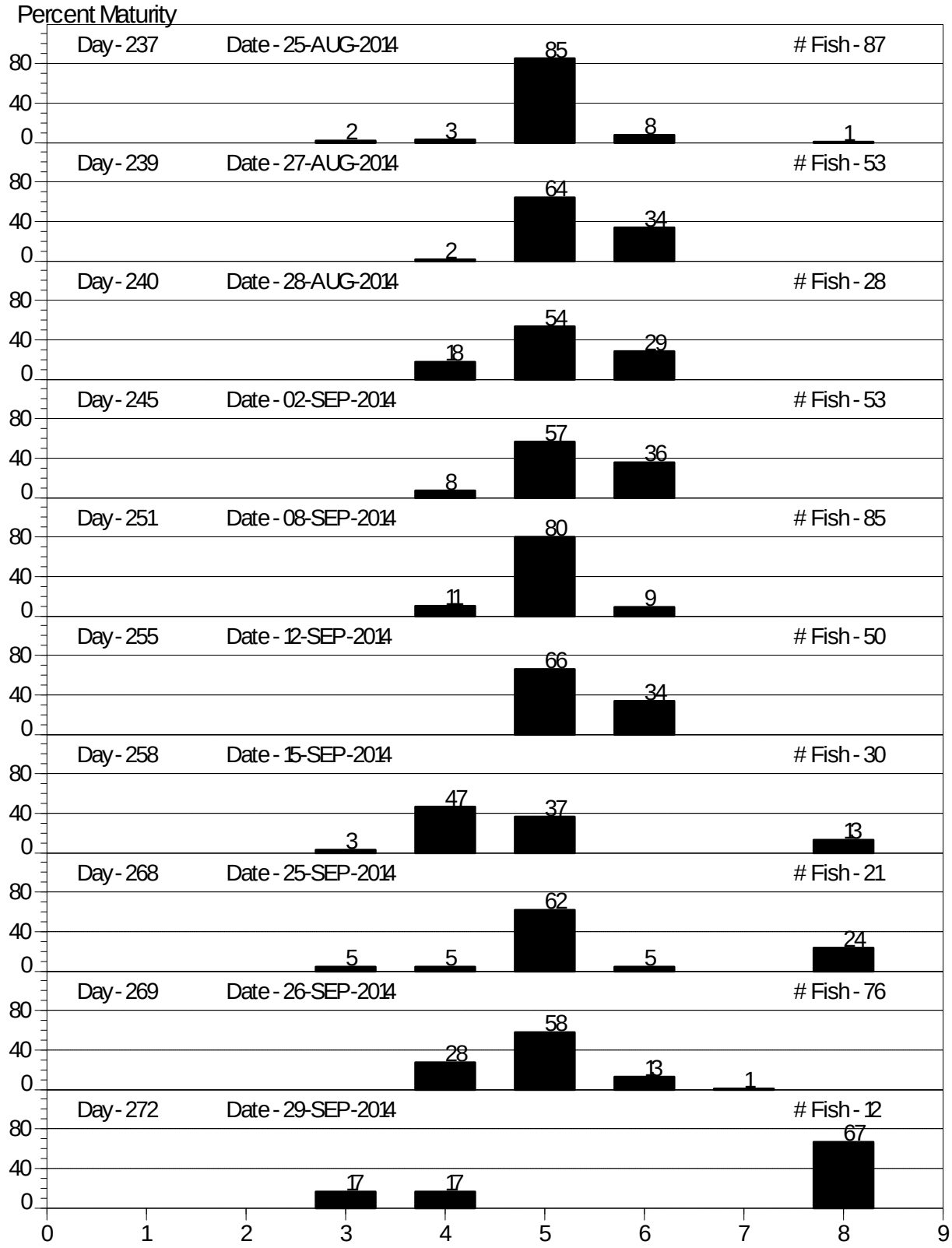

Figure 24B (Continue from above). Daily herring maturity samples collected from German Bank survey box area in 2014. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

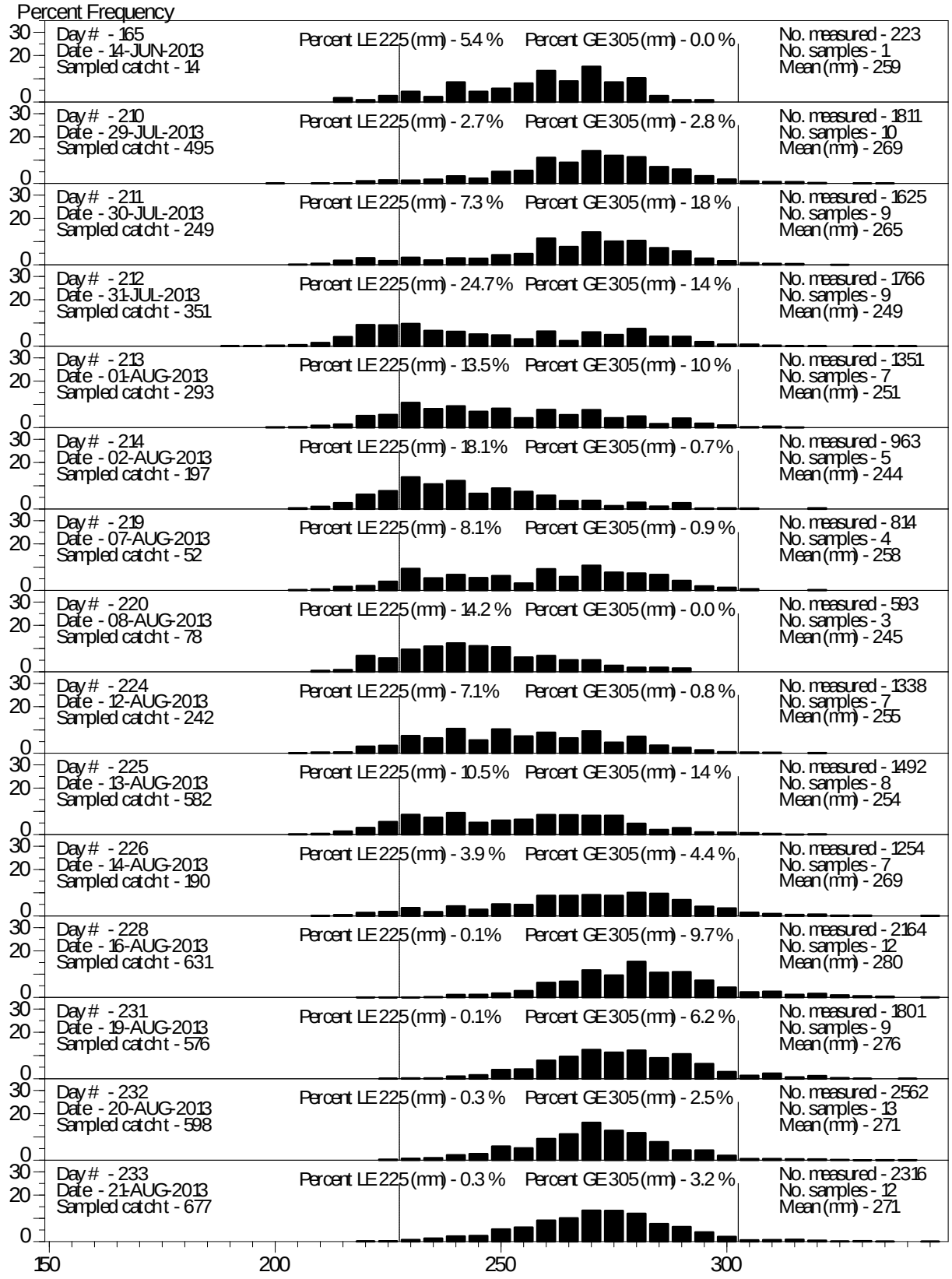

Figure 25A (Continue below). Daily herring length frequency samples collected from 2013 German Bank survey box area for period from June 14 to October 11, with proportions <23cm and >30cm.

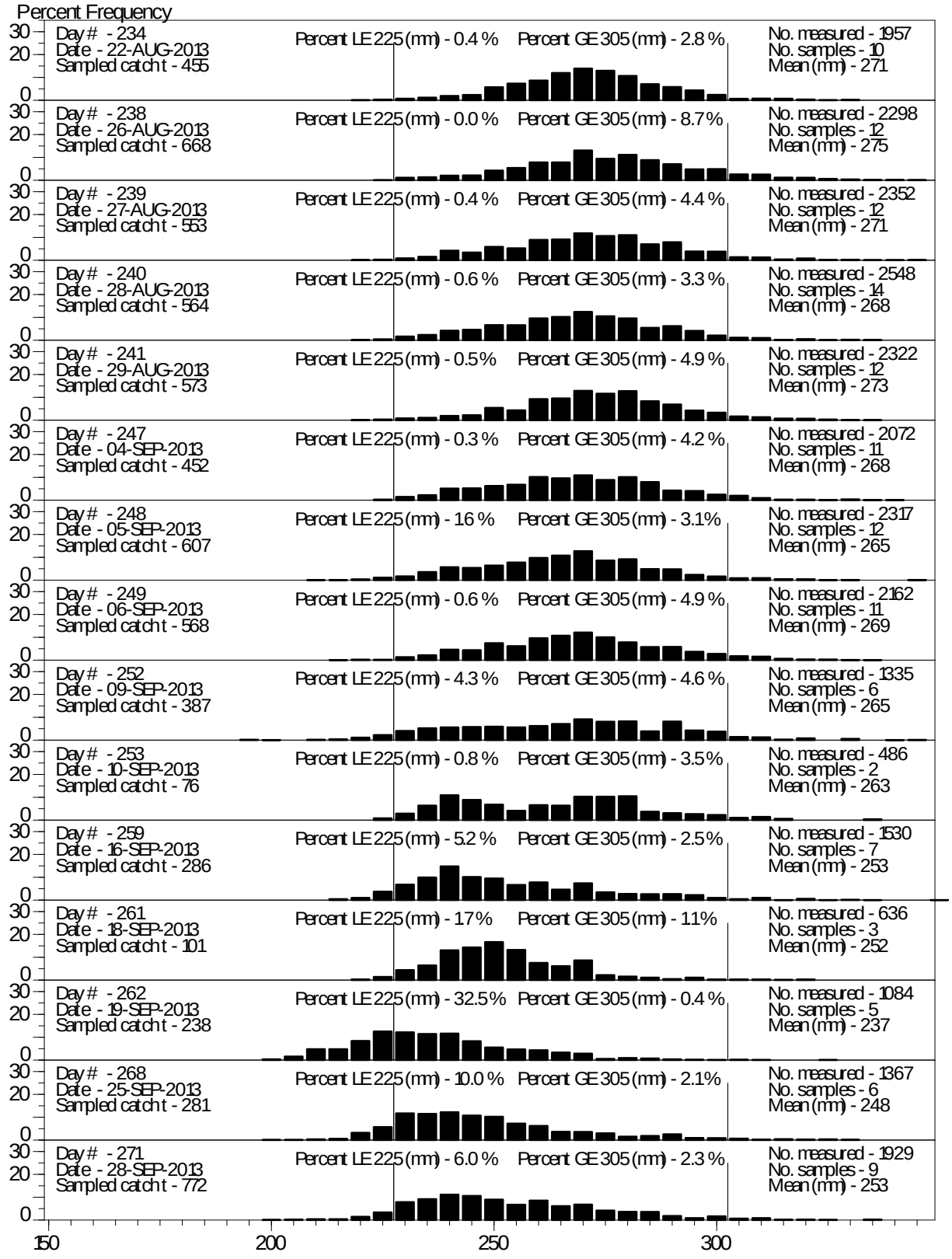

Figure 25A (Continue from above and continued below). Daily herring length frequency samples collected from 2013 German Bank survey box area for period from June 14 to October 11, with proportions <23cm and >30cm.

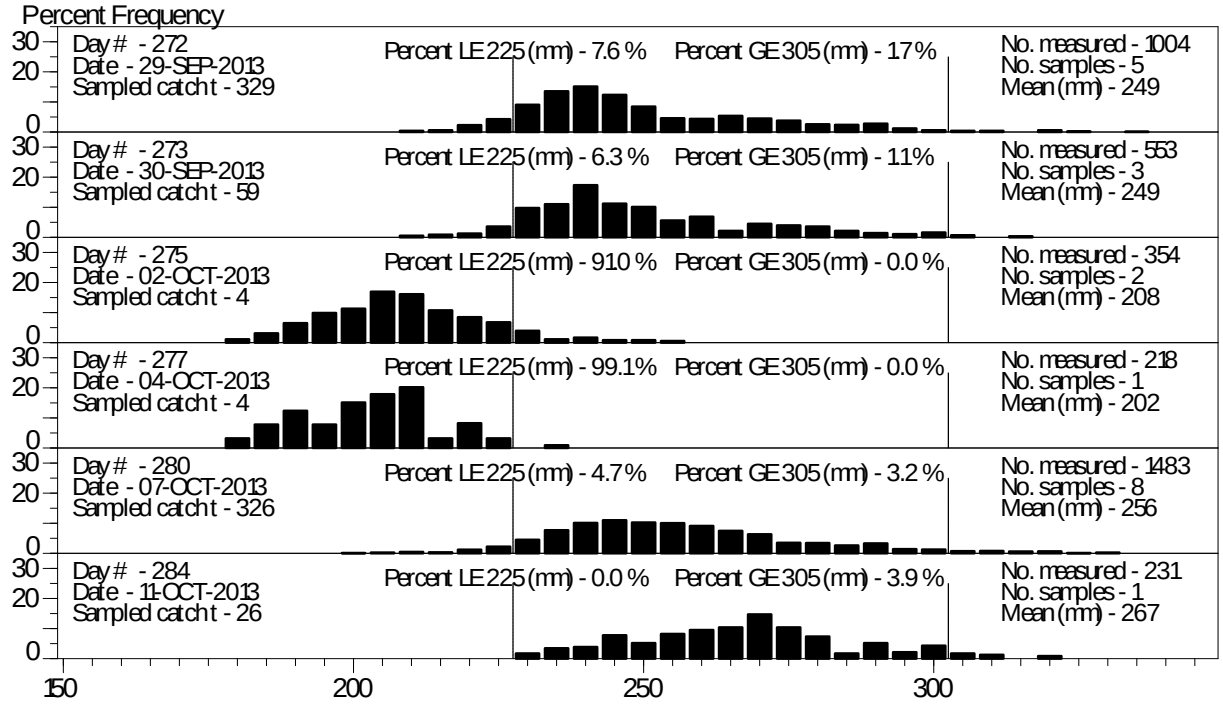

Figure 25A (Continue from above). Daily herring length frequency samples collected from 2013 German Bank survey box area for period from June 14 to October 11, with proportions <23cm and >30cm.

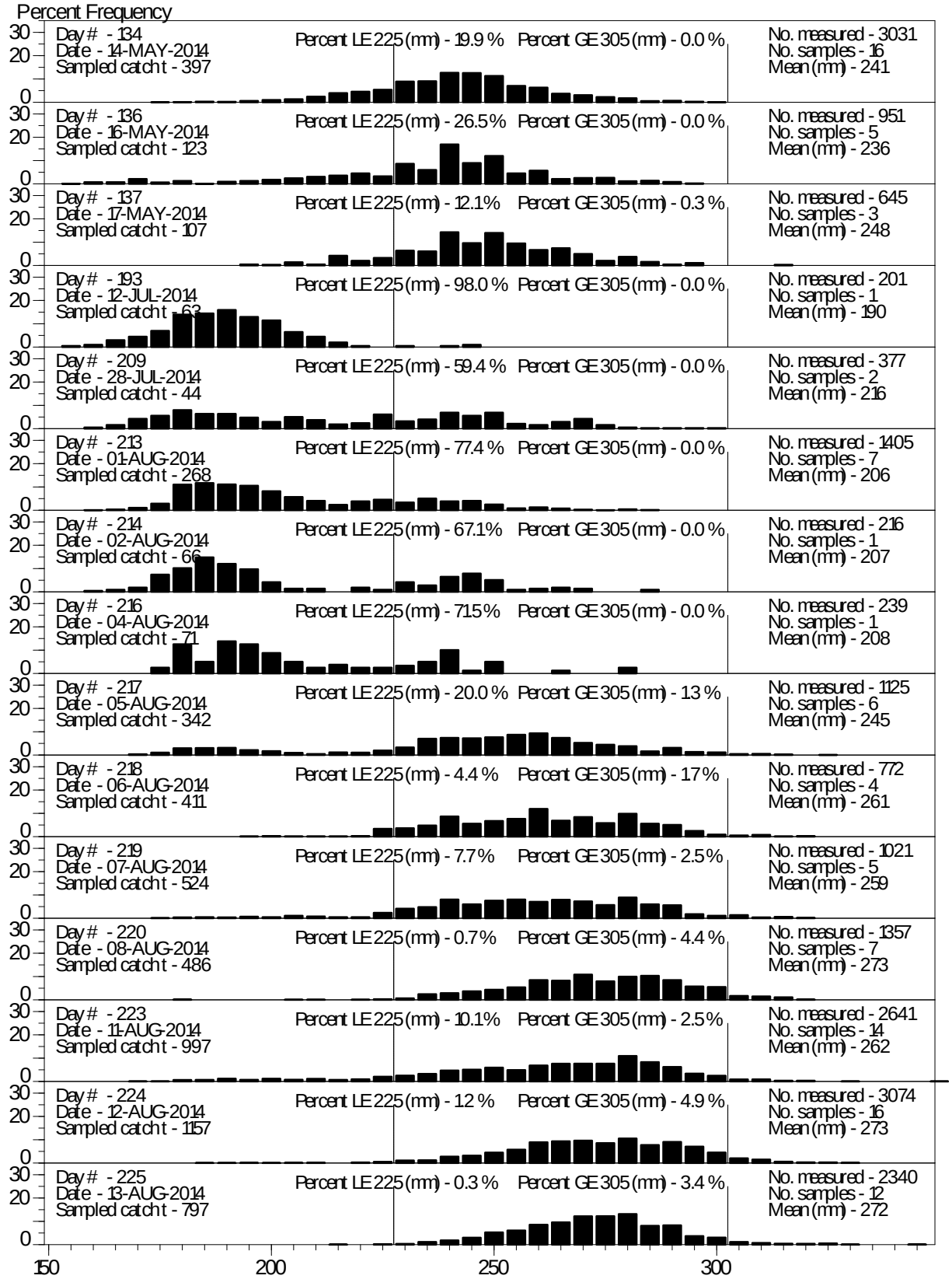

Figure 25B *(continued below)**. Daily herring length frequency samples collected from 2014 German Bank survey box area, with proportions <23cm and >30cm.*

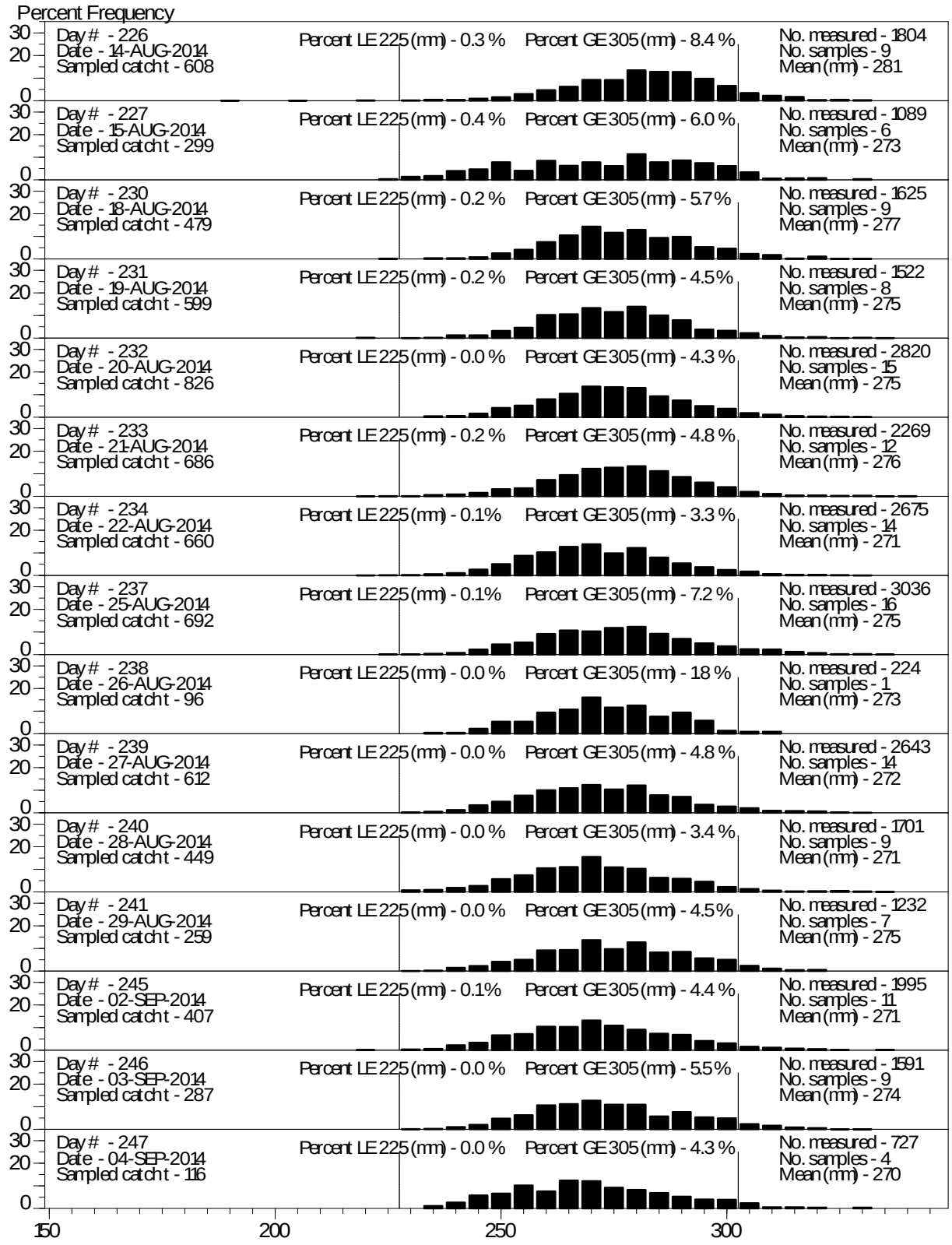

Figure 25B (continued from above and continued below). Daily herring length frequency samples collected from 2014 German Bank survey box area, with proportions <23cm and >30cm.

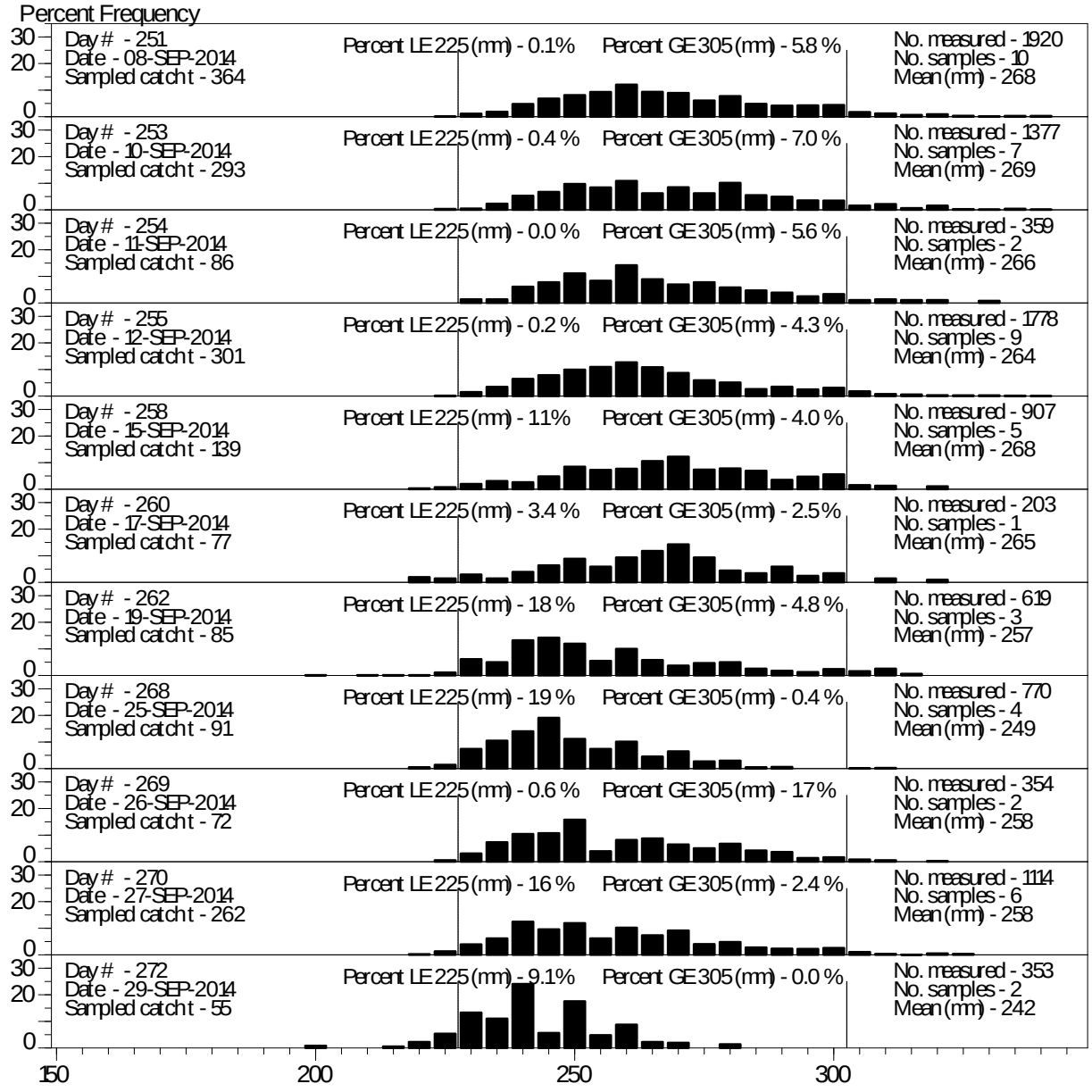

Figure 25B (continued from above). *Daily herring length frequency samples collected from 2014 German Bank survey box area, with proportions <23cm and >30cm.*

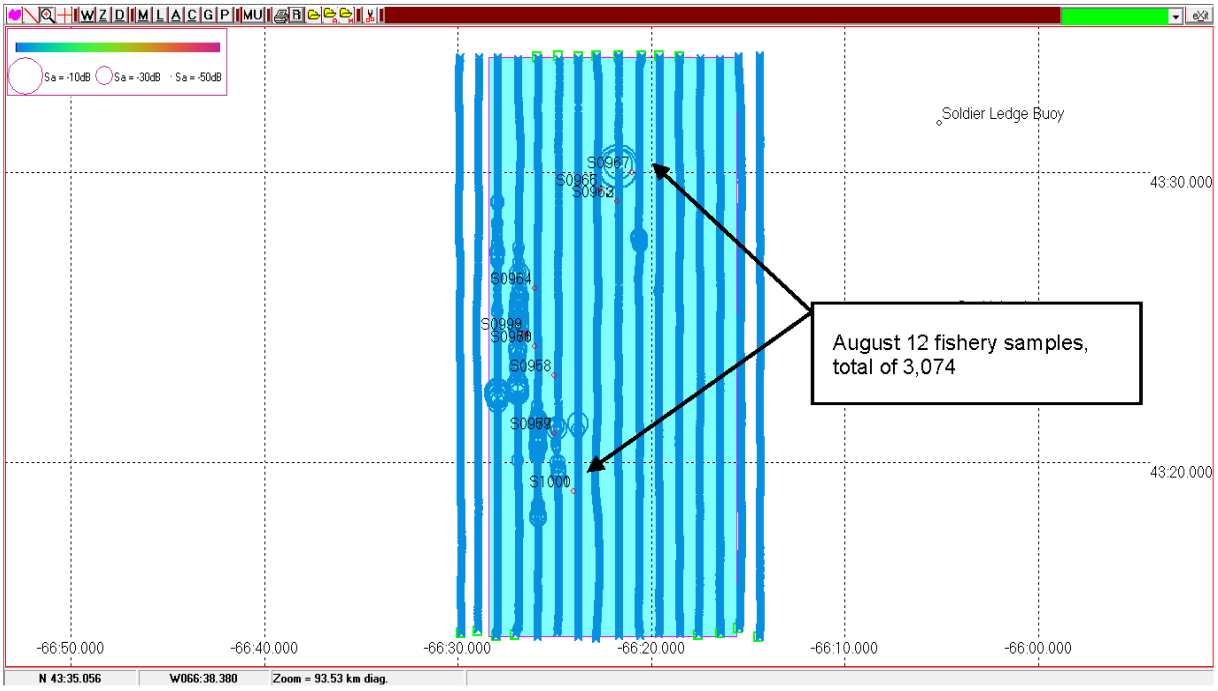

Figure 26. German Bank acoustic survey (#1) on August 12, 2014, with transects showing location and backscatter (Sa) in the main survey box (highlighted area) along with locations of samples used in calculation of TS.

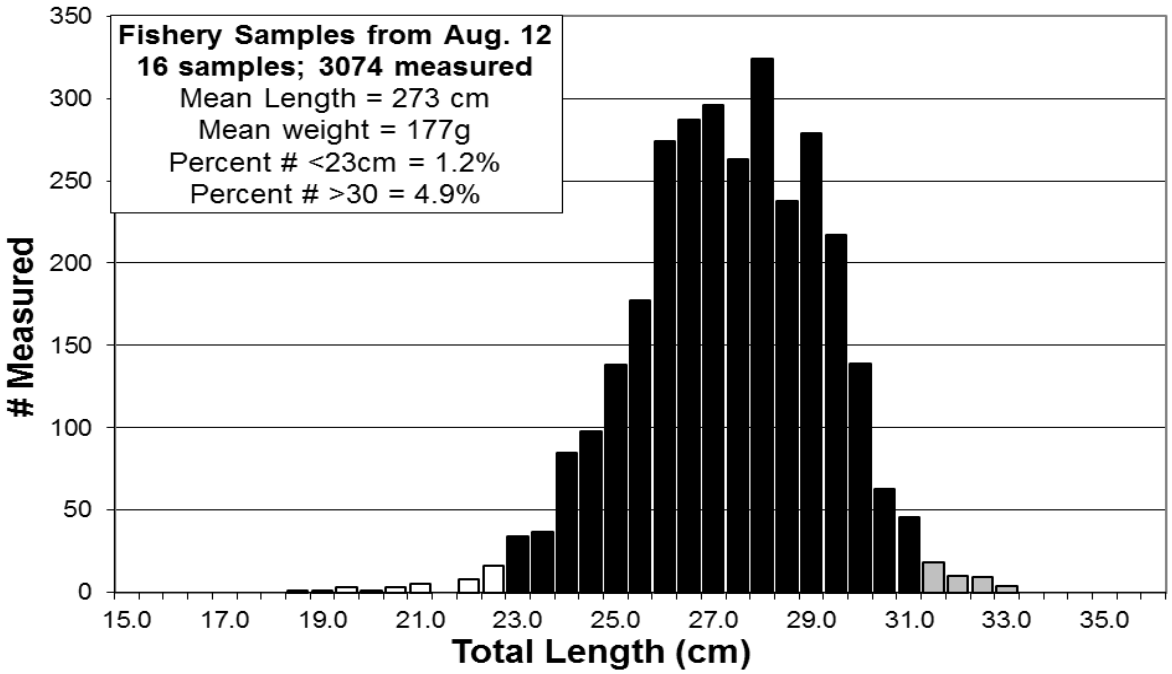

Figure 27. Length distribution used for calculation of TS for the German Bank acoustic survey (#1) on August 12, 2014, from sampling on August 12, with proportions <23cm and >30cm shown as white and grey bars.

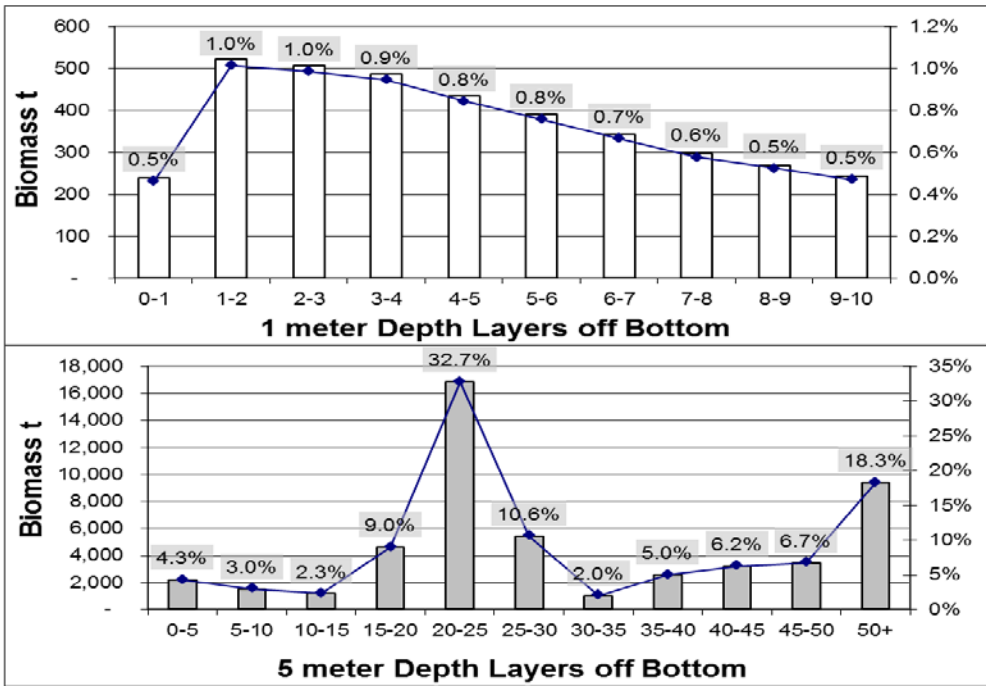

Figure 28. Distribution of biomass by depth layer from bottom for the German Bank acoustic survey (#1) on August 12, 2014. Biomass and % of total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

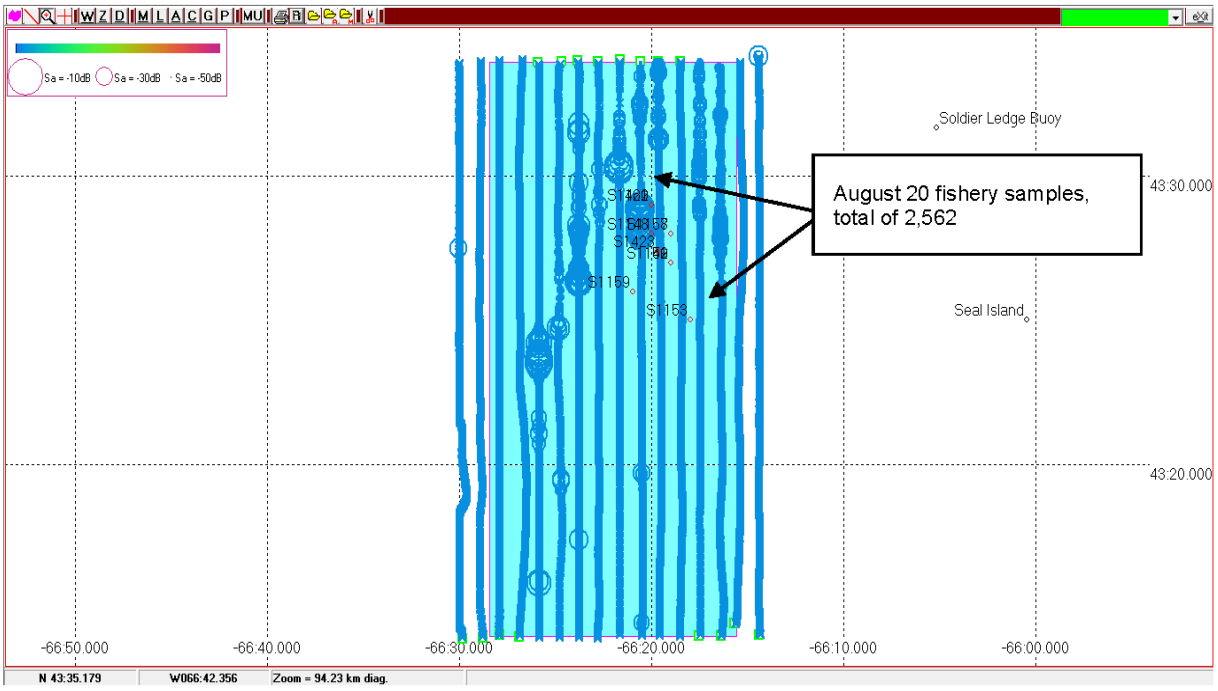

Figure 29A. German Bank acoustic survey (#1) on August 19, 2013, with transects showing location and backscatter (Sa) in the main survey box (highlighted area) along with locations of samples used in calculation of TS.

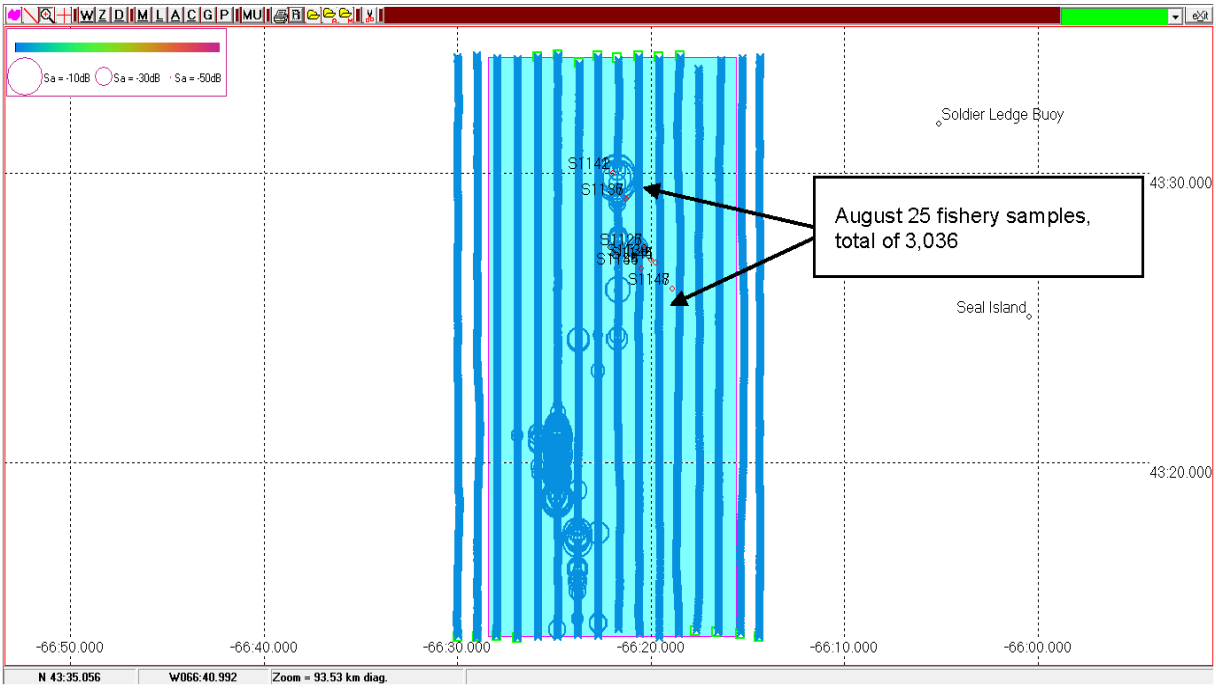

Figure 29B. German Bank acoustic survey (#2) on August 25, 2014, with transects showing location and backscatter (Sa) in the main survey box (highlighted area). Fishery samples are identified by location with sample number.

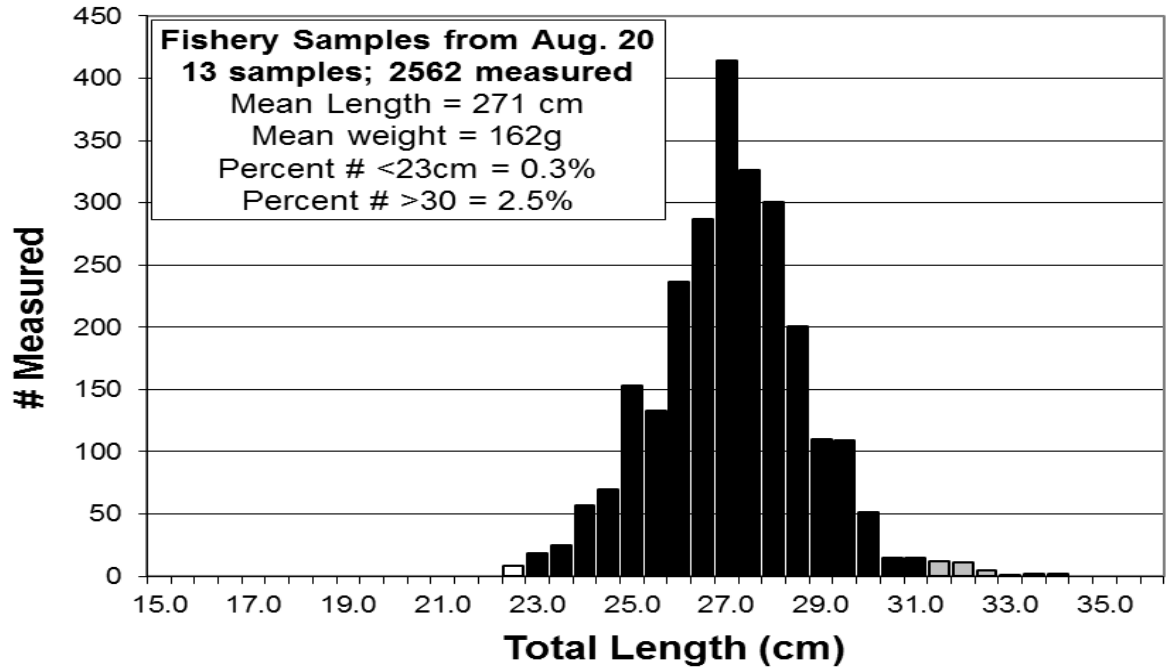

Figure 30A. Length distribution used for calculation of TS for the German Bank acoustic survey (#1) on August 19, 2013, from sampling during on August 20, with proportions <23cm and >30cm shown as white and grey bars. NOTE: there was no significant difference between the length and weight data from August 20 and September 4 and 5, so the three samples were used to generate the TS for the August 19 survey.

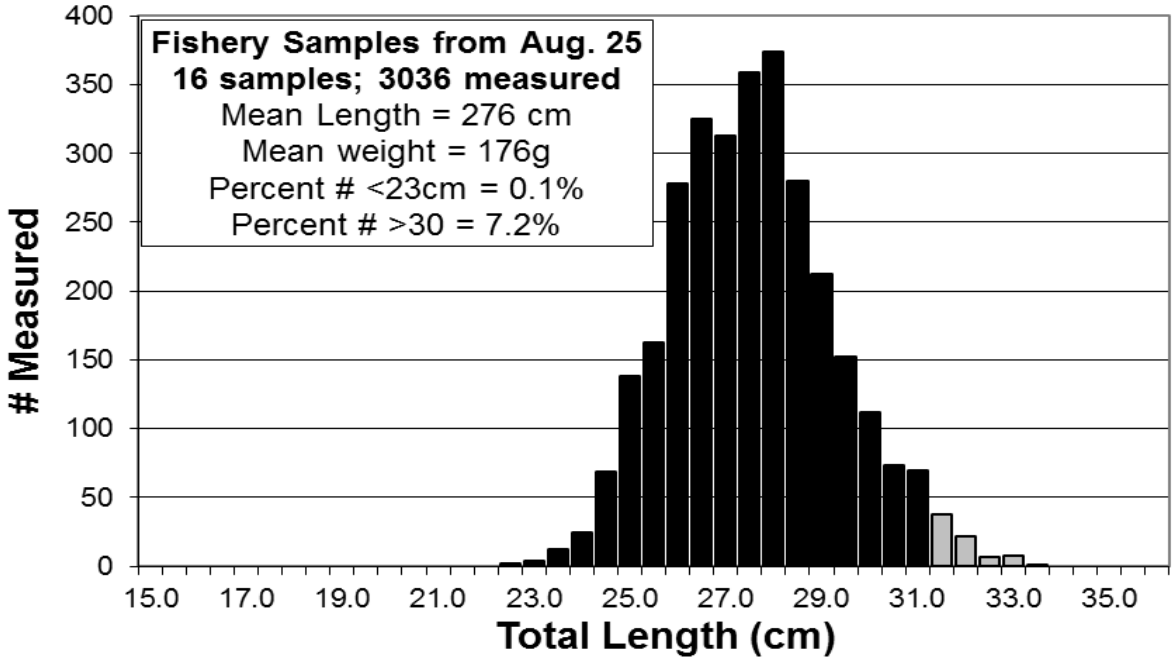

Figure 30B. Length distribution used for final calculation of TS for the German Bank acoustic survey (#2) on August 25, 2014, based on August 25 sampling from purse seine fishery landings. Note proportions <23cm and >30cm shown as white and grey bars.

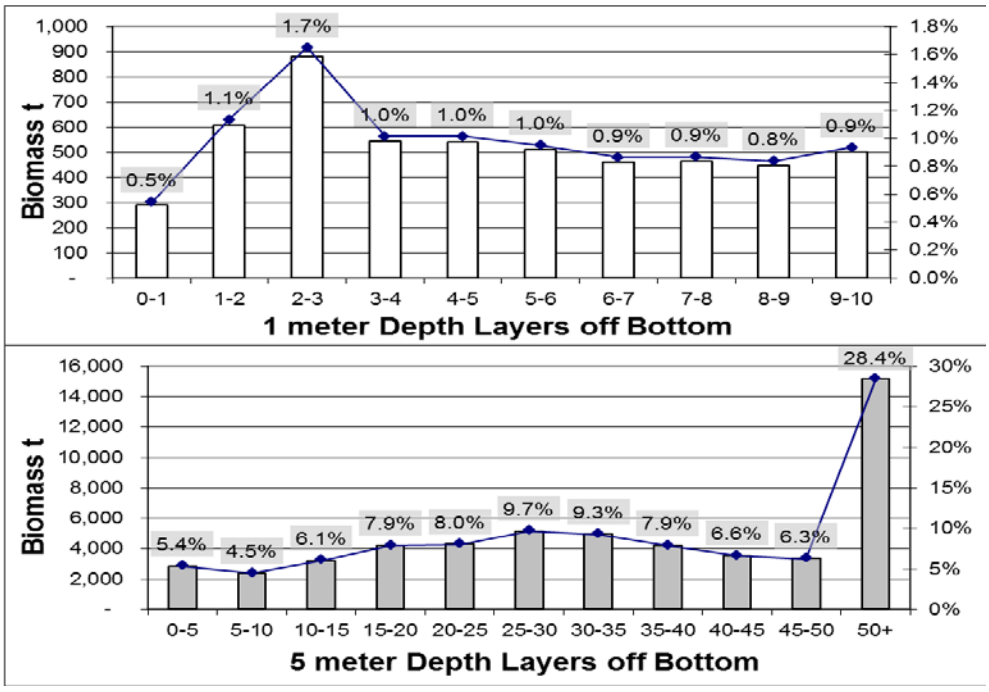

Figure 31A. Distribution of biomass by depth layer from bottom for the German Bank acoustic survey (#1) on August 19, 2013. Biomass and % of total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

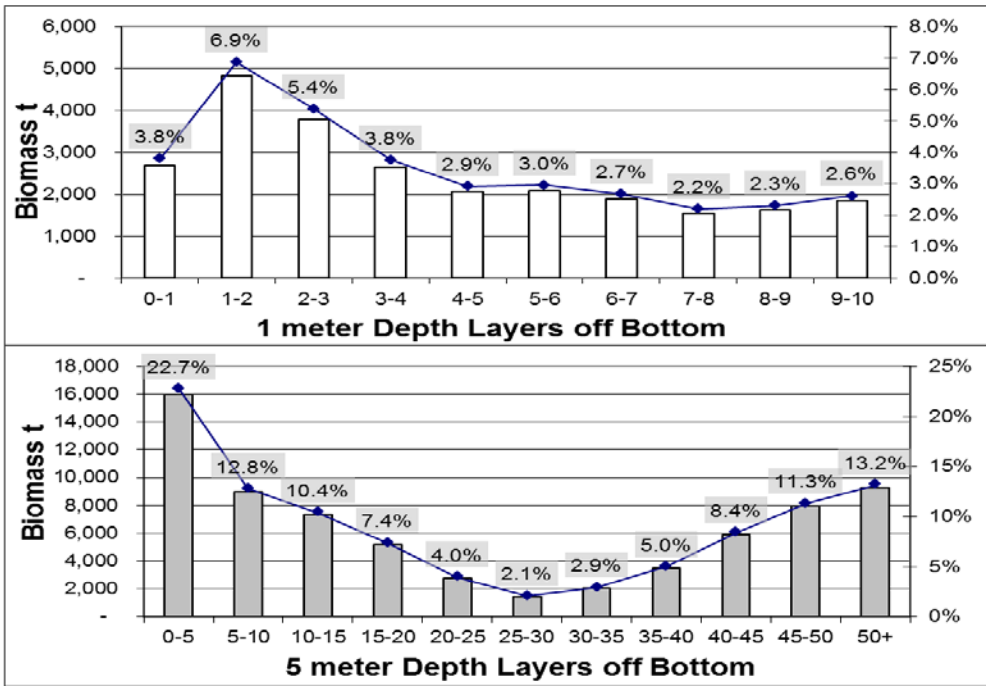

Figure 31B. Distribution of biomass by depth layer from bottom for the German Bank acoustic survey (#2) on August 25, 2014. Biomass and % of total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

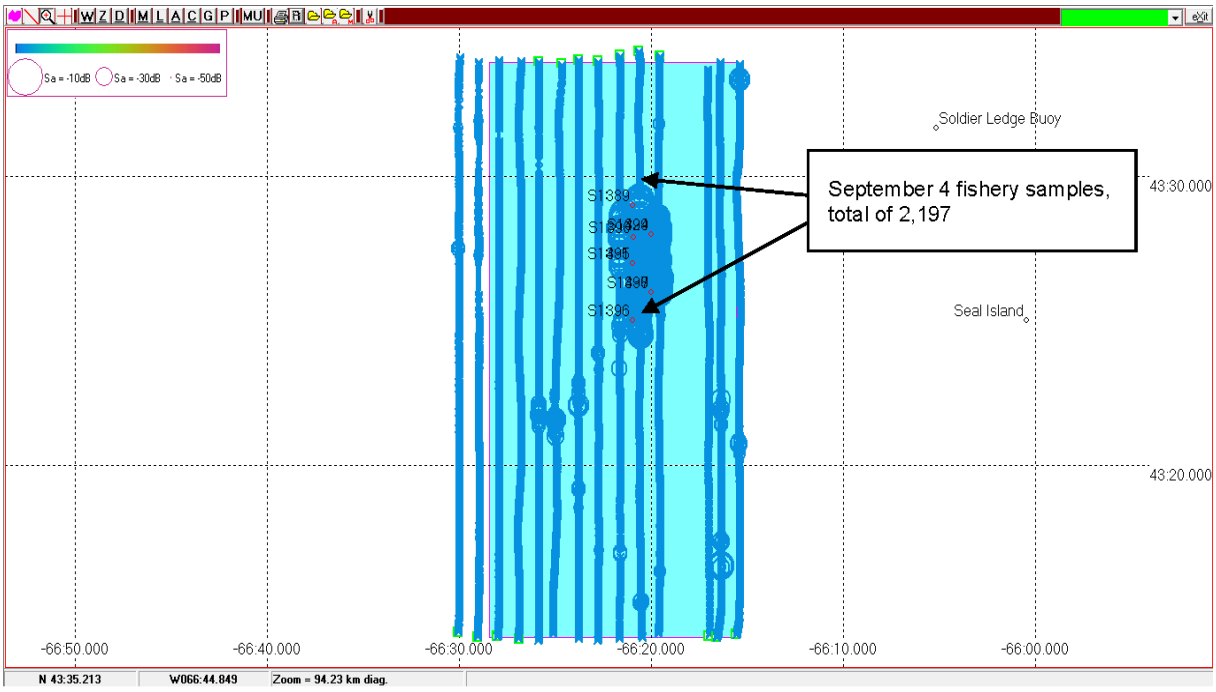

Figure 32A. German Bank acoustic survey (#2) on September 3, 2013, with transects showing location and backscatter (Sa) in the main survey box (highlighted area). Fishery samples are identified by location with sample number.

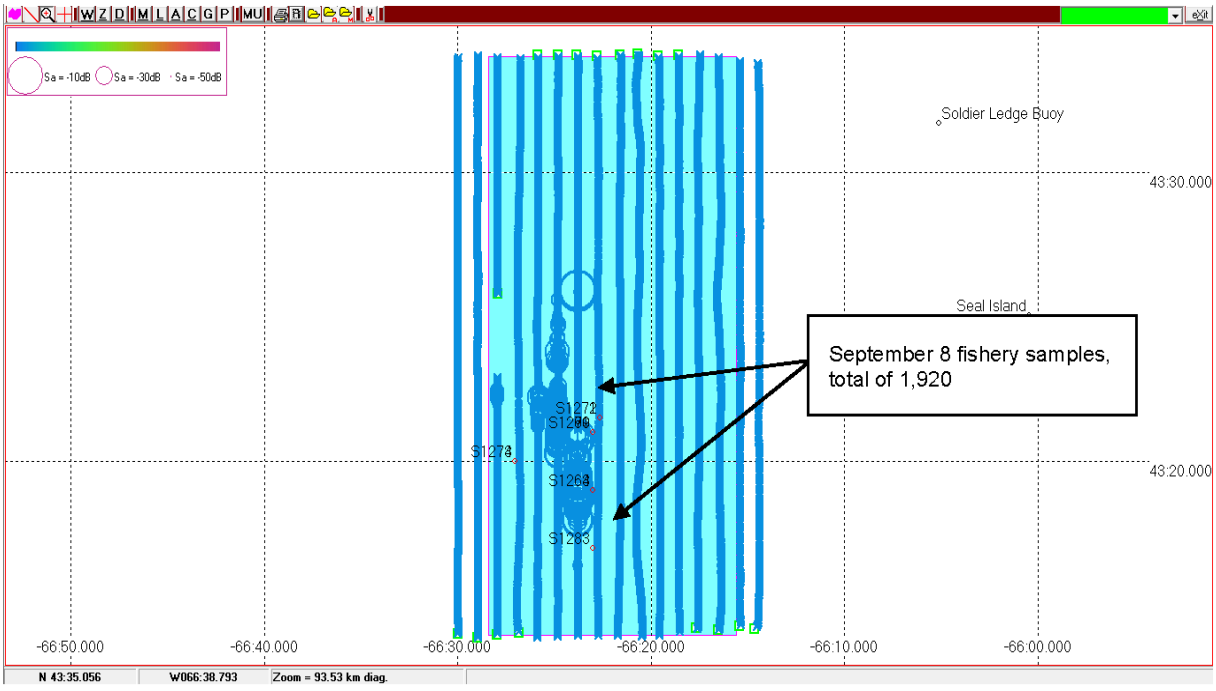

Figure 32B. German Bank acoustic survey (#3) on September 8, 2014, with transects showing location and backscatter (Sa) in the main survey box (highlighted area). Fishery samples are identified by location with sample number.

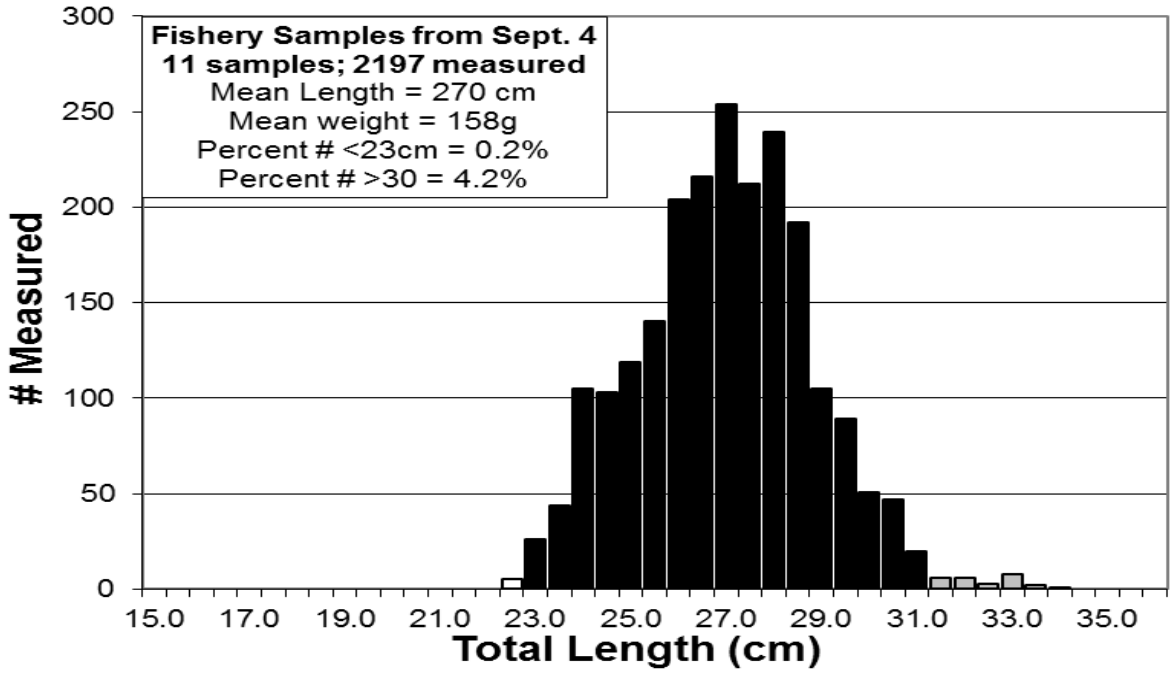

Figure 33A. Length distribution used for calculation of TS for the German Bank acoustic survey (#2) on September 3, 2013, from sampling on September 4, with proportions <23cm and >30cm shown as white and grey bars.

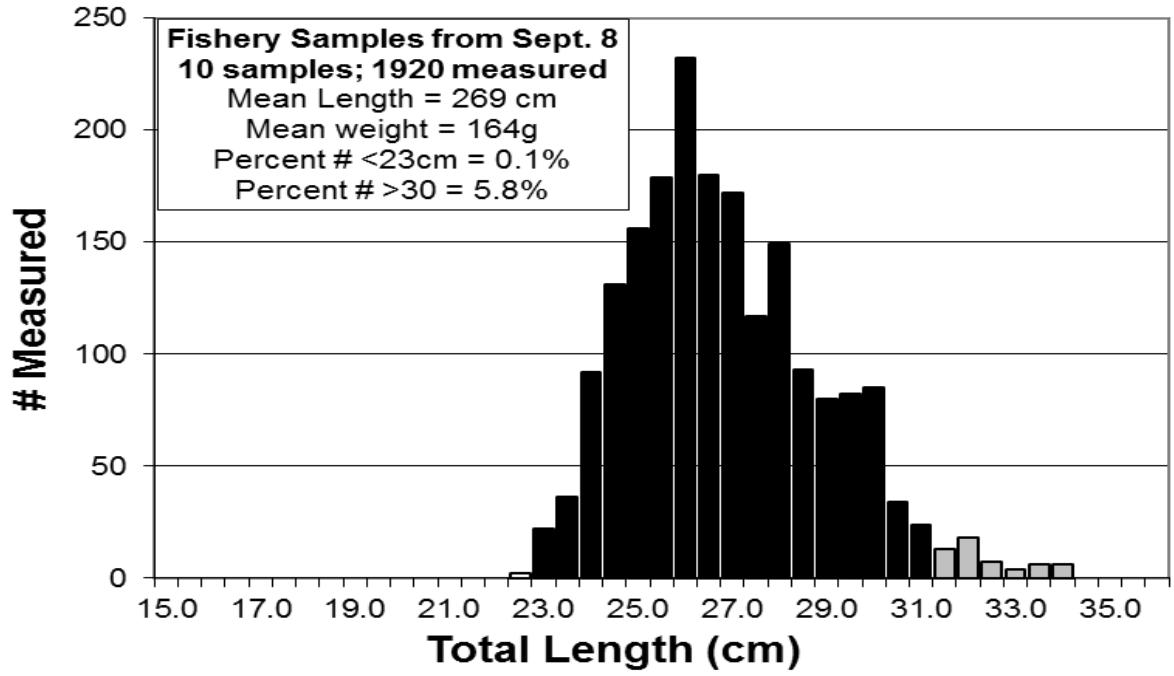

Figure 33B. Length distribution used for calculation of TS for the German Bank acoustic survey (#3) on September 8, 2014, from sampling on September 8, with proportions <23cm and >30cm shown as white and grey bars.

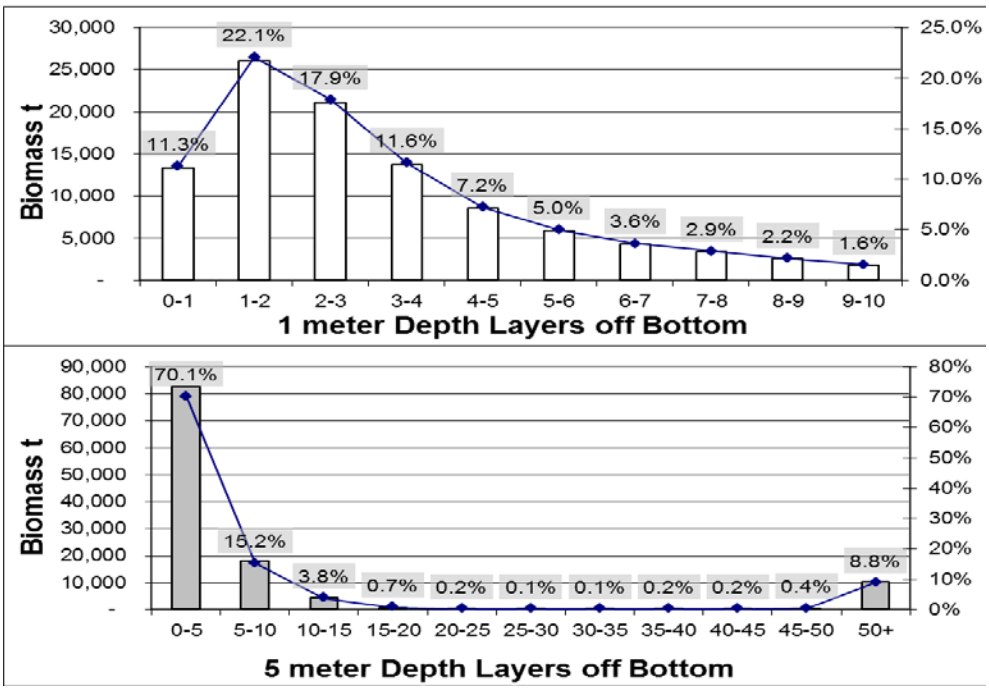

Figure 34A. Distribution of biomass by depth layer from bottom for the German Bank acoustic survey (#2) on September 3, 2013. Biomass and % of total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

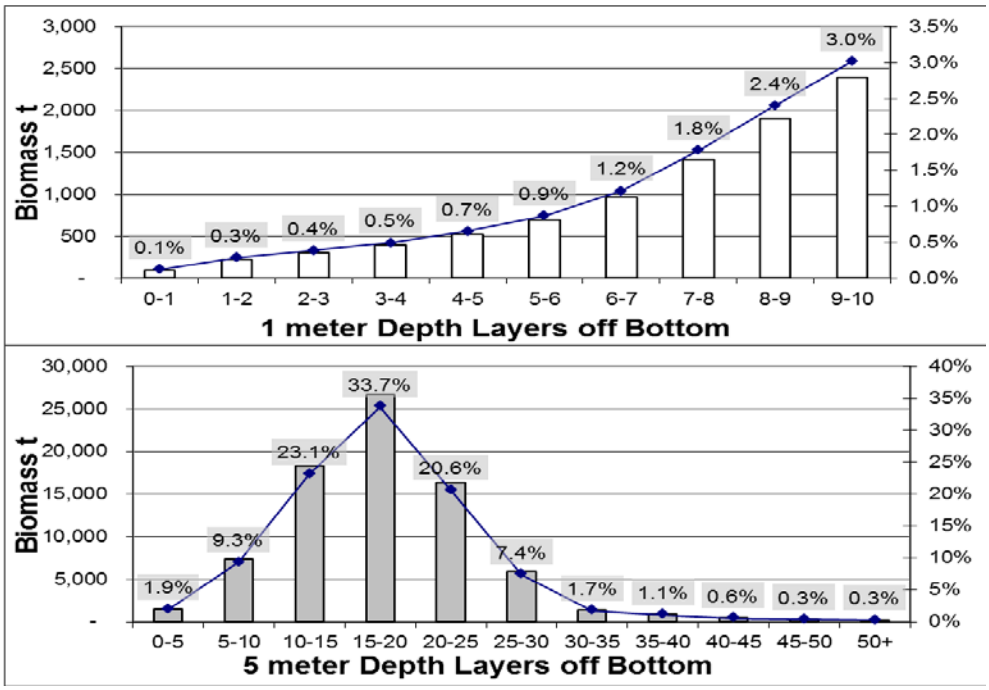

Figure 34B. Distribution of biomass by depth layer from bottom for the German Bank acoustic survey (#3) on September 8, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

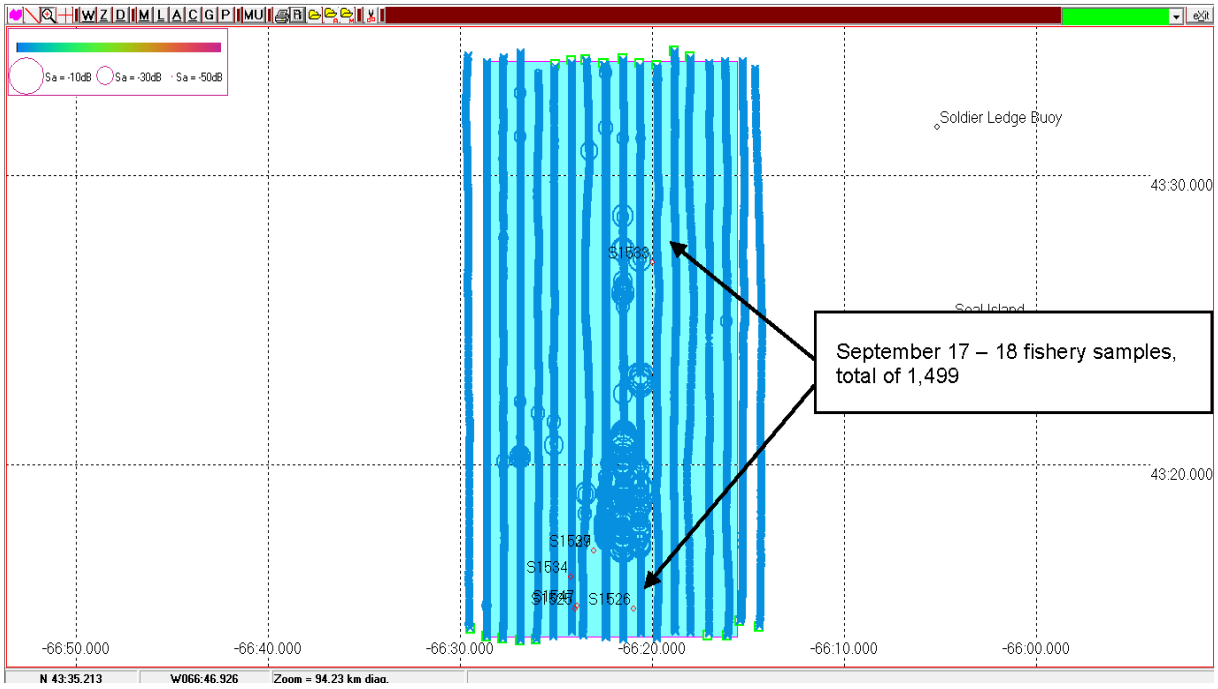

Figure 35A. German Bank acoustic survey (#3) on September 17, 2013, showing the main survey box (highlighted area) and transects with backscatter (Sa) along with the locations of fishery samples.

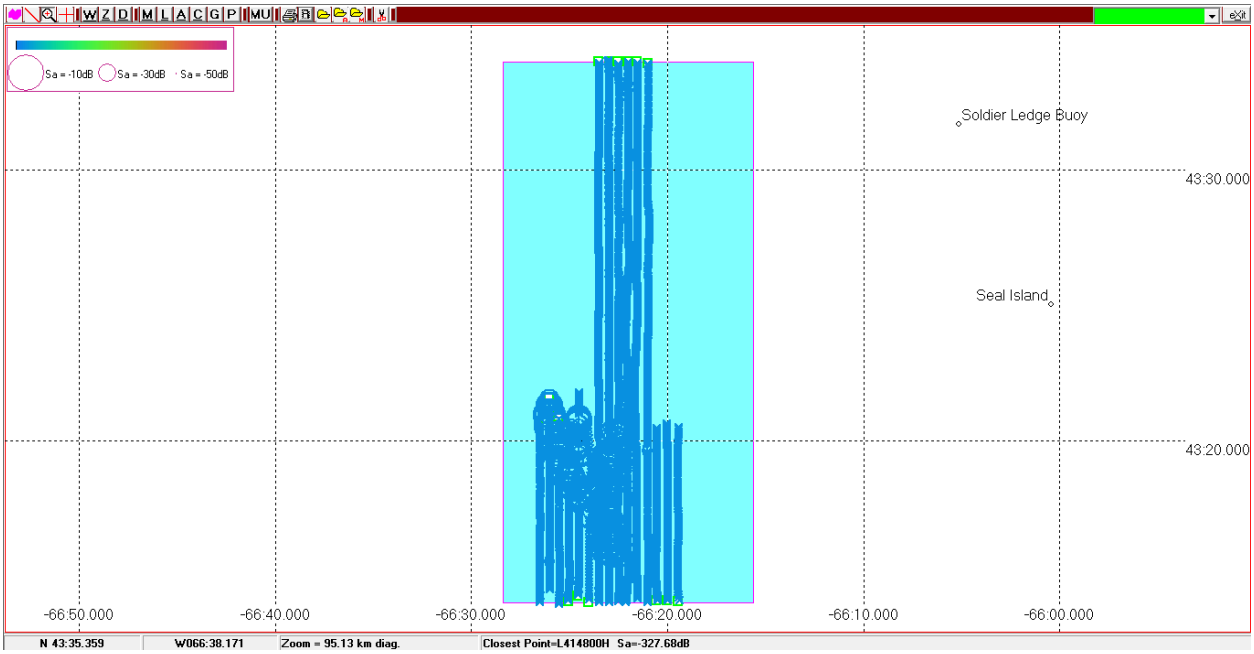

Figure 35B. German Bank acoustic survey (#3a) on September 11, 2014, showing the main survey box (highlighted area) and transects (excluded from analysis for number of days between surveys).

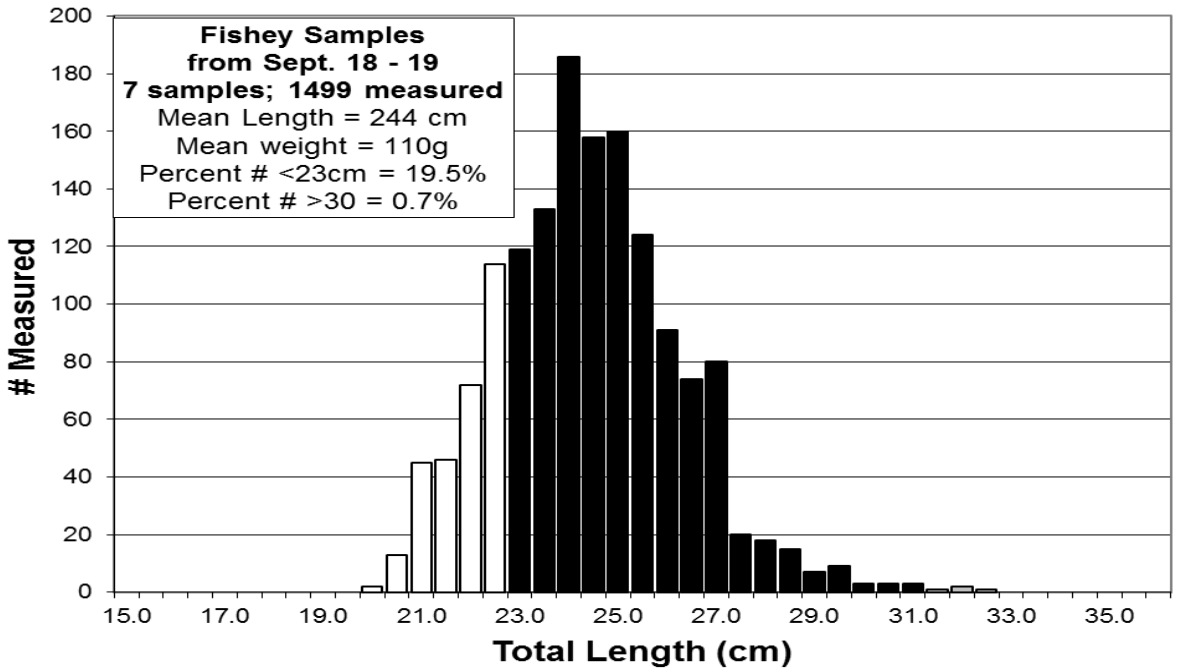

Figure 36. Length distribution used for calculation of TS for the German Bank acoustic survey (#3) on September 17, 2013, from sampling on September 18 - 19, with proportions <23cm and >30cm shown as white and grey bars.

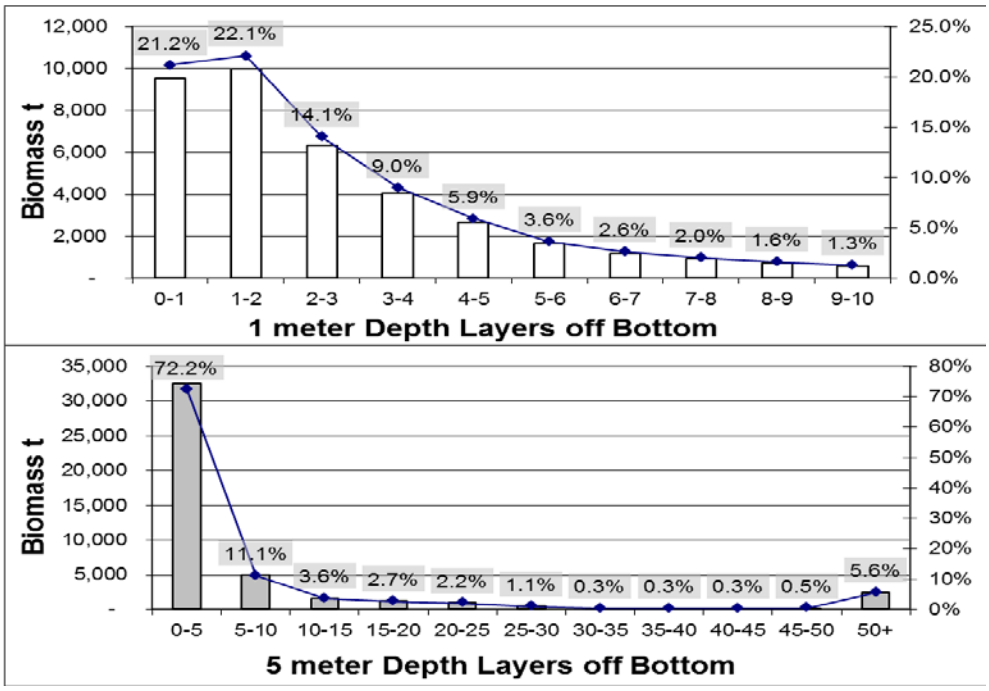

Figure 37. Distribution of biomass by depth layer from bottom for the German Bank acoustic survey (#3) on September 17, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

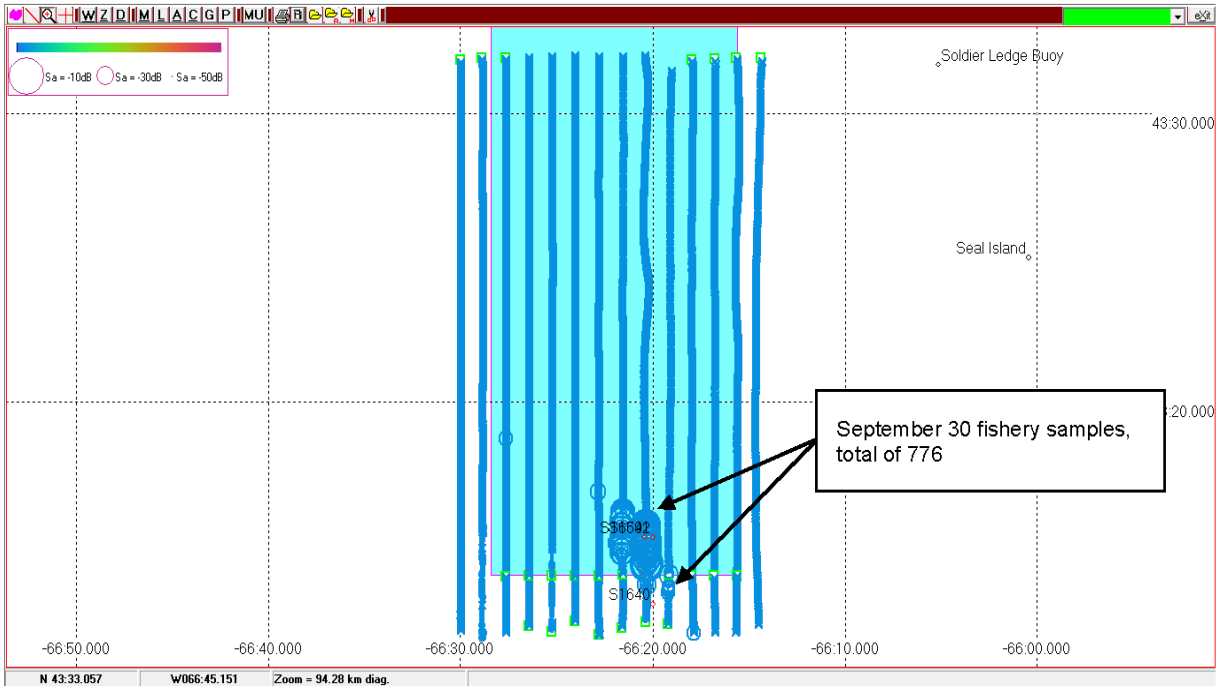

Figure 38A. German Bank acoustic survey (#4) on September 29, 2013, showing the main survey box (highlighted area) and transects with backscatter (Sa) along with the locations of fishery samples used for the TS.

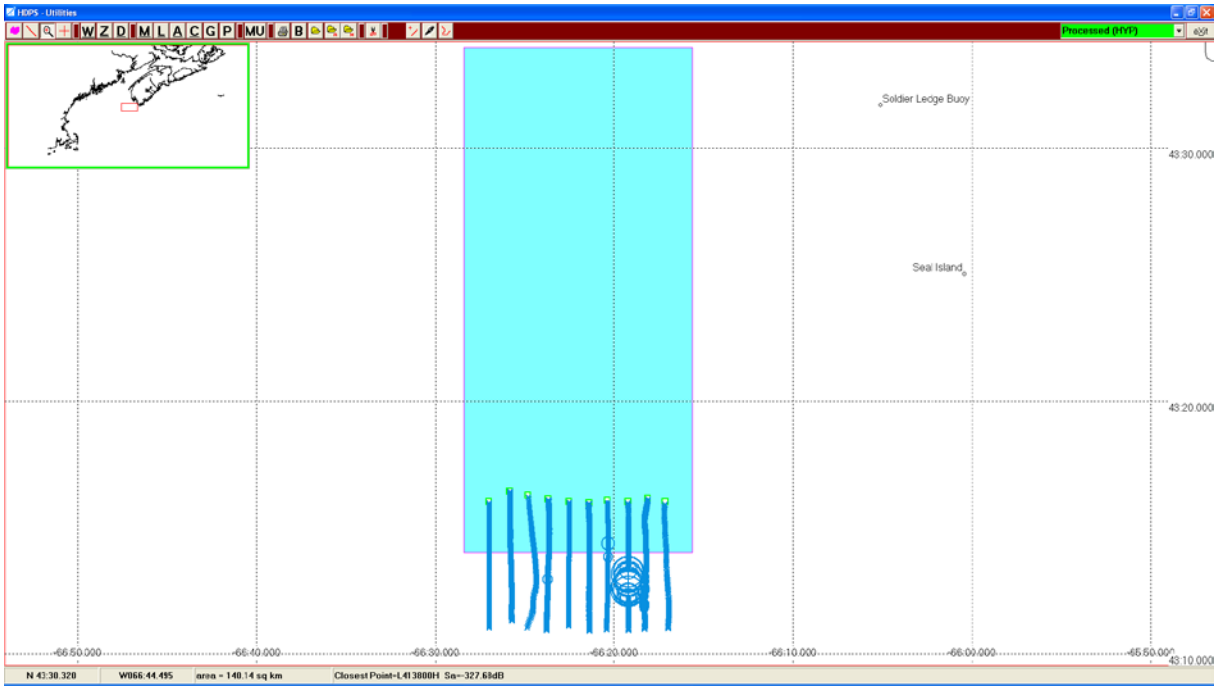

Figure 38B. German Bank "mini" acoustic survey (#4a) on October 5, 2013, showing the main survey box (highlighted area) and transects with backscatter (Sa) along with the locations of fishery samples used for the TS. Note: This survey was excluded from the total biomass estimate because it was too close to the one done on September 29.

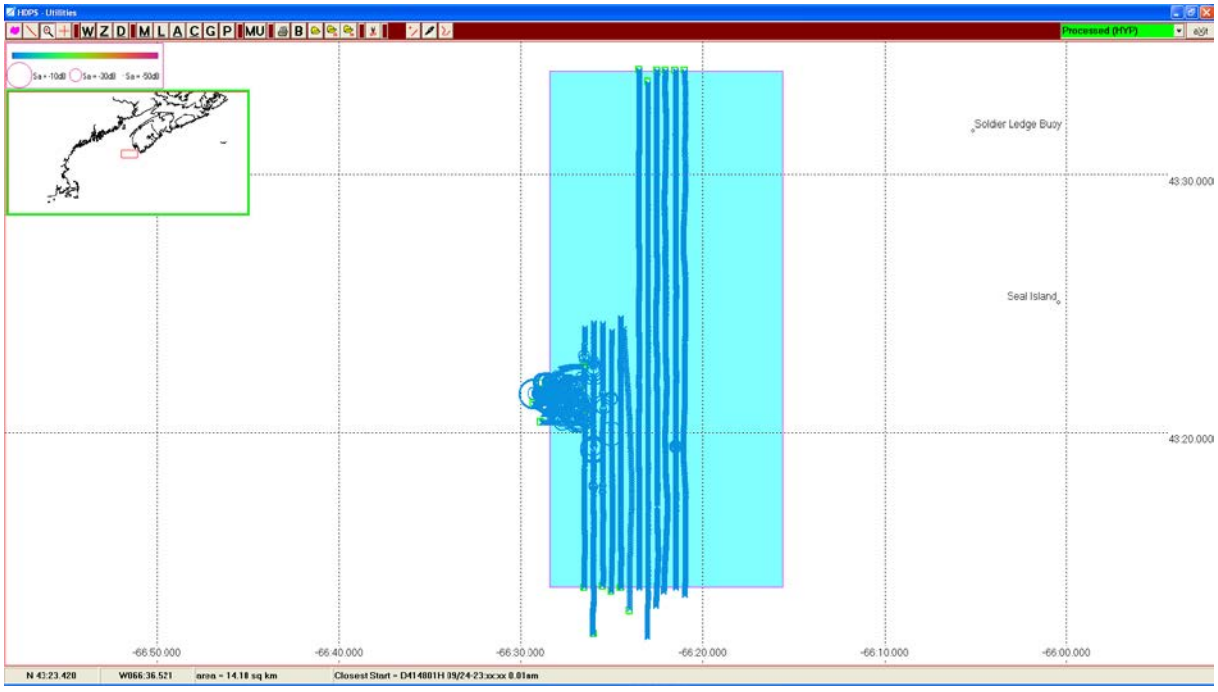

Figure 38C. German Bank acoustic survey (#4) on September 24, 2014, showing the main survey box (highlighted area) and transects with backscatter (Sa). Note: This survey was excluded from the total biomass estimate because it was too close to the one done on September 26.

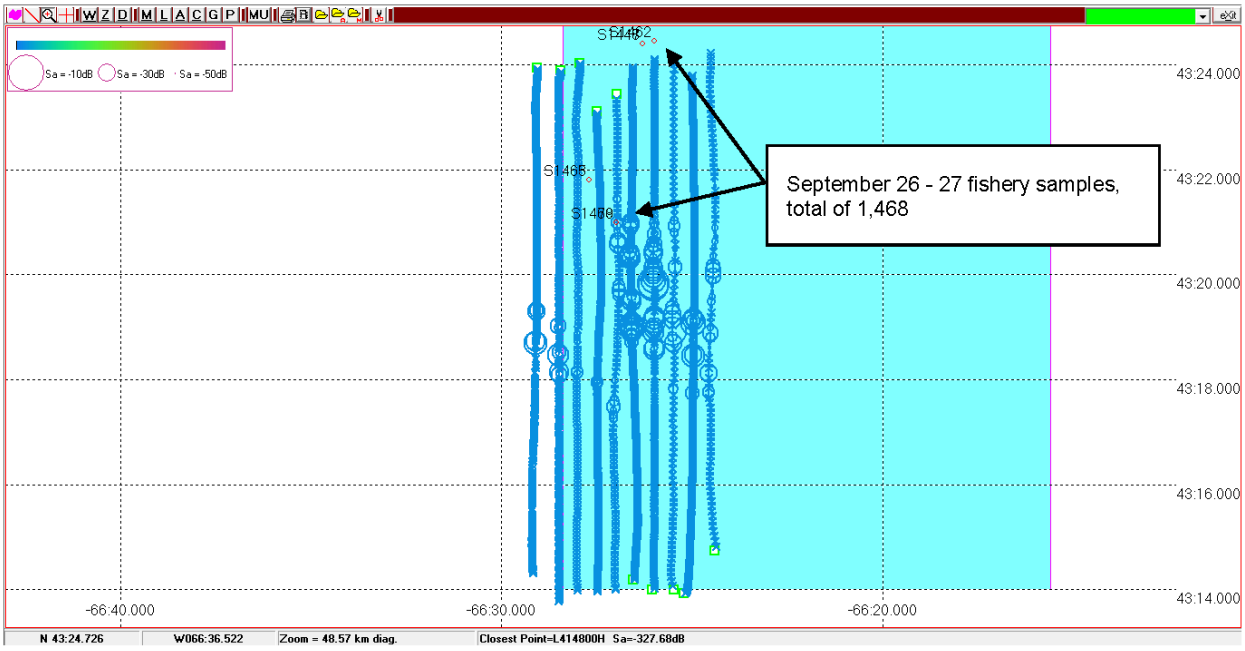

Figure 38D. German Bank acoustic survey (#4a) on September 26, 2014, showing the main survey box (highlighted area) and transects along with the locations of fishery samples used for the TS.

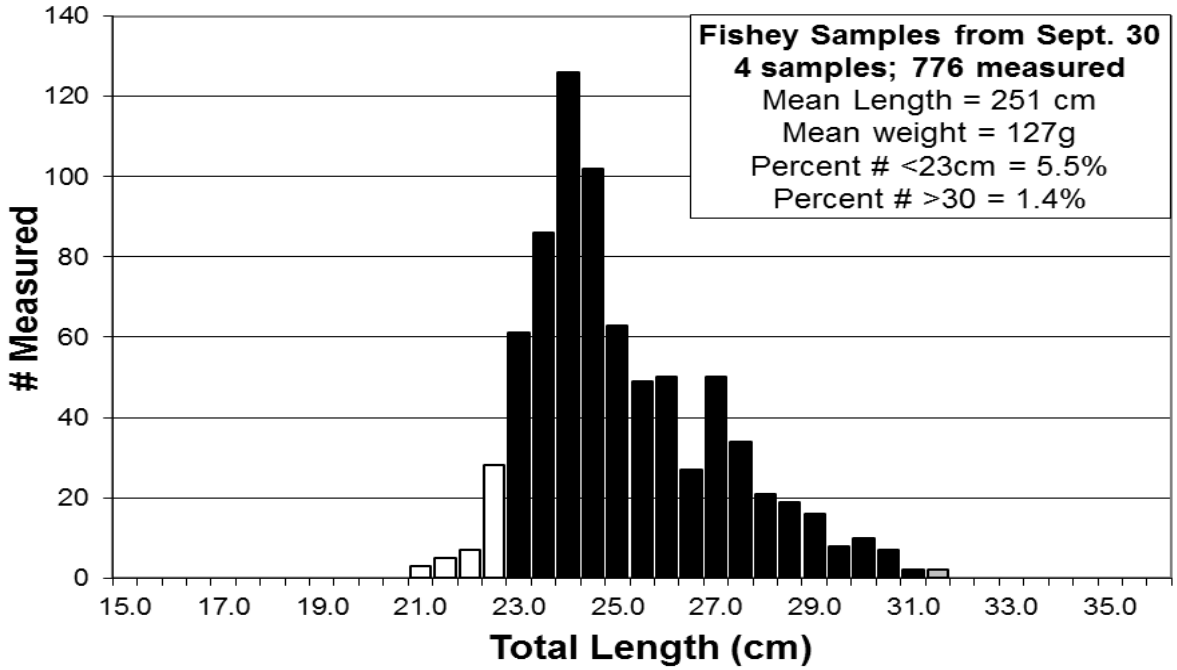

Figure 39A. Length distribution used for calculation of TS for the German Bank acoustic survey (#4) on September 29, 2013, from sampling on September 30, with proportions <23cm and >30cm shown as white and grey bars.

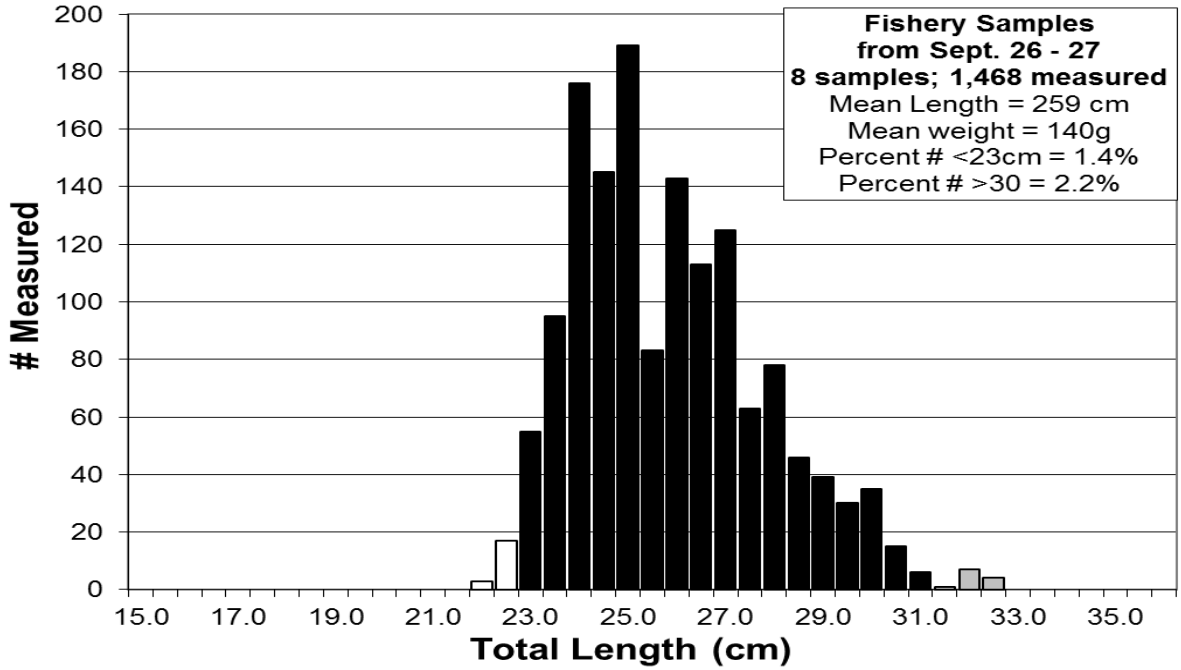

Figure 39B. Length distribution used for calculation of TS for the German Bank acoustic survey (#4a) on September 26, 2014, from sampling on September 26 and 27, with proportions <23cm and >30cm shown as white and grey bars.

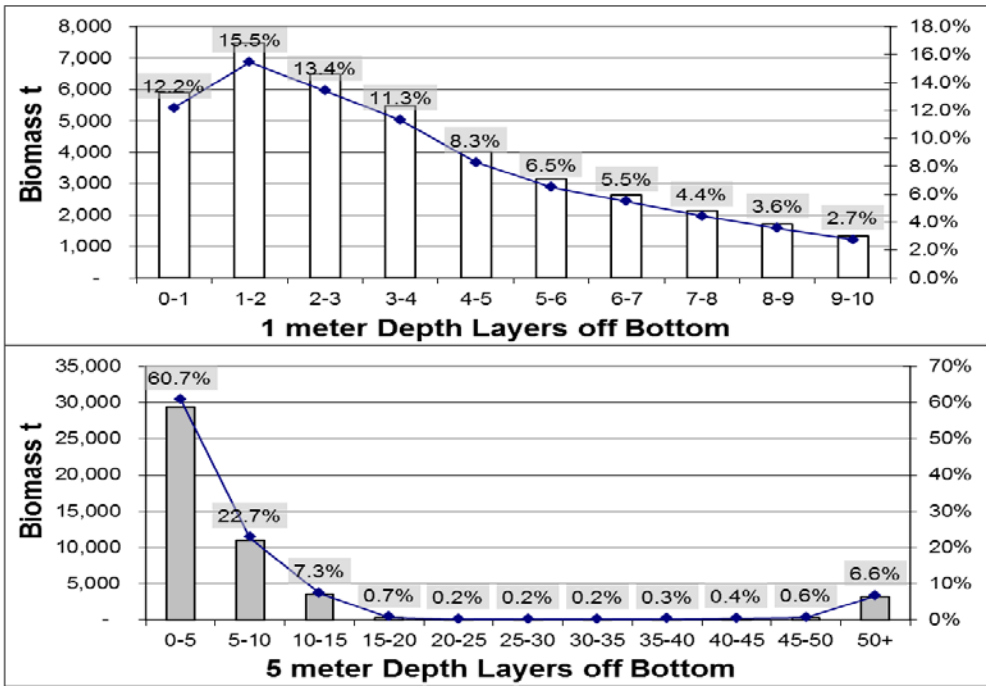

Figure 40A. Distribution of biomass by depth layer from bottom for the German Bank acoustic survey (#4) on September 29, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

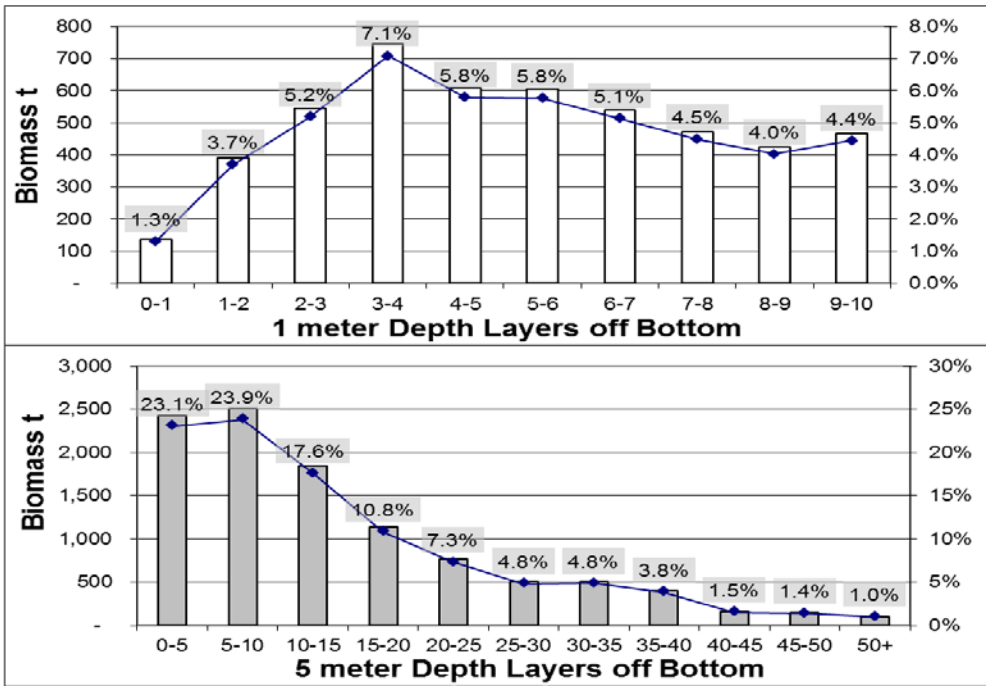

Figure 40B. Distribution of biomass by depth layer from bottom for the German Bank acoustic survey (#4a) on September 26, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

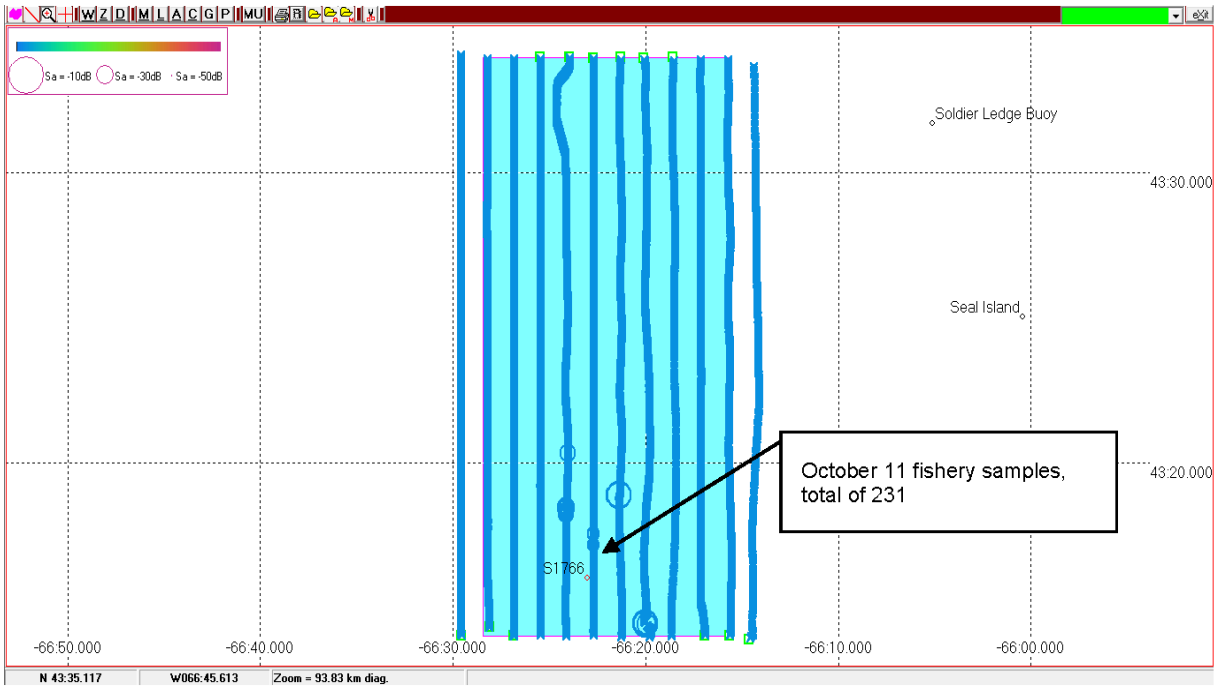

Figure 41A. German Bank acoustic survey (#5) on October 14, 2013, showing the main survey box (highlighted area) and transects with backscatter (Sa) along with the locations of fishery samples.

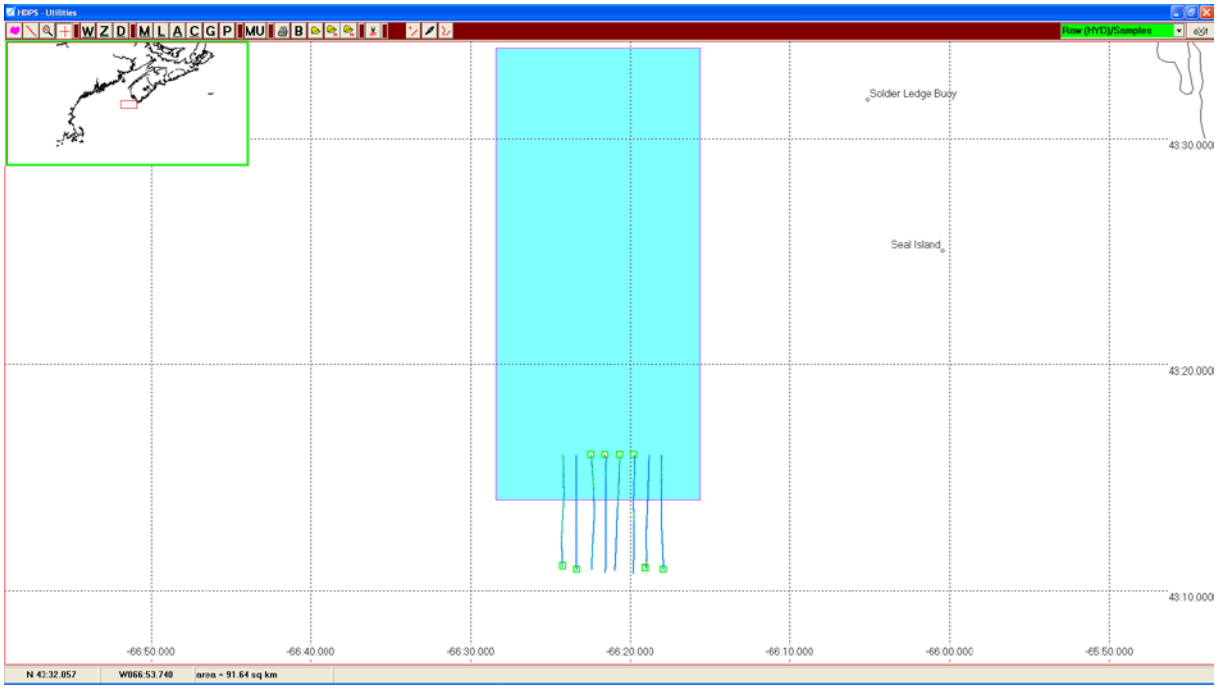

Figure 41B. German Bank "mini" acoustic survey (#5a) on October 21, 2013, with transects showing location in the main survey box (highlighted area). Note: This survey was excluded from the total biomass estimate because it was too close to the one done on October 14.

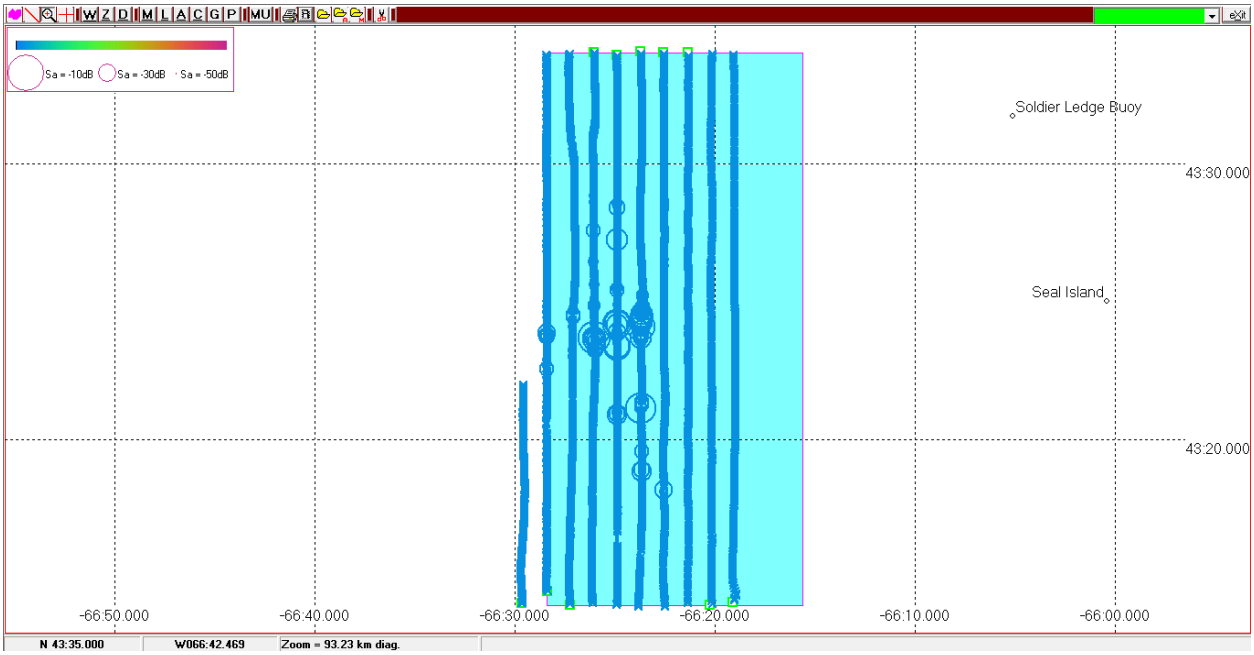

Figure 41C. German Bank acoustic survey (#5) on October 6, 2014, showing the main survey box (highlighted area) and transects with backscatter (Sa). No samples were available and the standard TS was used in the biomass estimate.

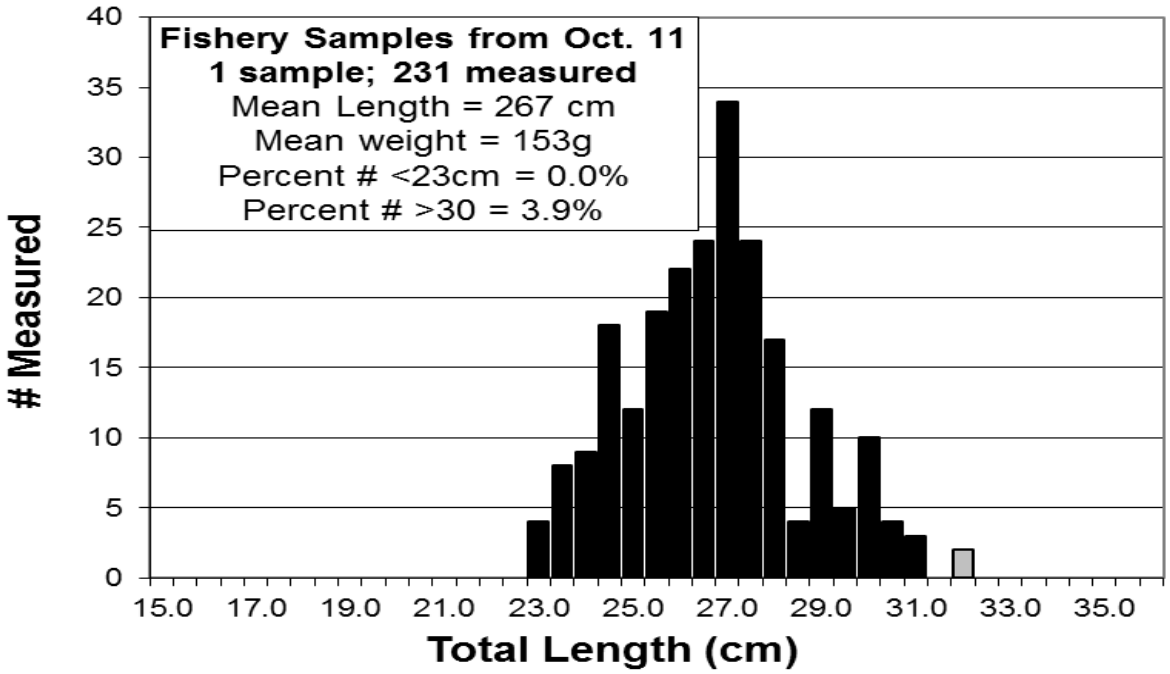

Figure 42. Length distribution used for calculation of TS for the German Bank acoustic survey (#5) on October 14, 2013, from sampling on October 11, with proportions <23cm and >30cm shown as white and grey bars.

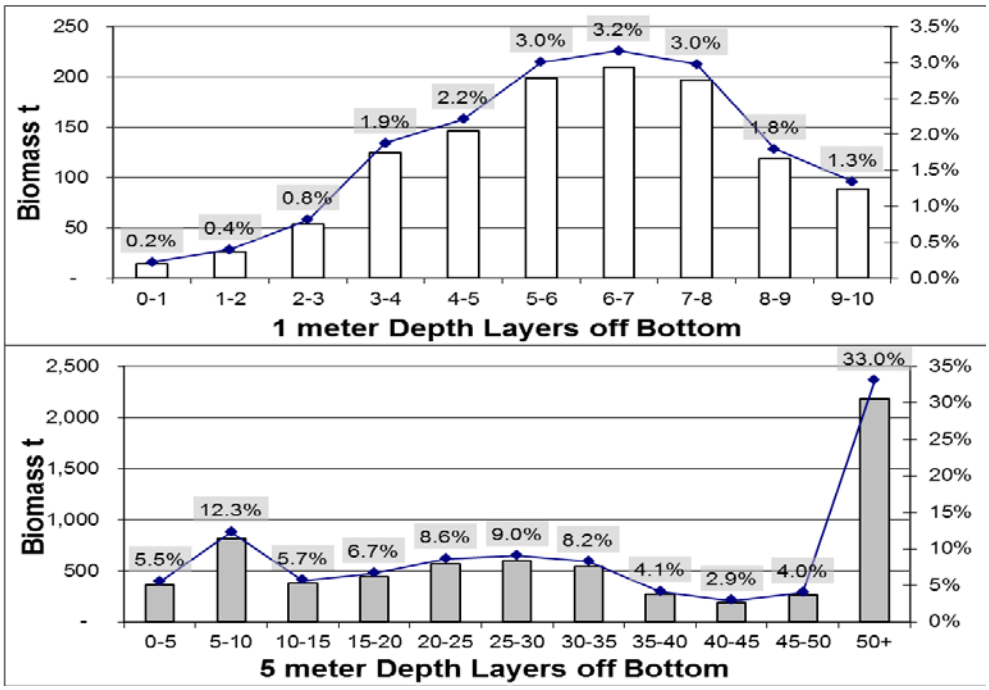

Figure 43A. Distribution of biomass by depth layer from bottom for the German Bank acoustic survey (#5) on October 14, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

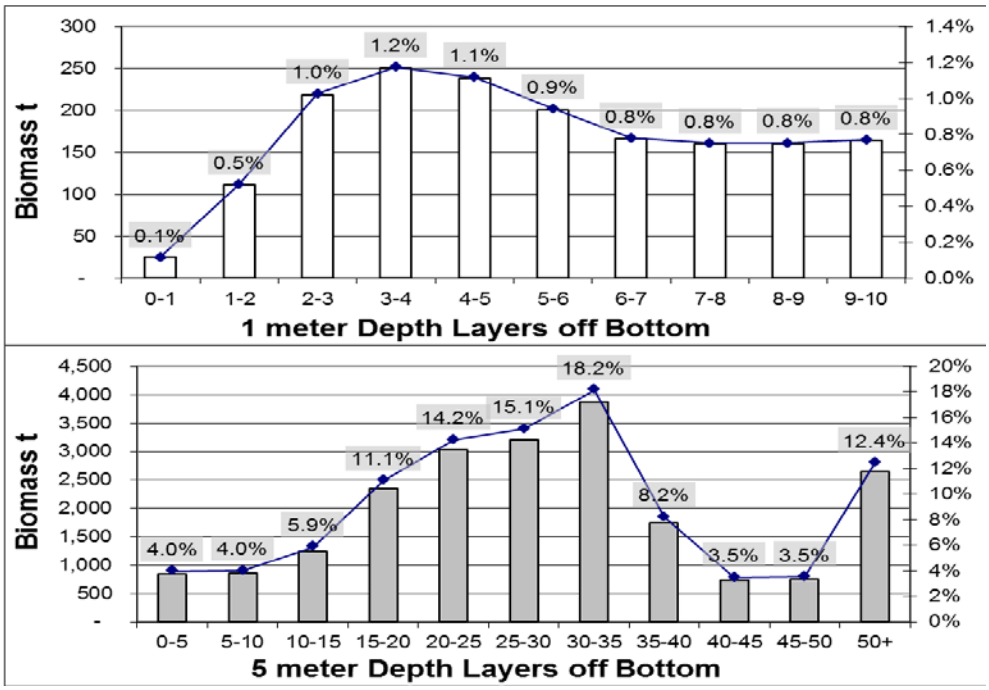

Figure 43B. Distribution of biomass by depth layer from bottom for the German Bank acoustic survey (#5) on October 6, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

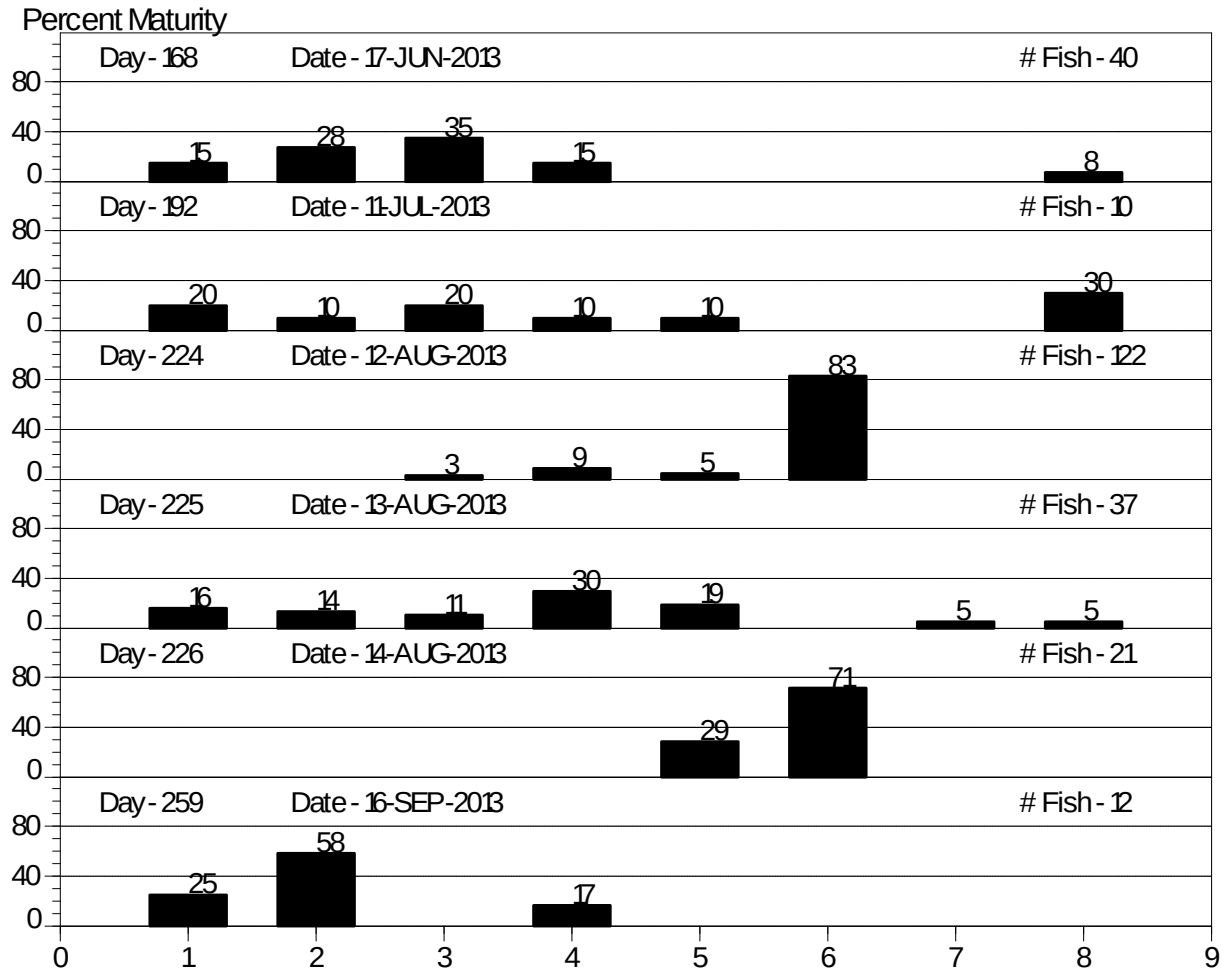

Figure 44A. Herring maturity samples collected from the Trinity Ledge area in 2013. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

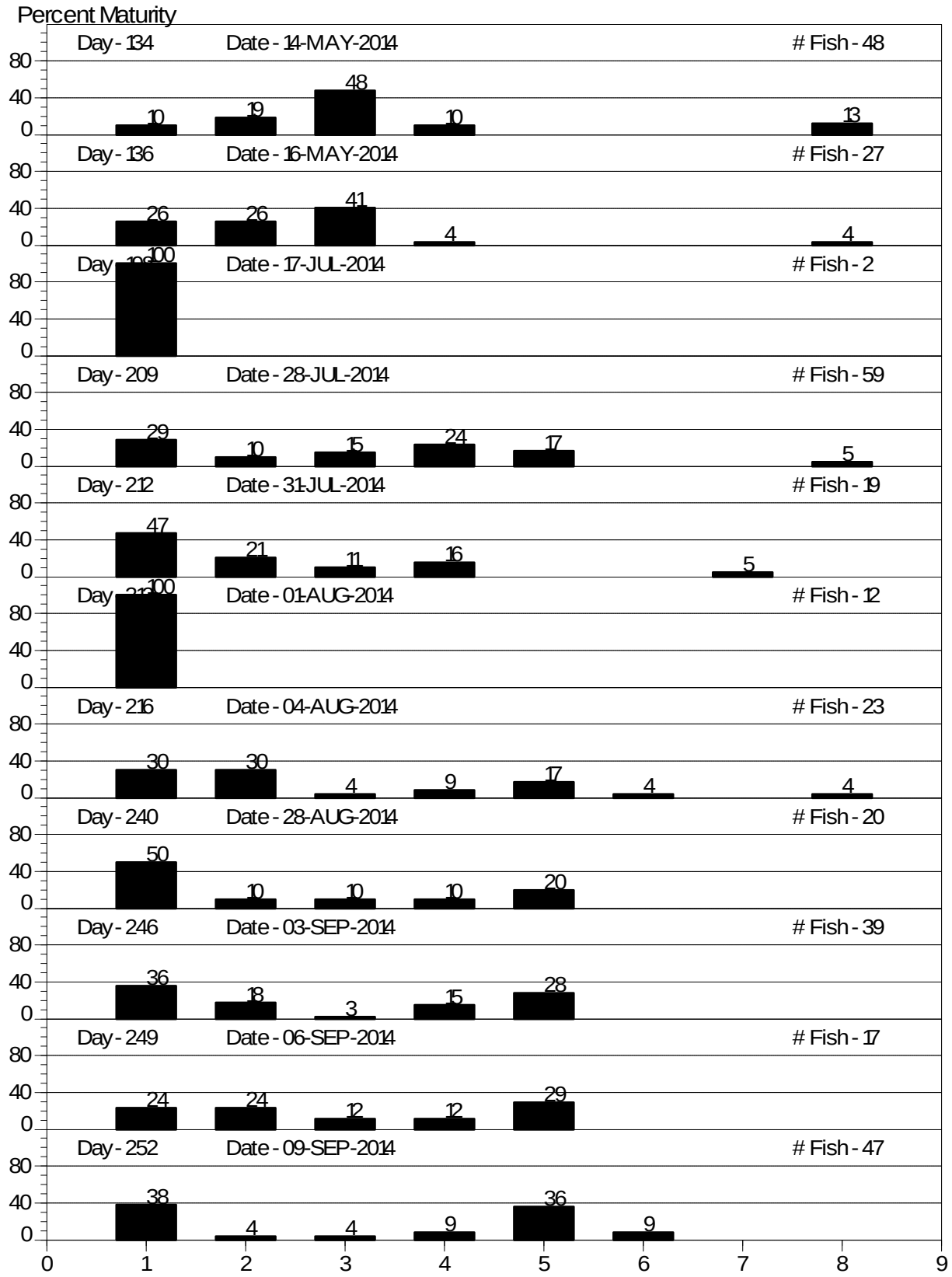

Figure 44B (Continued below). *Herring maturity samples collected from the Trinity Ledge area in 2014. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.*

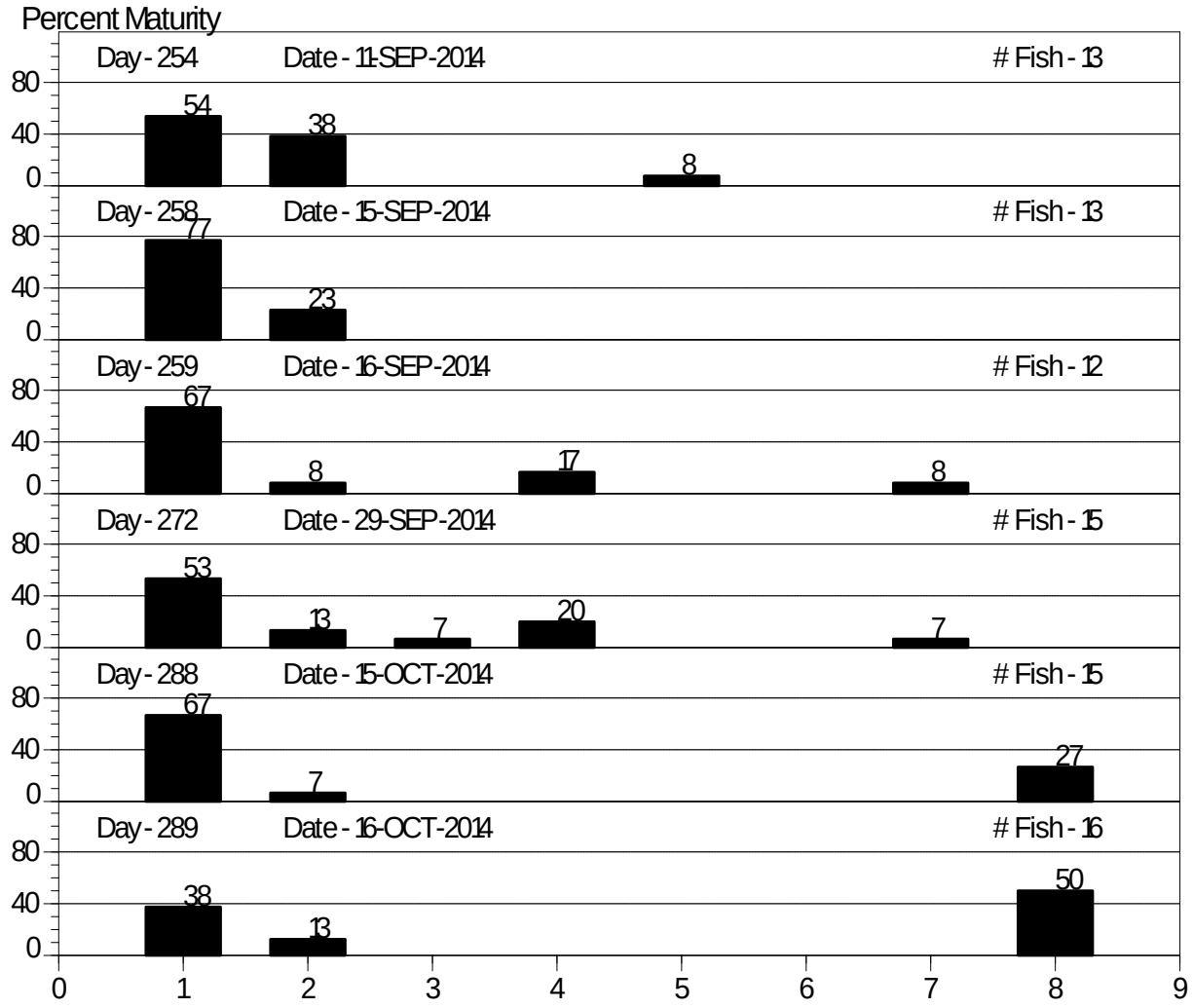

Figure 44B (Continued from above). *Herring maturity samples collected from the Trinity Ledge area in 2014. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.*

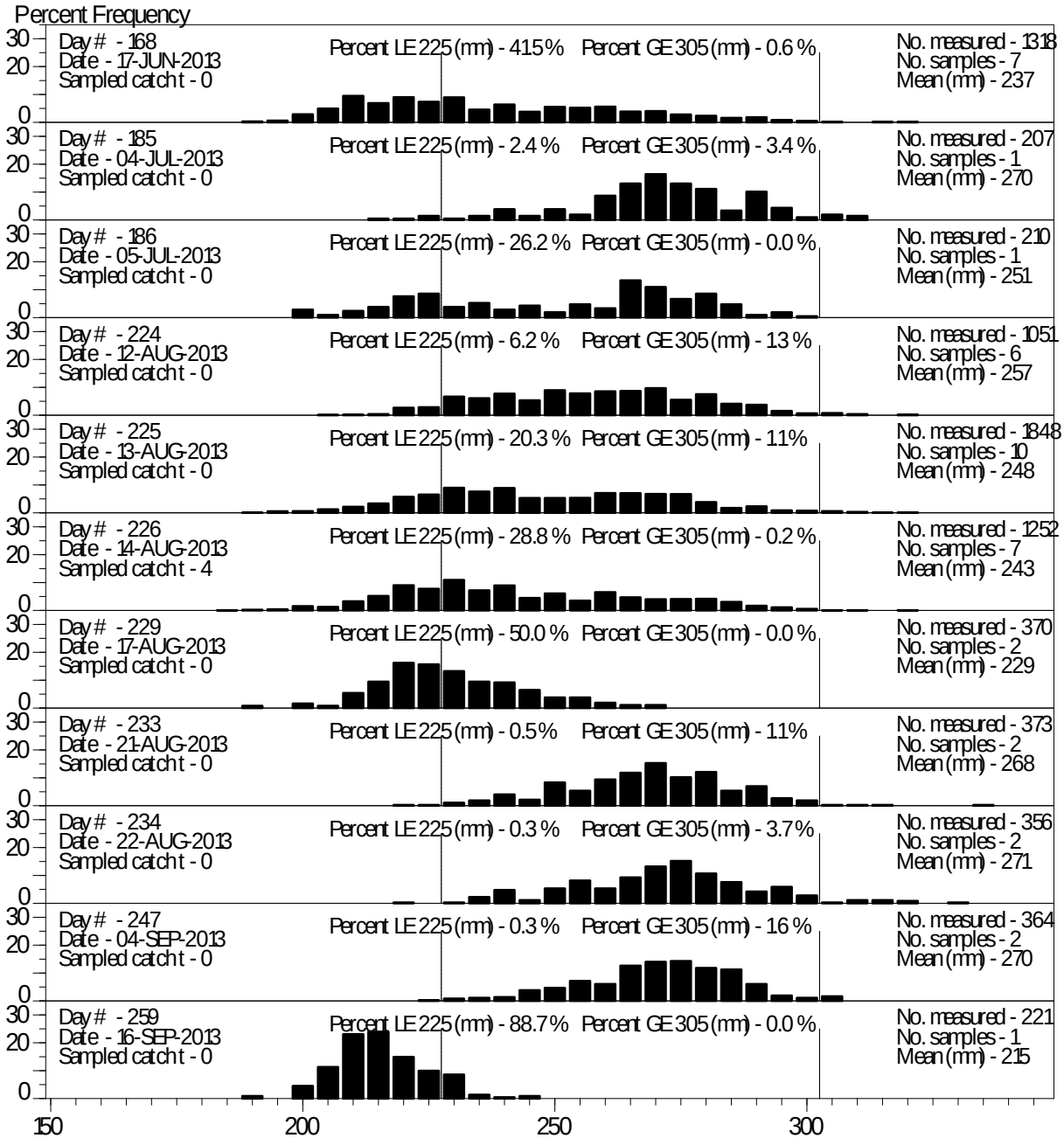

Figure 45A. Daily herring length frequency samples collected from the Trinity Ledge gillnet fishery in 2013, with proportions <23cm and >30cm.

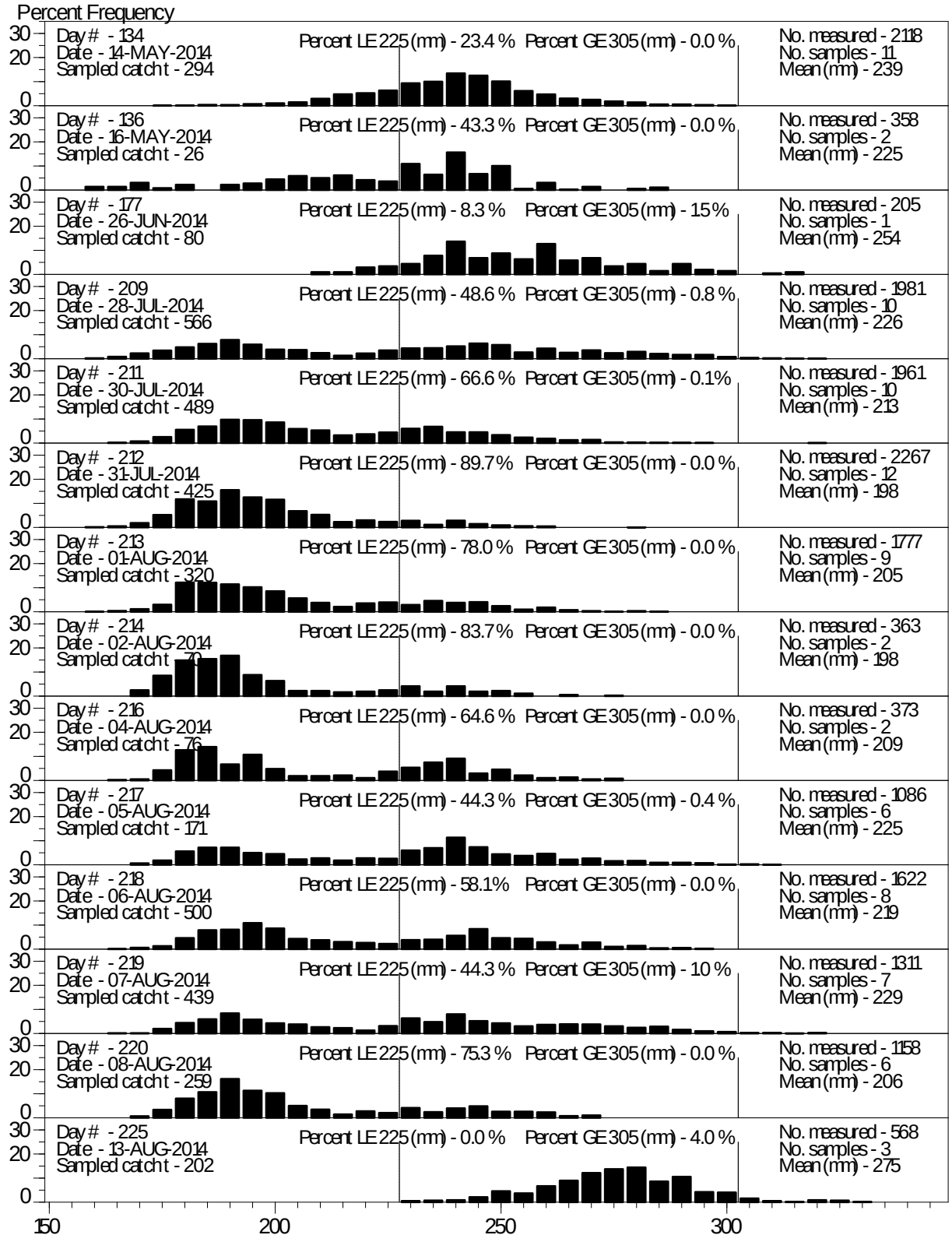

Figure 45B *(Continued below)**. Daily herring length frequency samples collected from the Trinity Ledge gillnet fishery in 2014, with proportions <23cm and >30cm.*

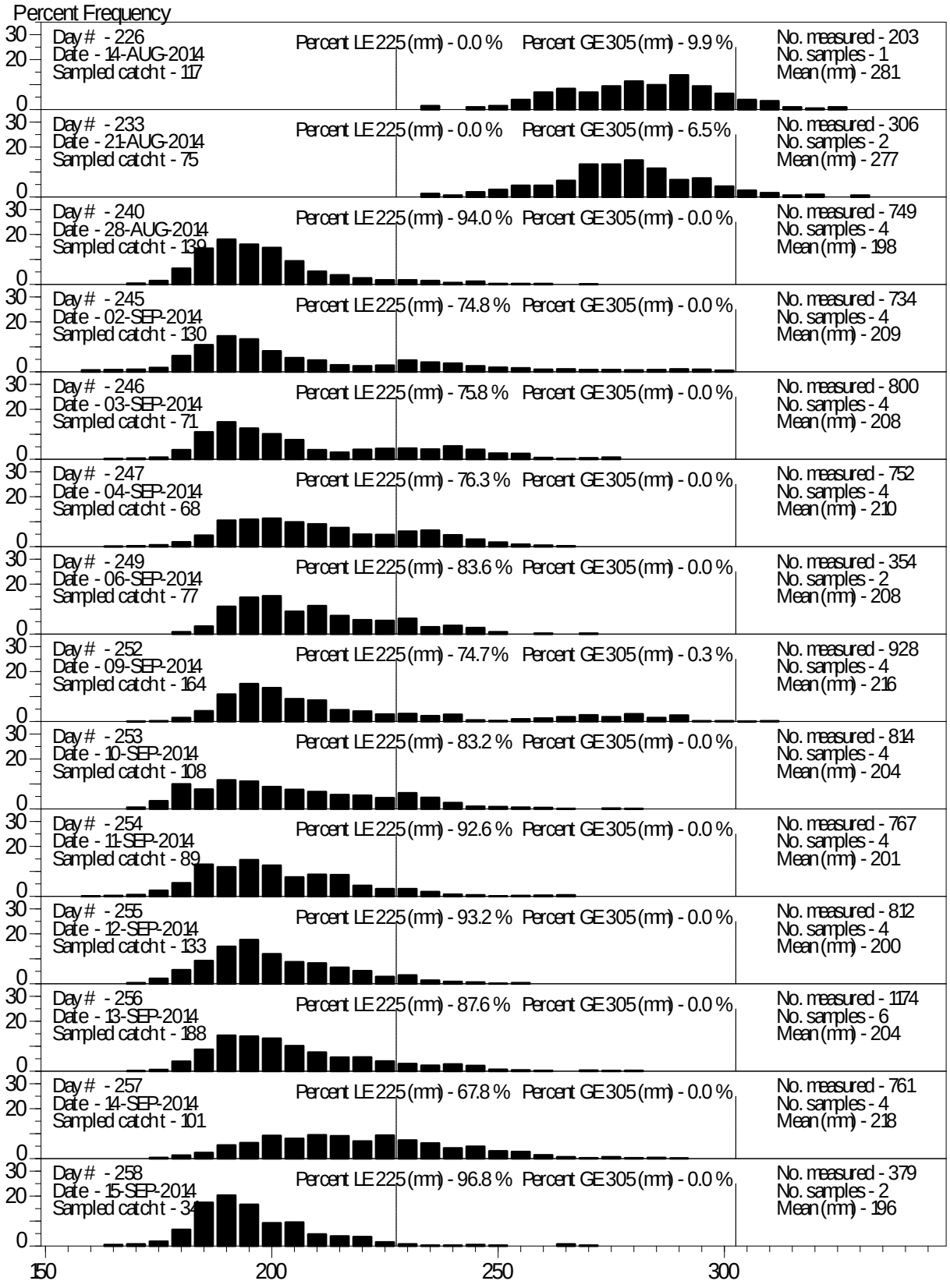

Figure 45B (Continued from above and continued below). *Daily herring length frequency samples collected from the Trinity Ledge gillnet fishery in 2014, with proportions <23cm and >30cm.*

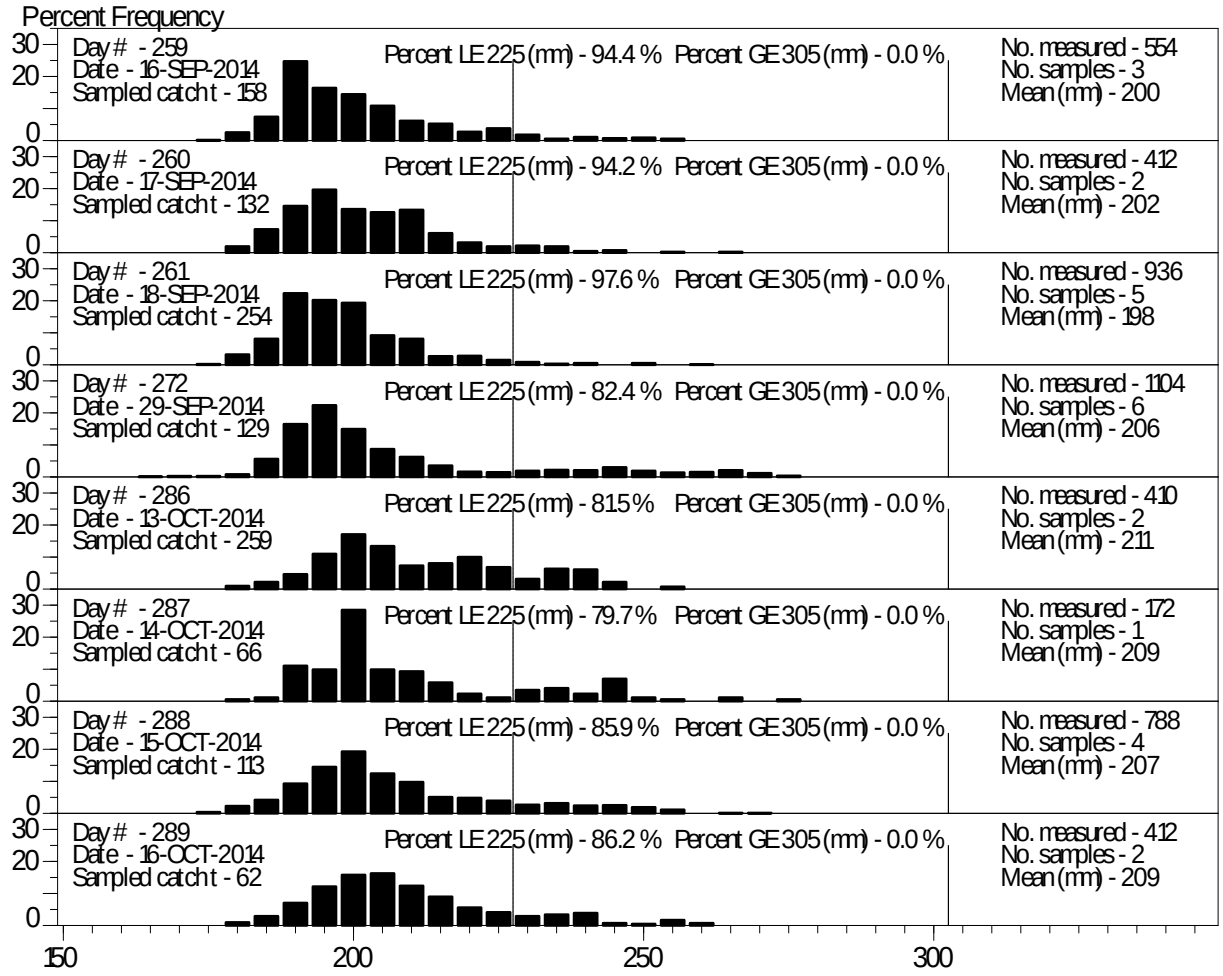

Figure 45B [(Continued from above)]*. Daily herring length frequency samples collected from the Trinity Ledge gillnet fishery in 2014, with proportions <23cm and >30cm.*

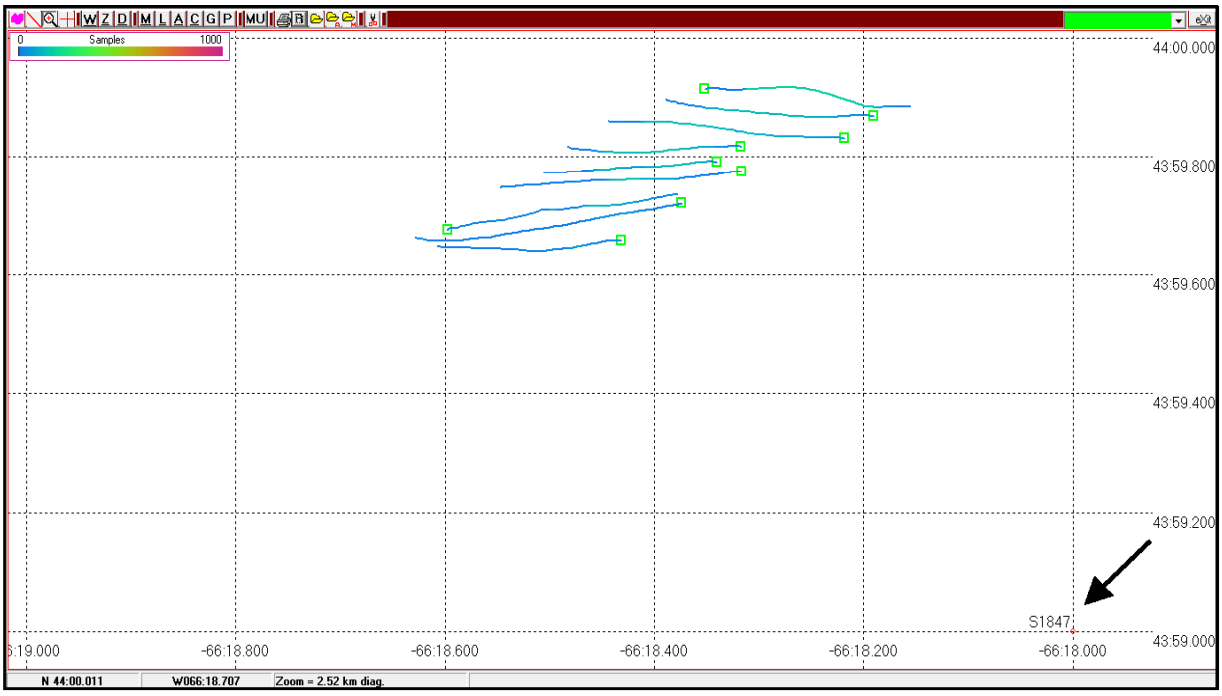

Figure 46A. Trinity Ledge area herring acoustic survey (#1) on August 12, 2013, showing tracks conducted by the vessel Katrina & Kayla. Location of one multi-panel sample collected is shown (arrow).

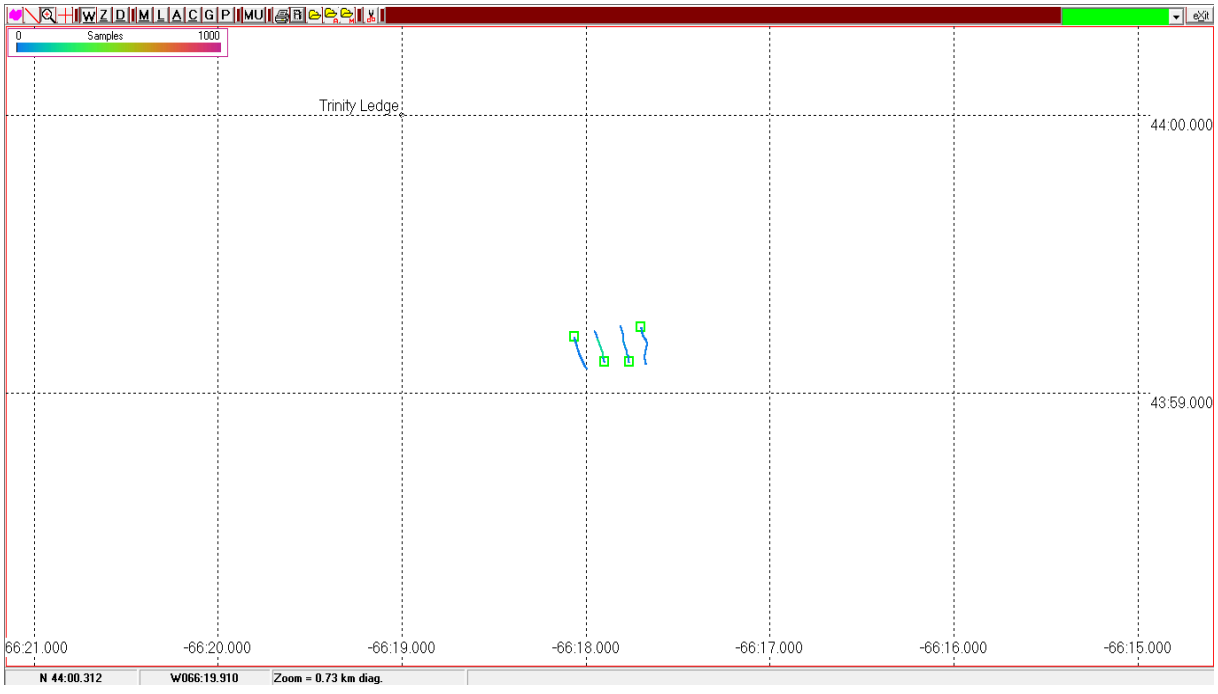

Figure 46B. Trinity Ledge area herring acoustic survey (#1) on August 26, 2014, showing tracks conducted by the vessel Katrina & Kayla. No samples were available. Standard TS used.

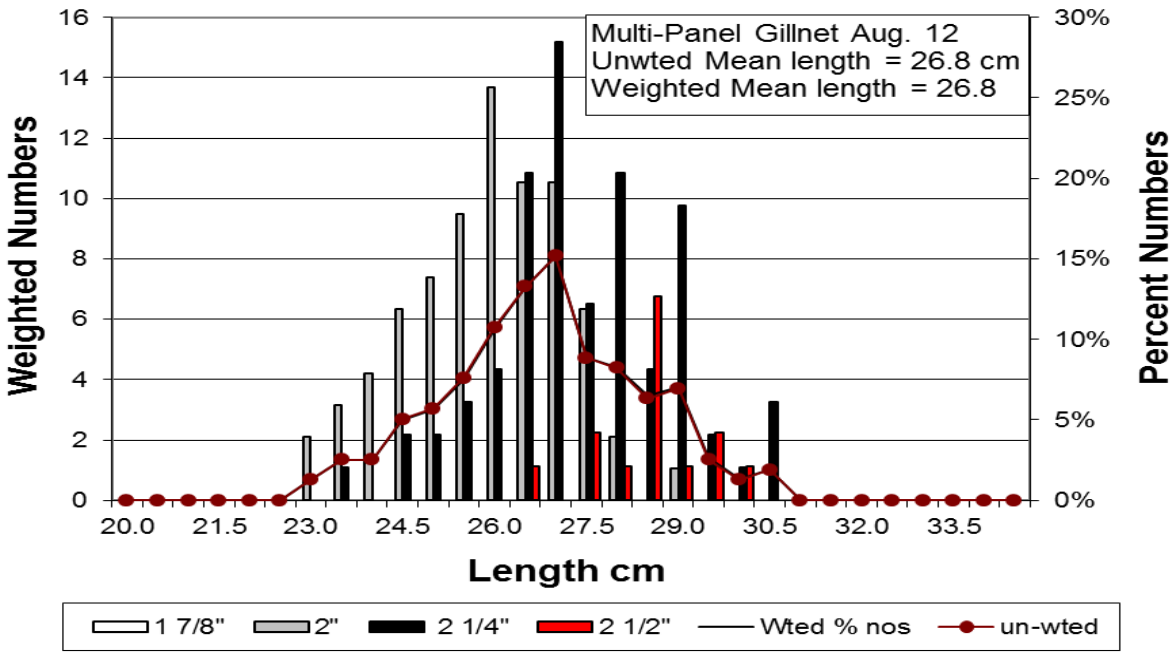

Figure 47. Multi-panel herring gillnet sample collected on August 12, 2013 for the Trinity Ledge herring acoustic survey (#1) on August 12, 2013.

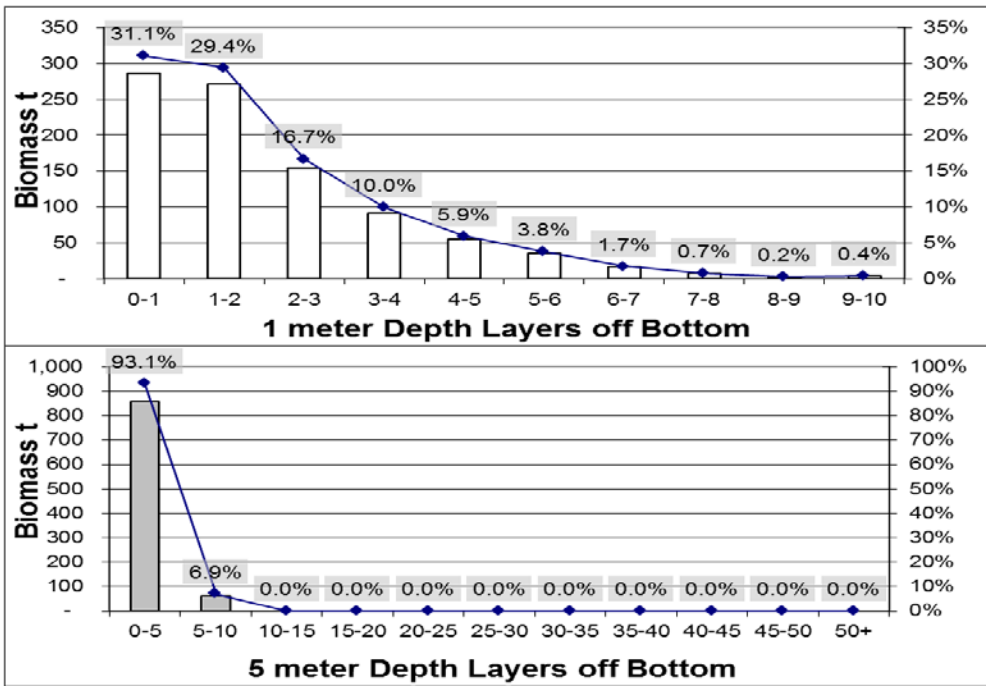

Figure 48A. Distribution of biomass by depth layer from bottom for the Trinity Ledge acoustic survey (#1) on August 12, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

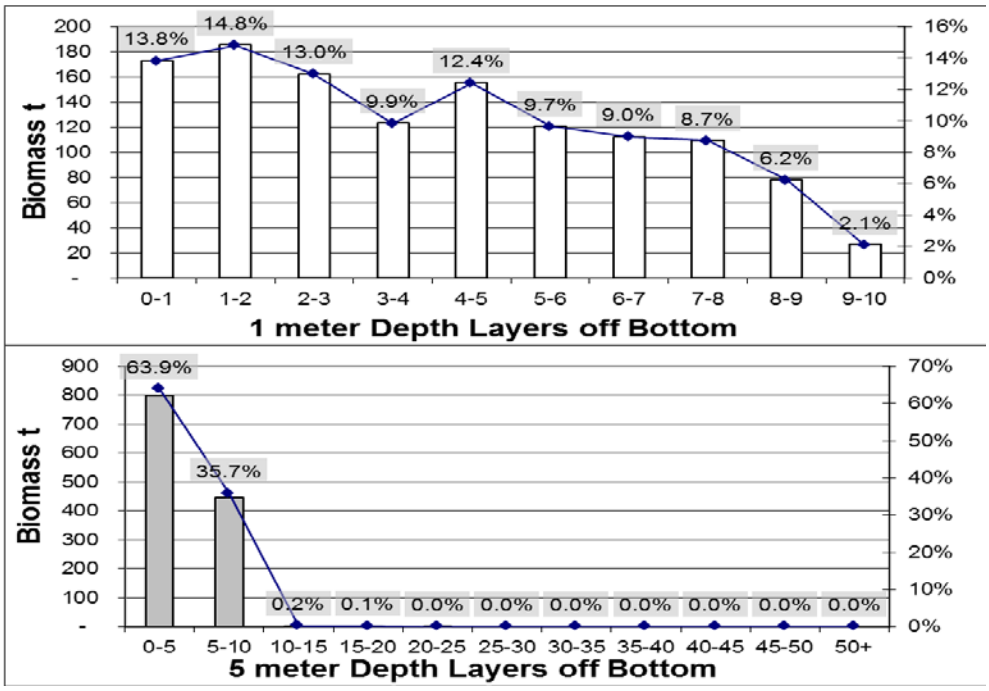

Figure 48B. Distribution of biomass by depth layer from bottom for the Trinity Ledge acoustic survey (#1) on August 26, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

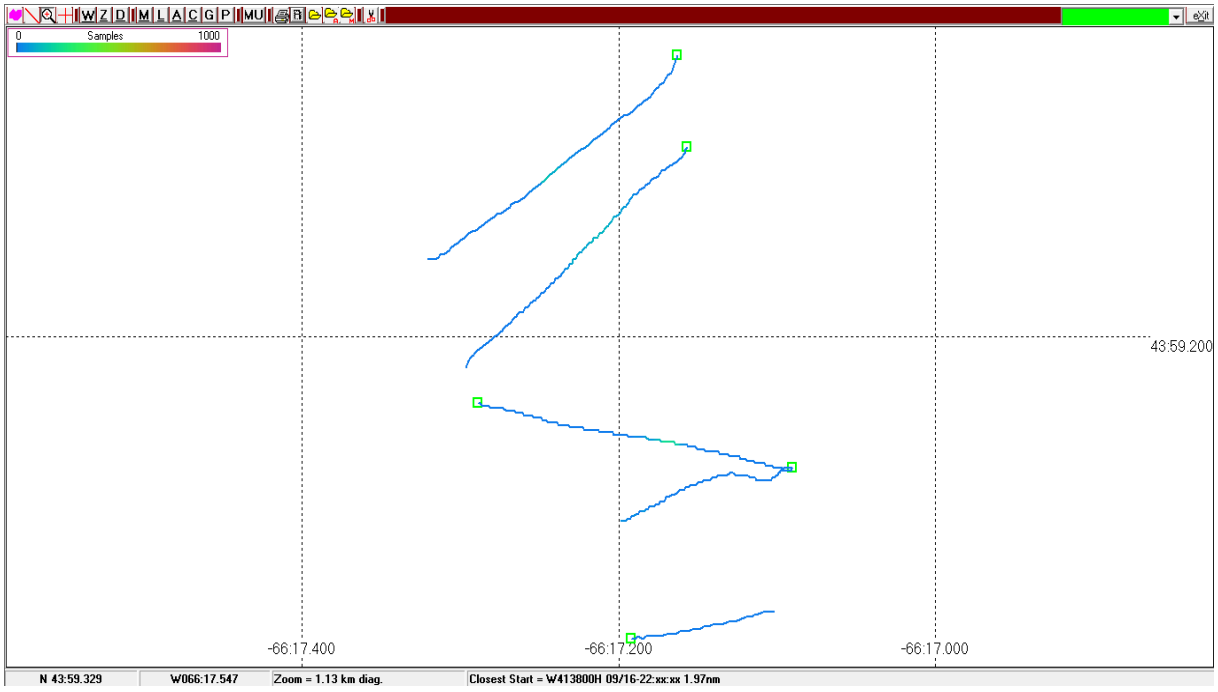

Figure 49A. Trinity Ledge area herring acoustic survey (#2) on September 16, 2013, showing tracks conducted by the vessel Katrina & Kayla. Note: The survey was not considered optimal since the survey protocol was not followed; however, there were some parallel lines over three aggregations. No samples were available. Standard TS used.

Figure 49B. Trinity Ledge area herring acoustic survey (#2) on September 10, 2014, showing tracks conducted by the vessel Katrina & Kayla. No samples were available. Standard TS used.

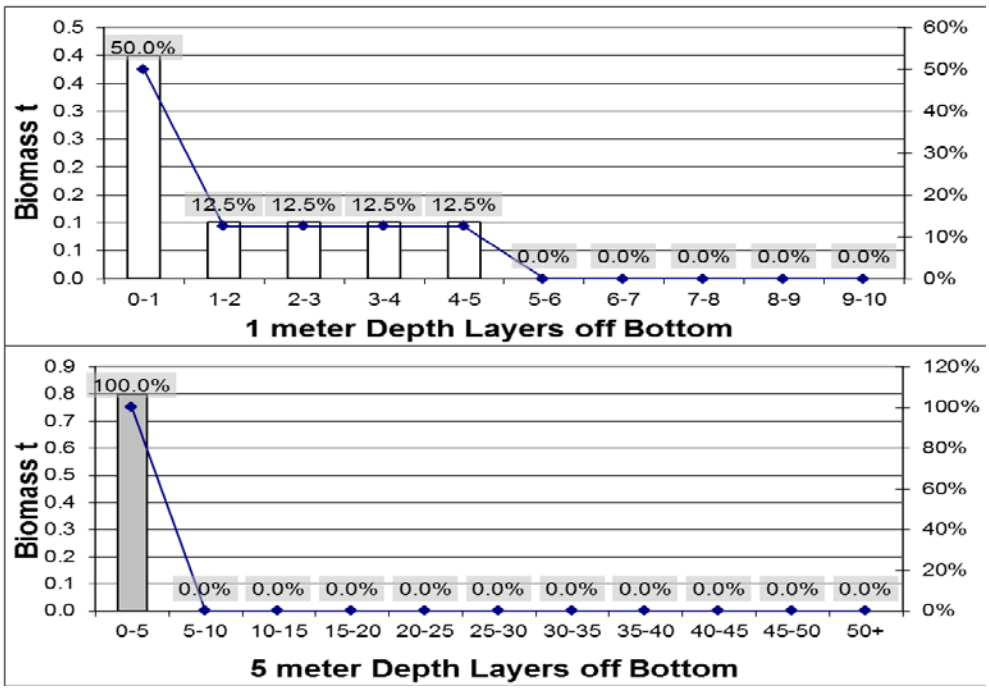

Figure 50A. Distribution of biomass by depth layer from bottom for the Trinity Ledge acoustic survey (#2) on September 16, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

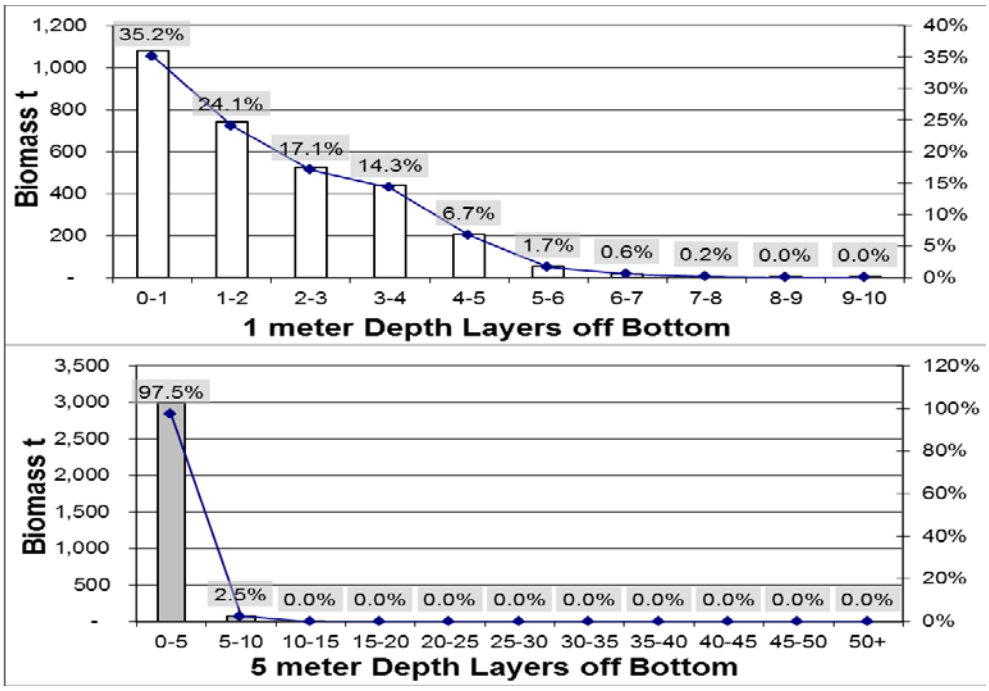

Figure 50B. Distribution of biomass by depth layer from bottom for the Trinity Ledge acoustic survey (#2) on September 10, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

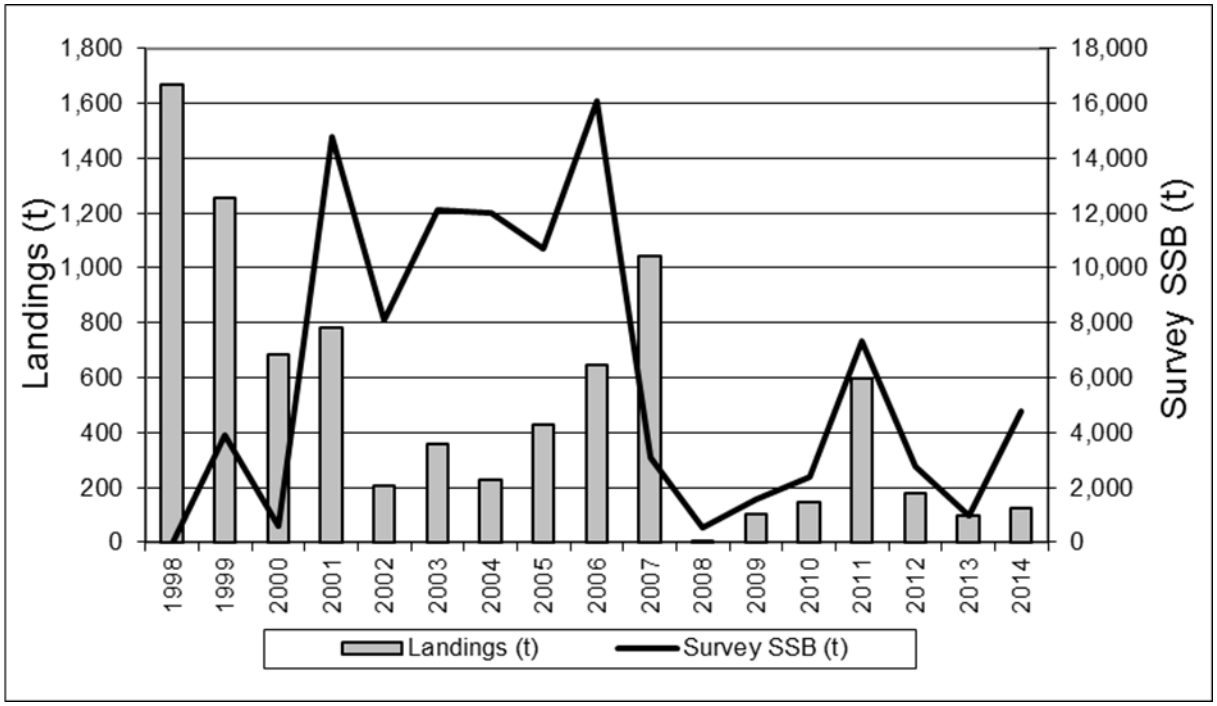

Figure 51. Trinity Ledge herring landings and acoustic survey biomass estimates from 1998-2014. All acoustic estimates were calculated with the CIF except 1999-2002. Note landings scale is 10% of that of survey biomass.

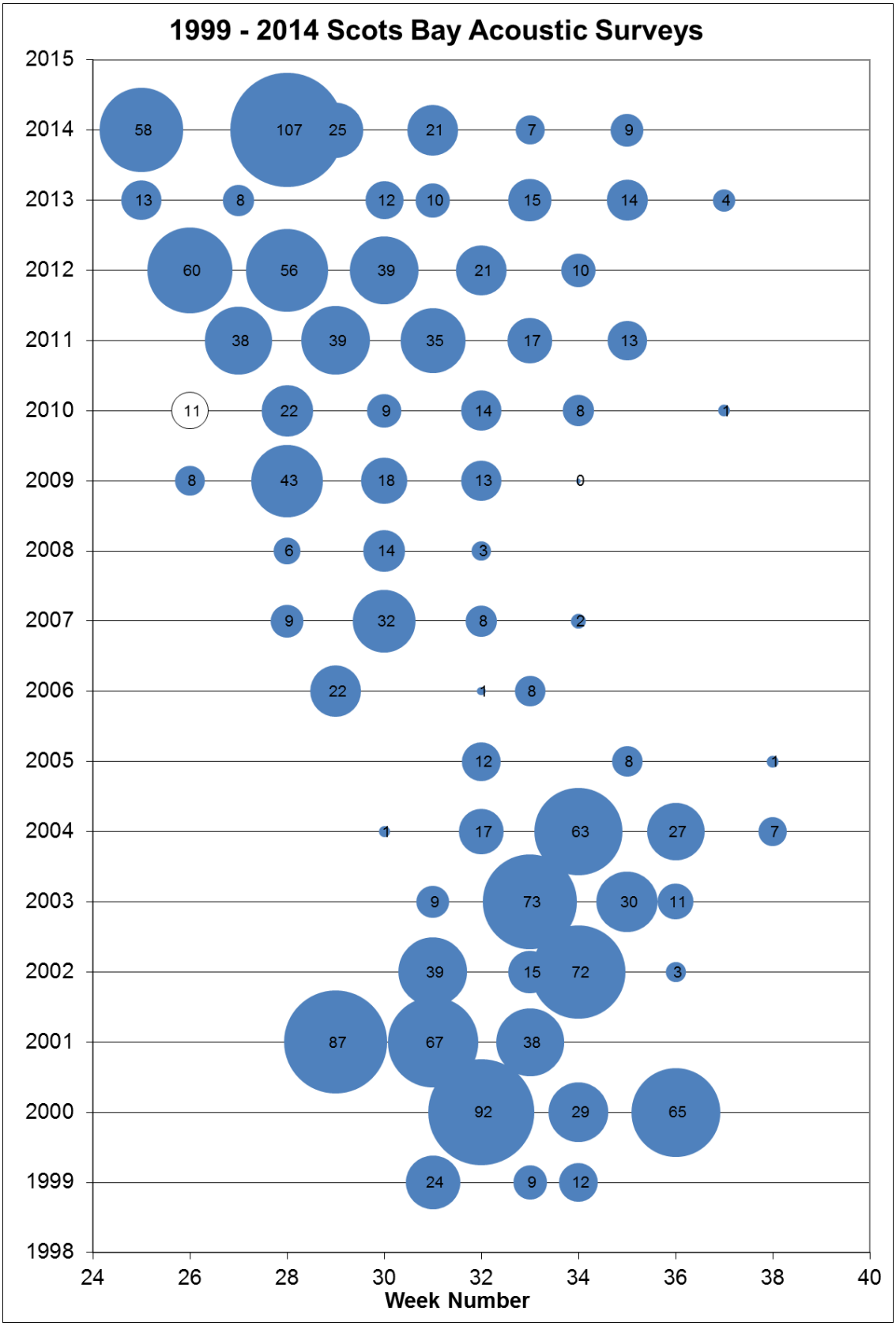

Figure 52. History of Scots Bay herring acoustic surveys from 1999-2014 by week number showing timing with bubble area representing biomass (in thousands) for each survey (calculated with CIF).

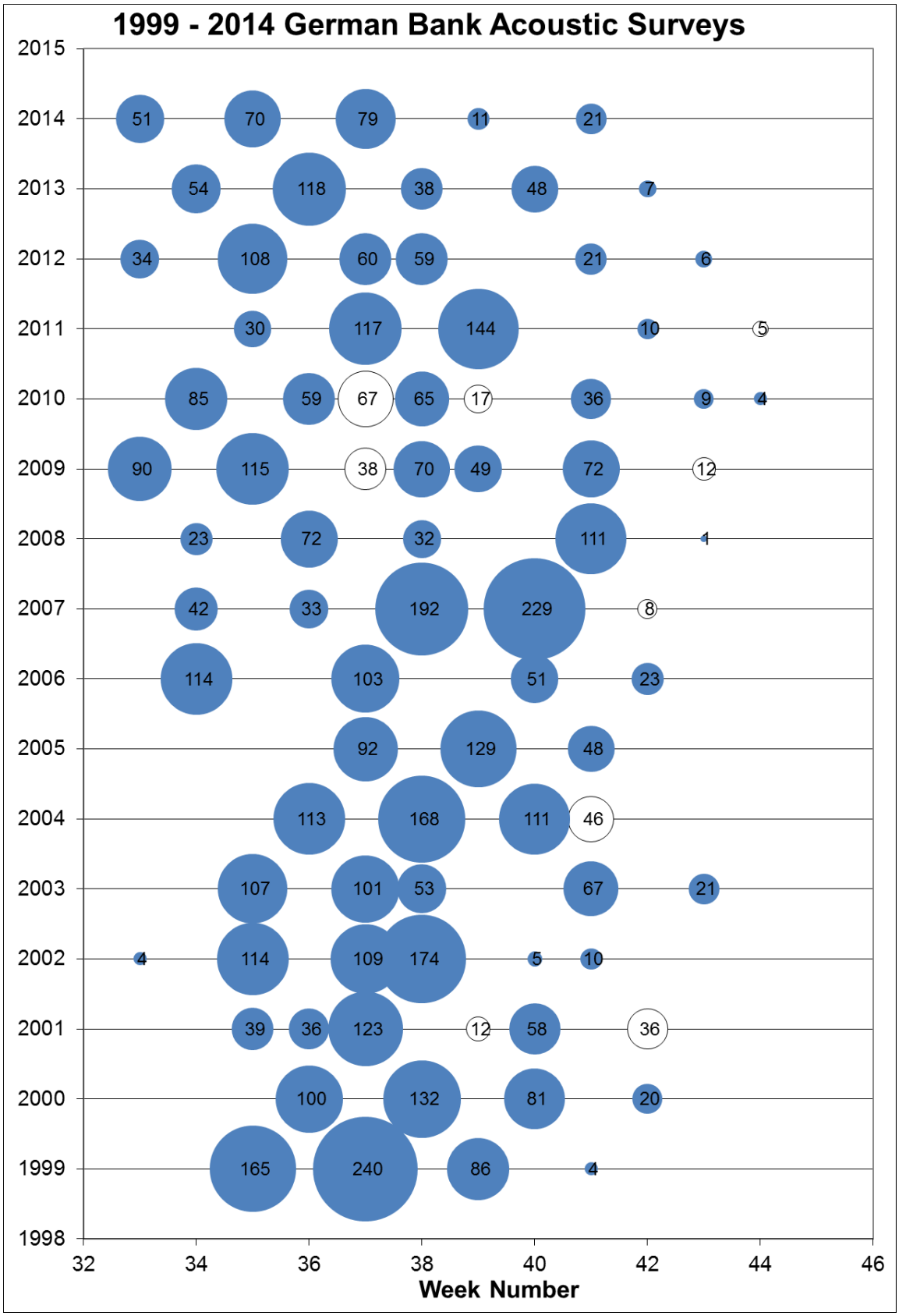

Figure 53. History of German Bank herring acoustic surveys from 1999-2014 by week number showing timing with bubble area representing biomass (in thousands) for each survey (calculated with CIF).

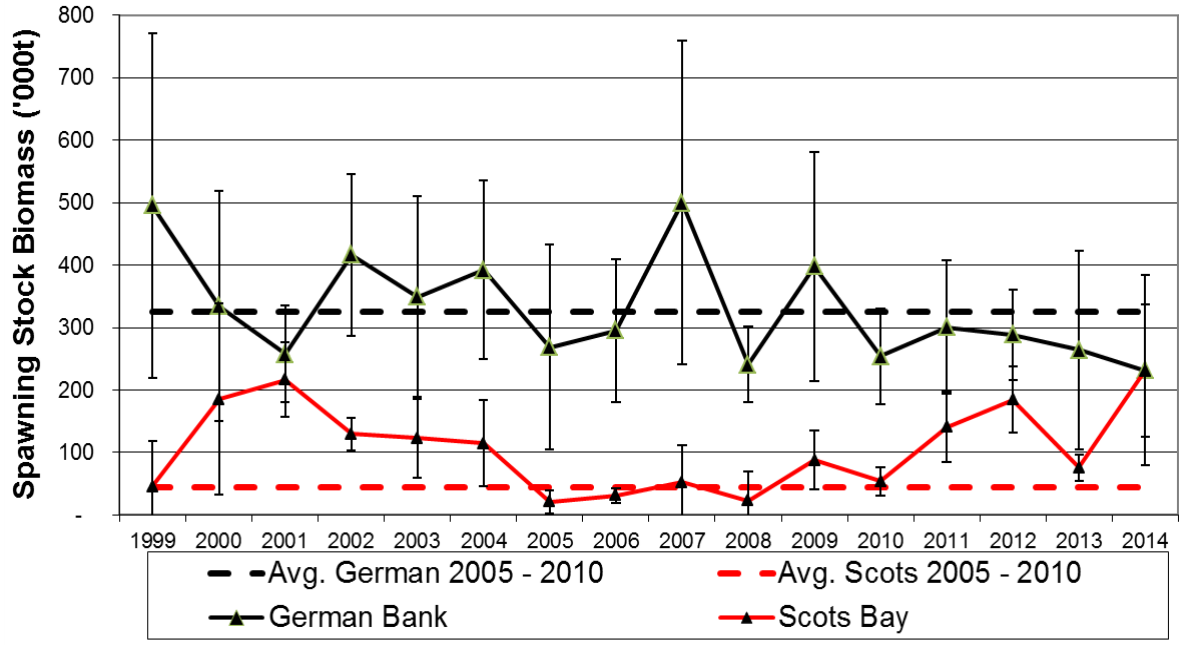

Figure 54. Trends in herring SSB from acoustic surveys areas with 95% confidence intervals in Scots Bay and German Bank areas in relation to the 2005-2010 average. All estimates calculated with CIF.

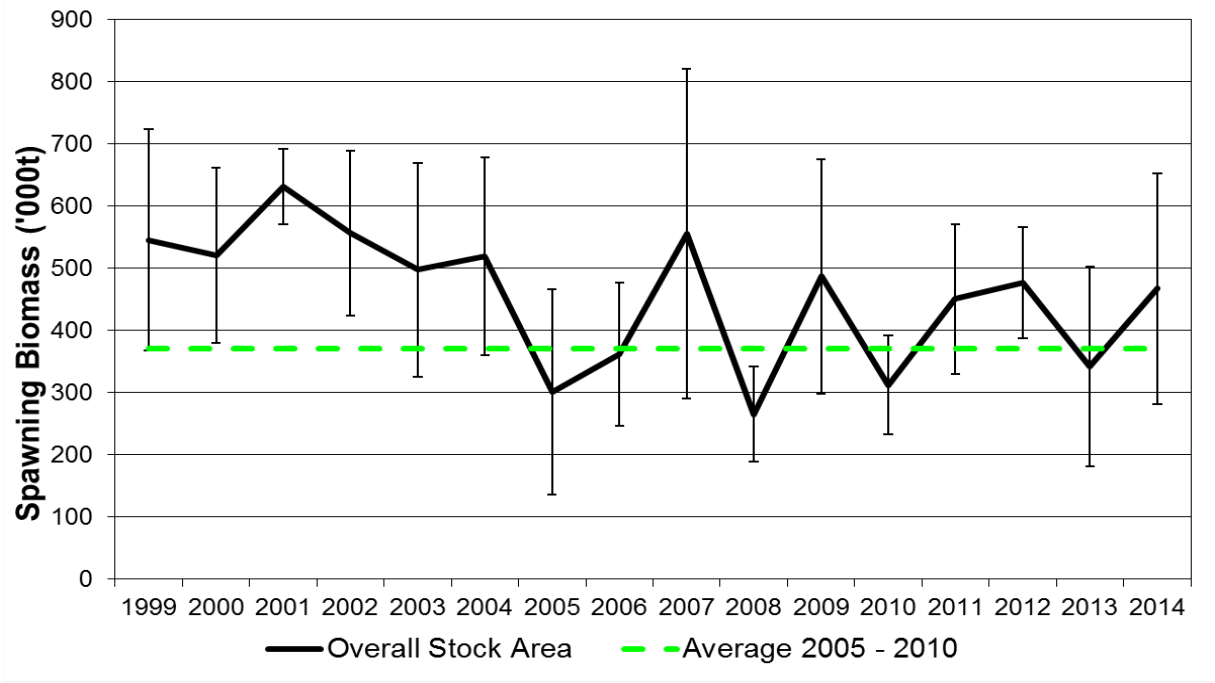

Figure 55. Herring SSB from acoustic surveys for the combined SWNS/BoF spawning component (along with the average from 2005-2010) with 95% confidence intervals (equivalent to two times SE). All estimates calculated with CIF.

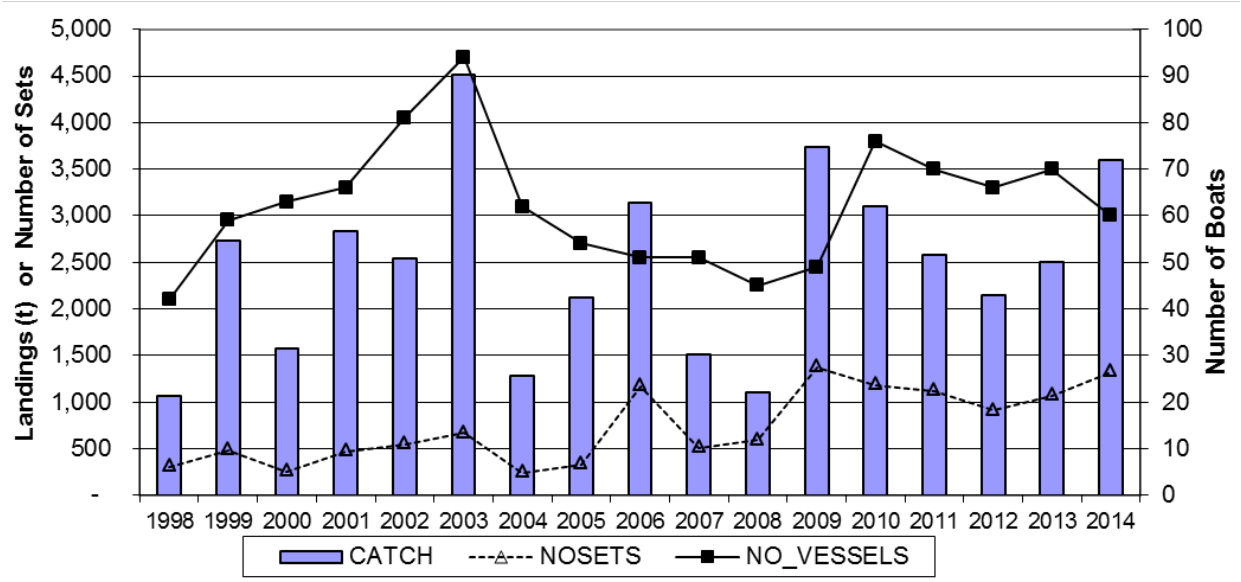

Figure 56. Herring gillnet total landings (t) and total effort in number of vessels and number of sets for the Little Hope/Port Mouton area for 1998-2014. Data for statistical districts 23, 25, 26-31 inclusive. Note overlap of district 26 with Liverpool area.

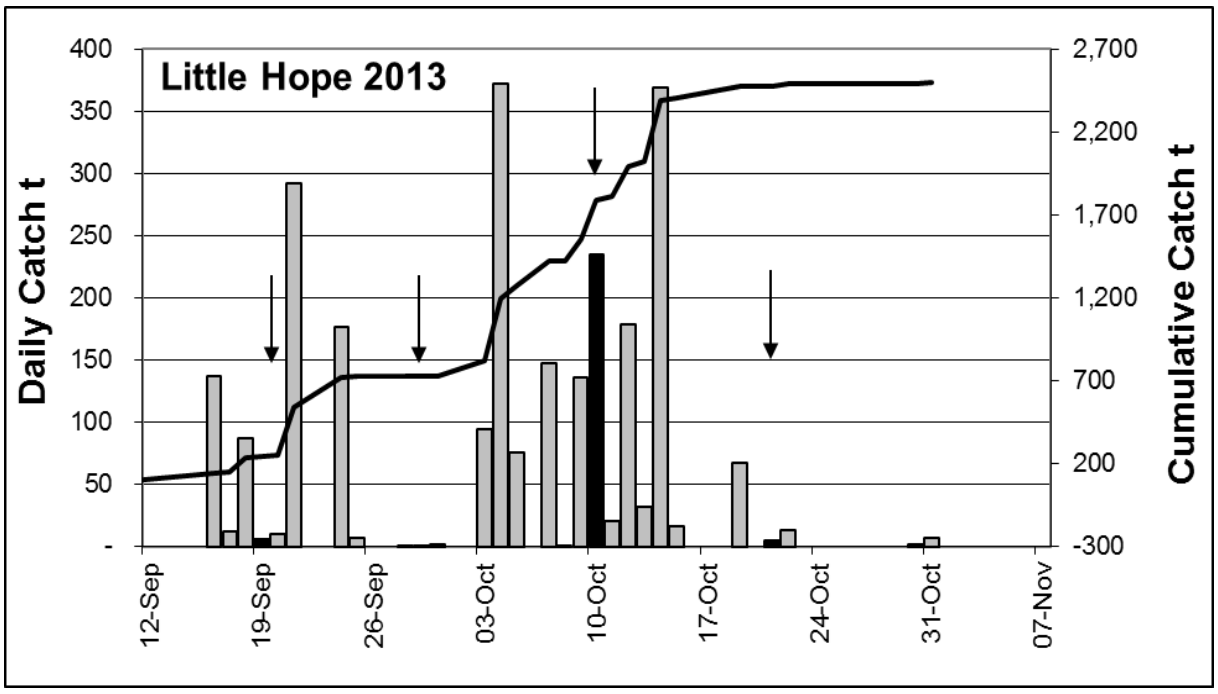

Figure 57A. Daily and cumulative catch for 2013 Little Hope/Port Mouton herring gillnet fishery. Survey dates are identified with arrows indicating survey timing.

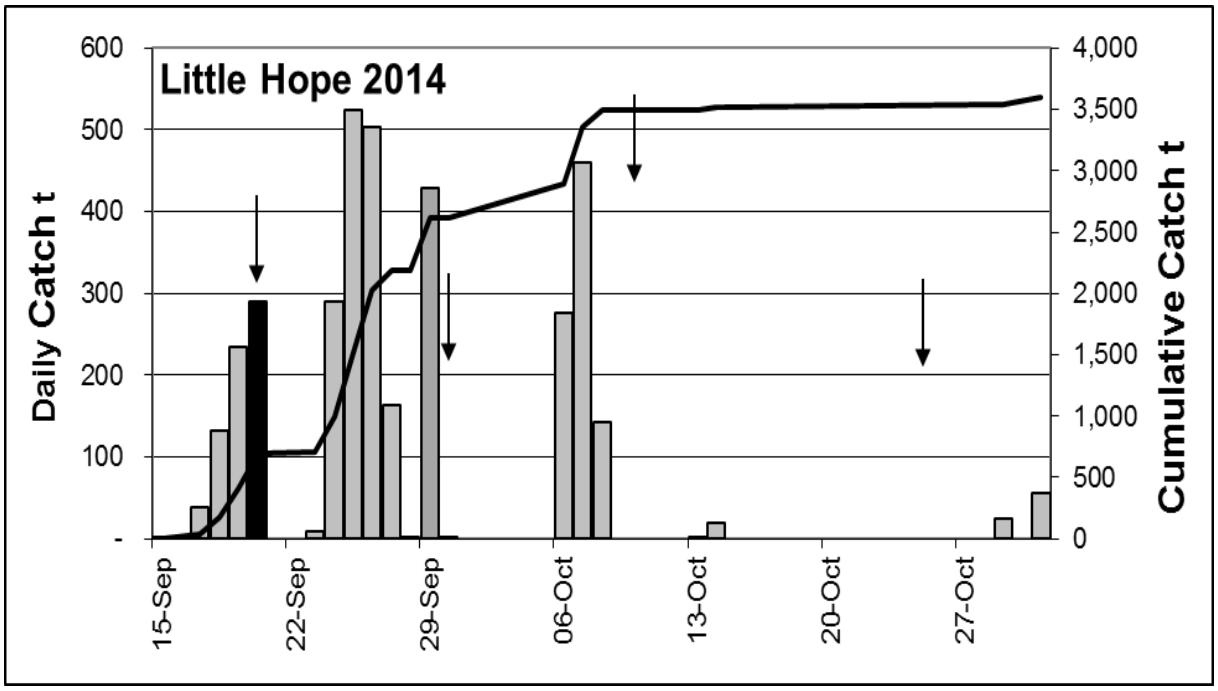

Figure 57B. Daily and cumulative catch for 2014 Little Hope/Port Mouton herring gillnet fishery. Survey dates are identified with arrows indicating survey timing.

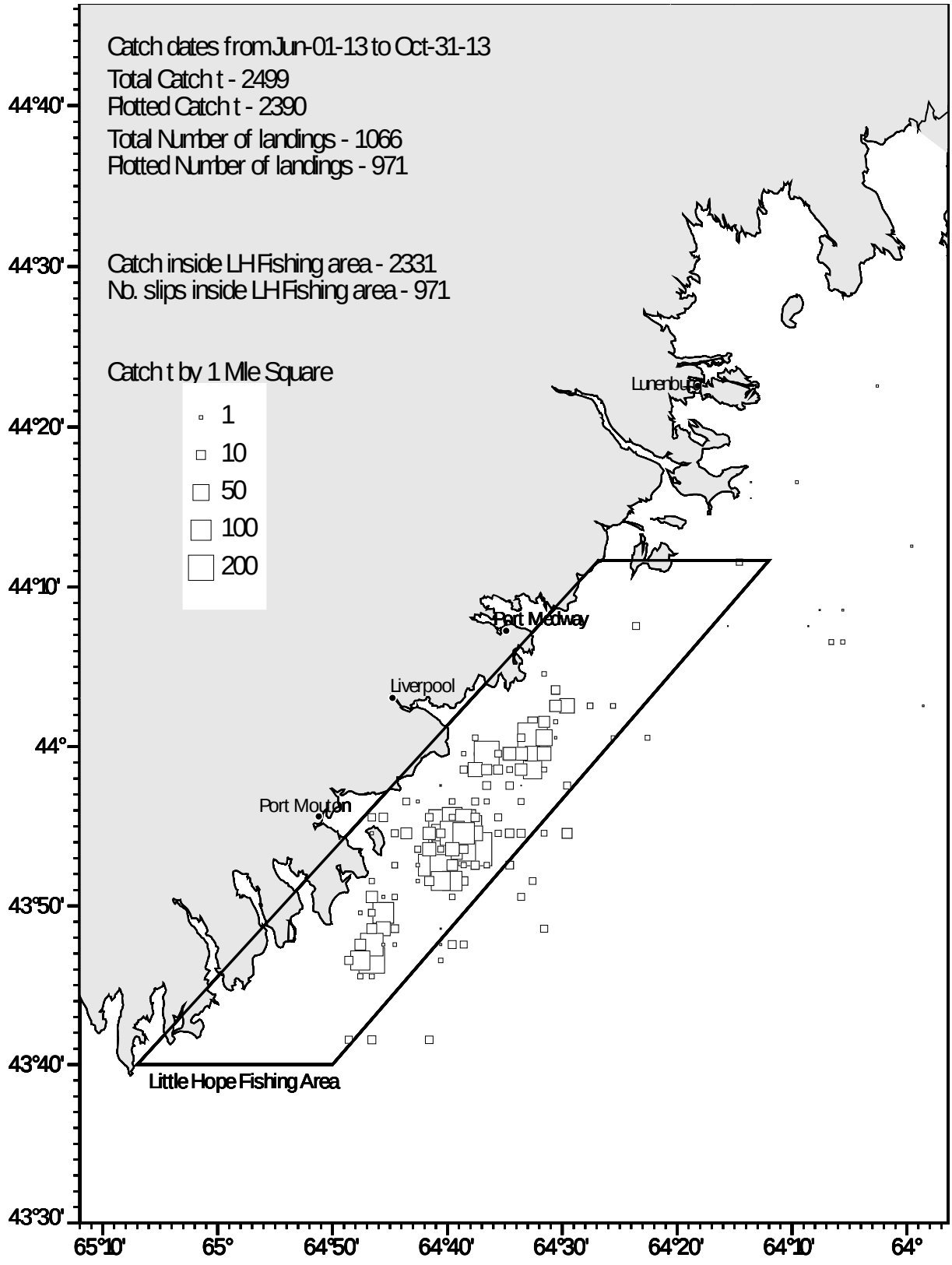

Figure 58A. Fishery herring gillnet catch distribution for the Little Hope/Port Mouton area for 2013.

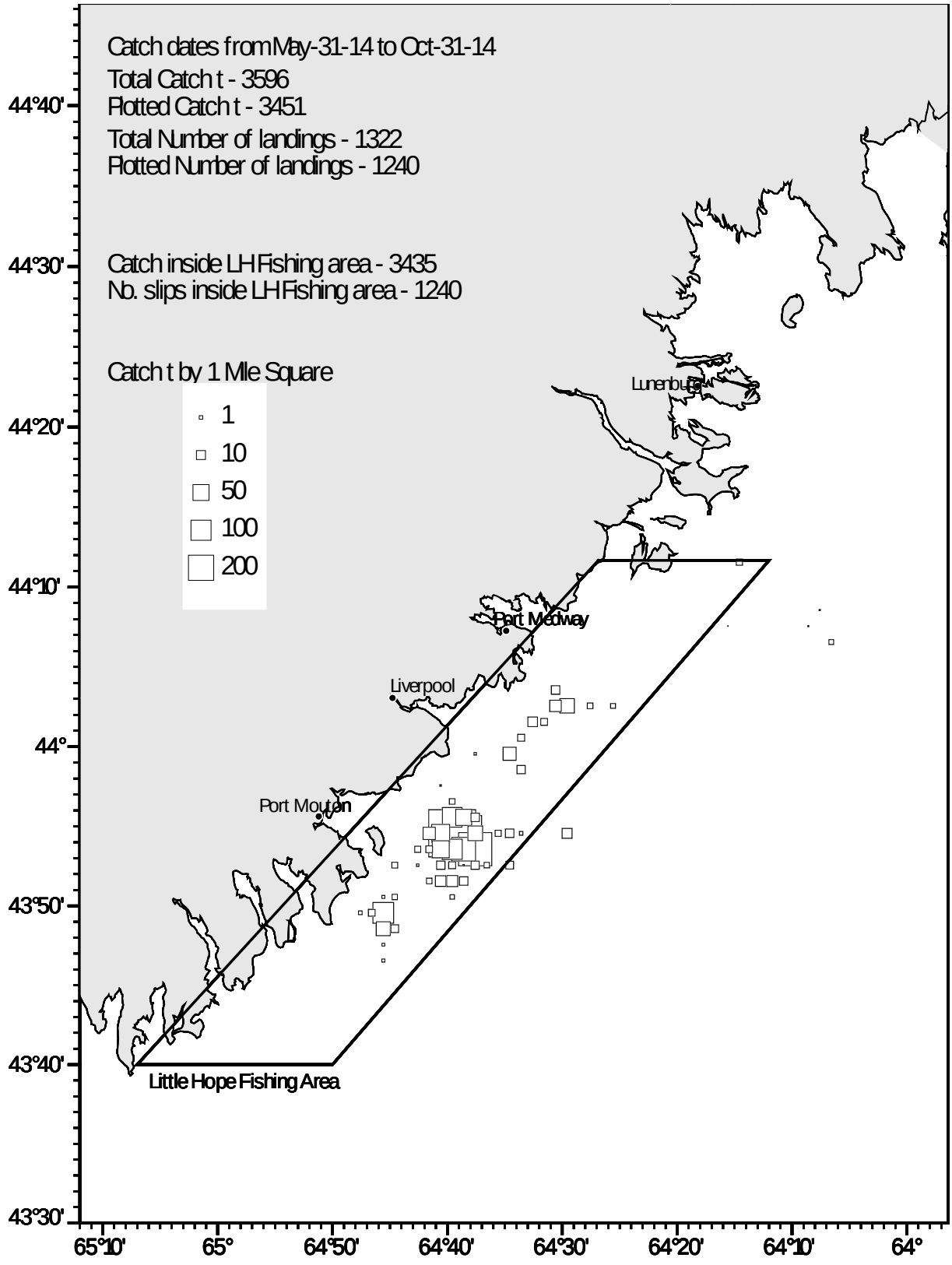

Figure 58B. Fishery herring gillnet catch distribution for the Little Hope/Port Mouton area for 2014.

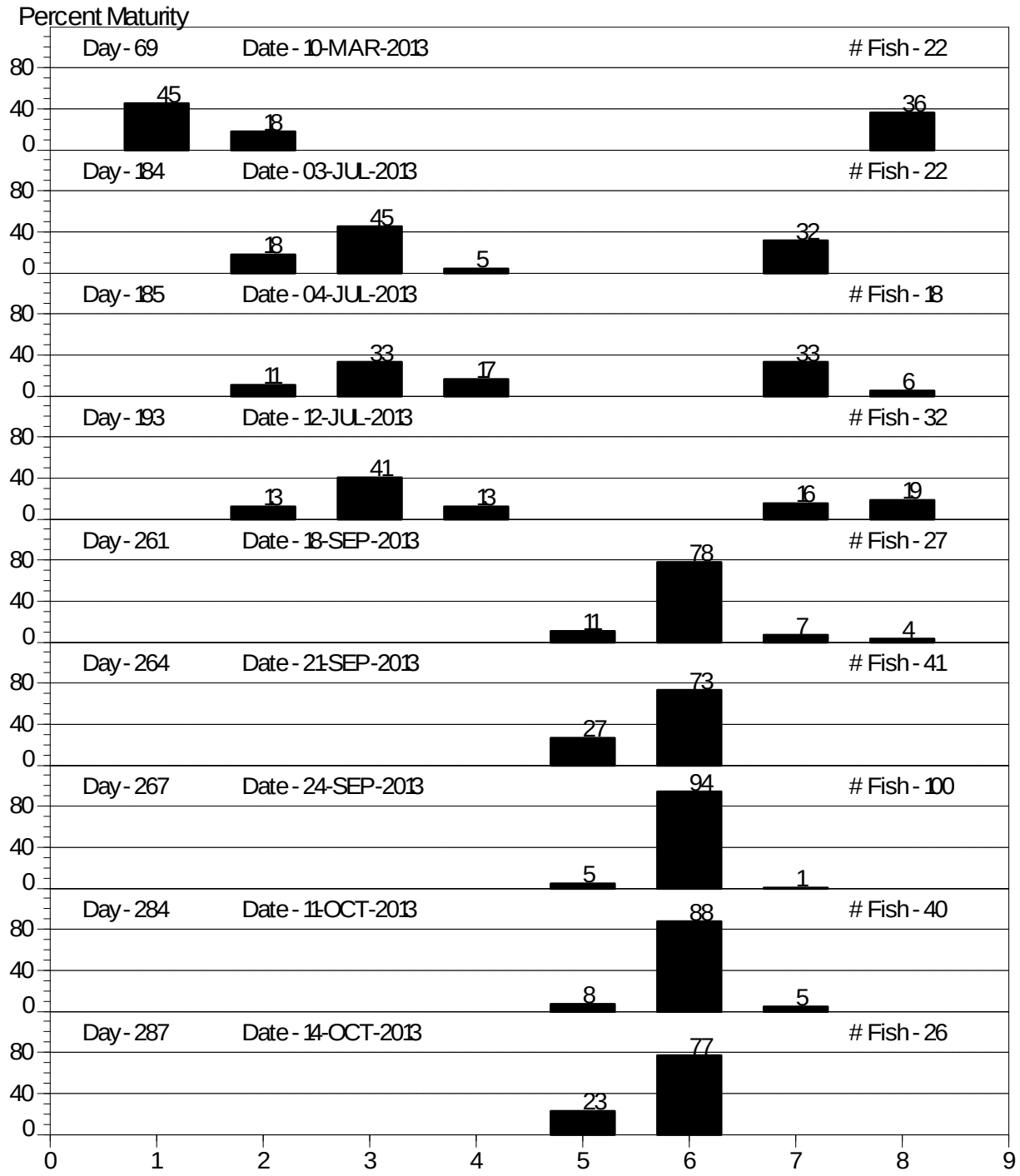

Figure 59A. Herring maturity samples collected from the Port Mouton/Little Hope area in 2013. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

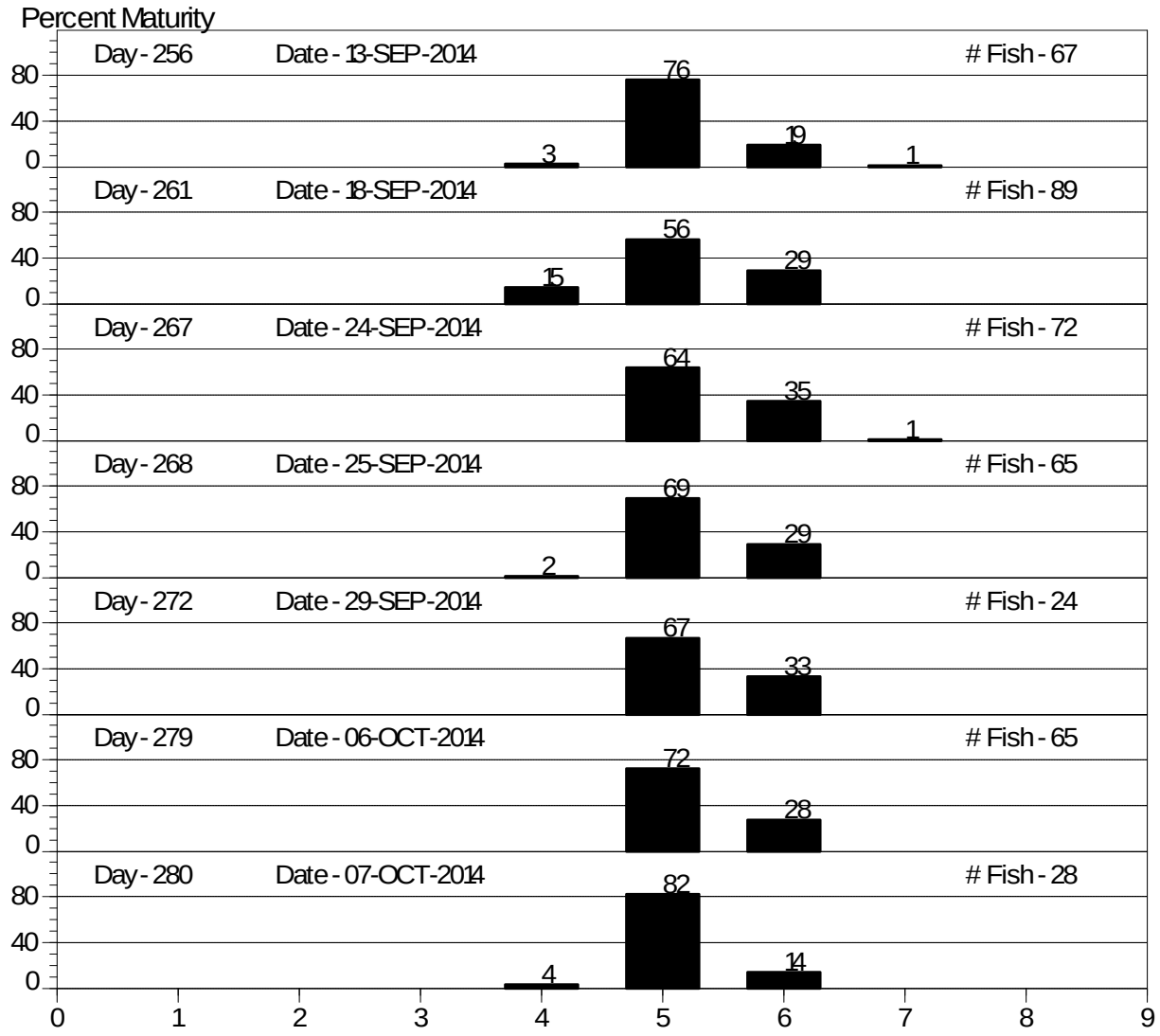

Figure 59B. Herring maturity samples collected from the Port Mouton/Little Hope area in 2014. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

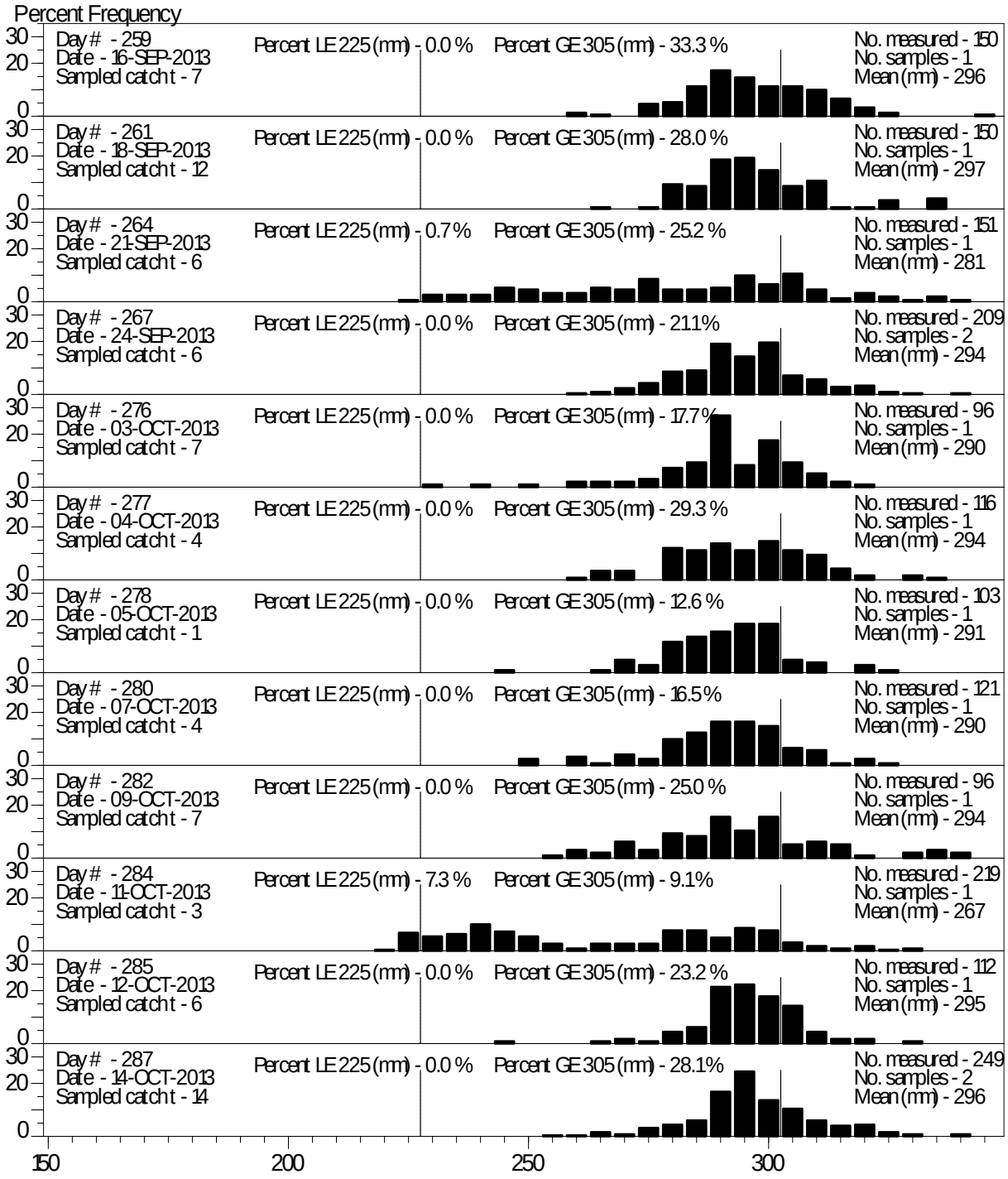

Figure 60A. Daily length frequency samples collected from the Port Mouton/Little Hope area between September 16 and October 14, 2013, with proportions <23cm and >30cm.

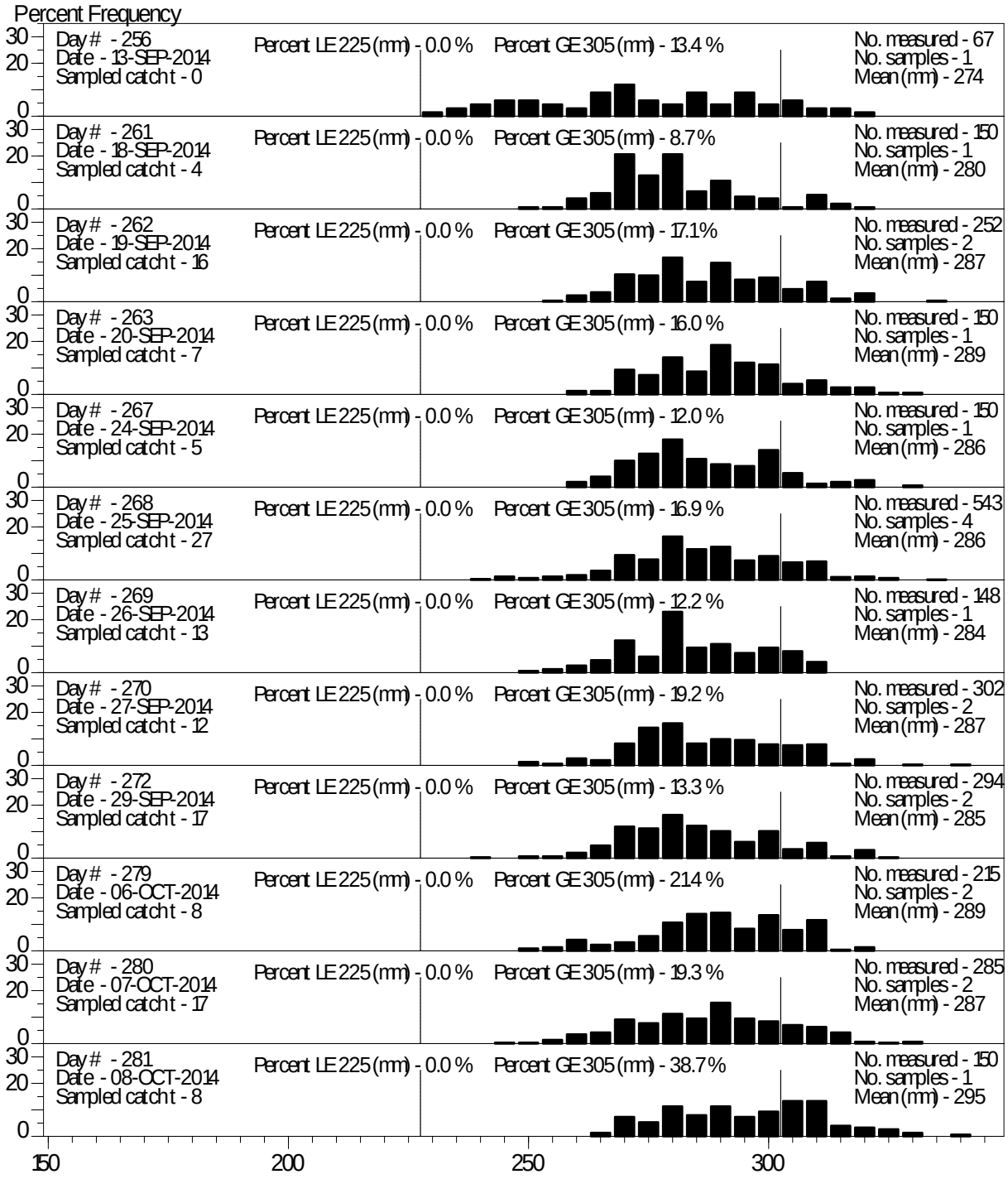

Figure 60B. Daily length frequency samples collected from the Port Mouton/Little Hope area between September 13 and October 8, 2014, with proportions <23cm and >30cm.

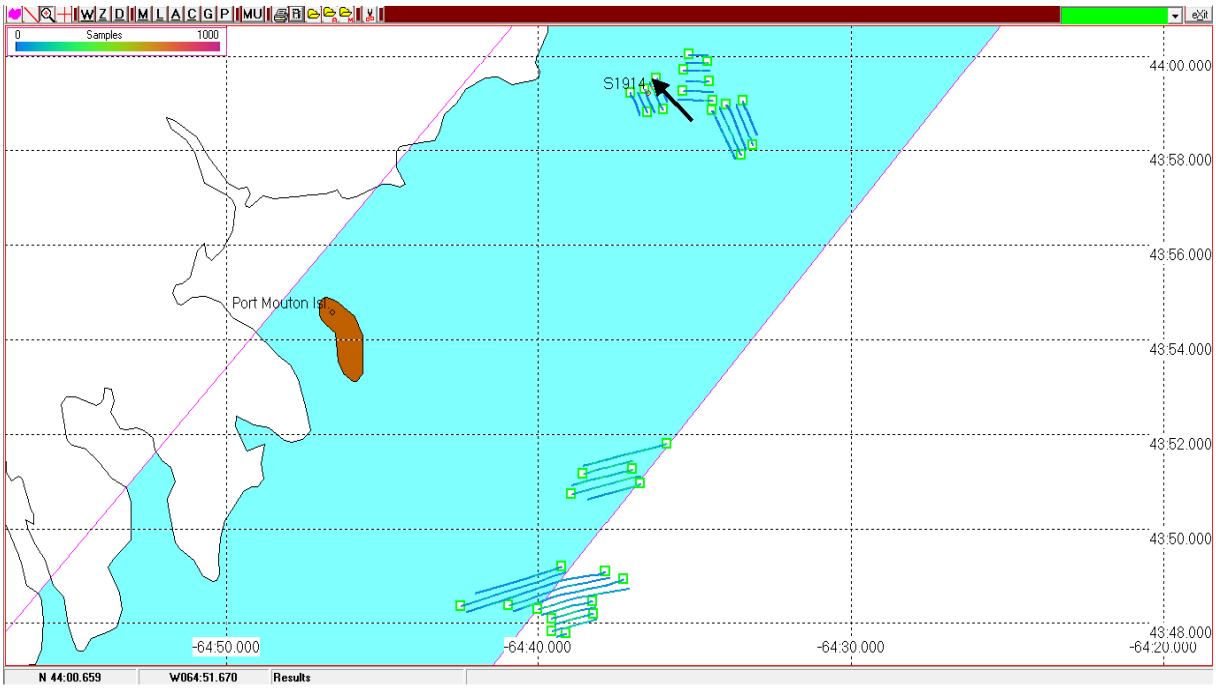

Figure 61A. Little Hope/Port Mouton acoustic survey (#1) on September 19, 2013, showing the main survey box (highlighted area), along with location (arrow) of multi-panel herring gillnet sample collected September 21, 2013.

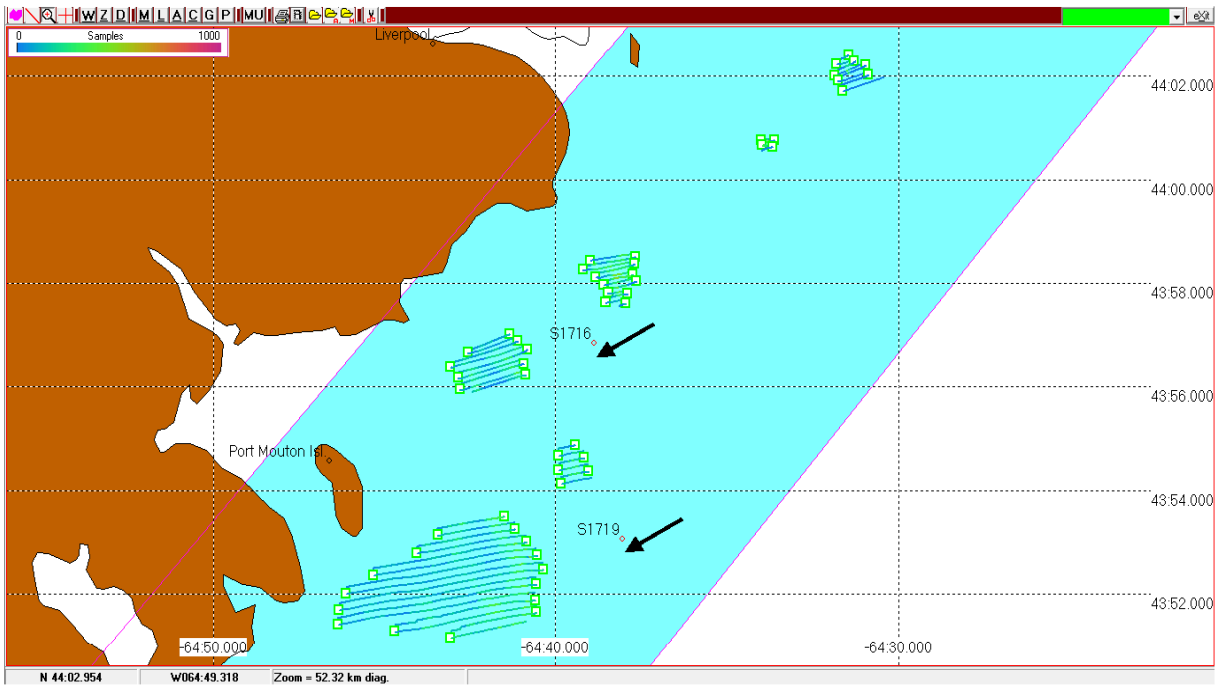

Figure 61B. Little Hope/Port Mouton acoustic survey (#1) on September 20, 2014, showing the main survey box (highlighted area), along with location (arrow) of two multi-panel herring gillnet samples collected on September 13 and September 25, 2014.

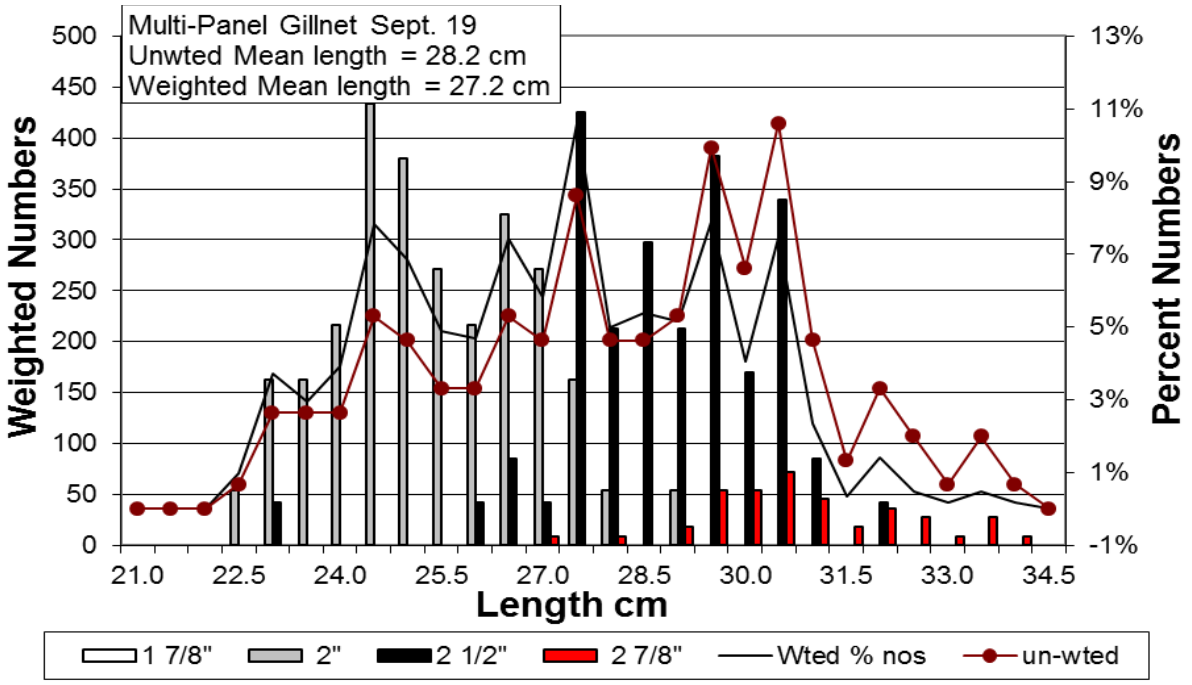

Figure 62A. Multi-panel herring gillnet sample collected on September 21, 2013 for the Little Hope herring acoustic survey (#1 & 2) on September 19 and 29, 2013.

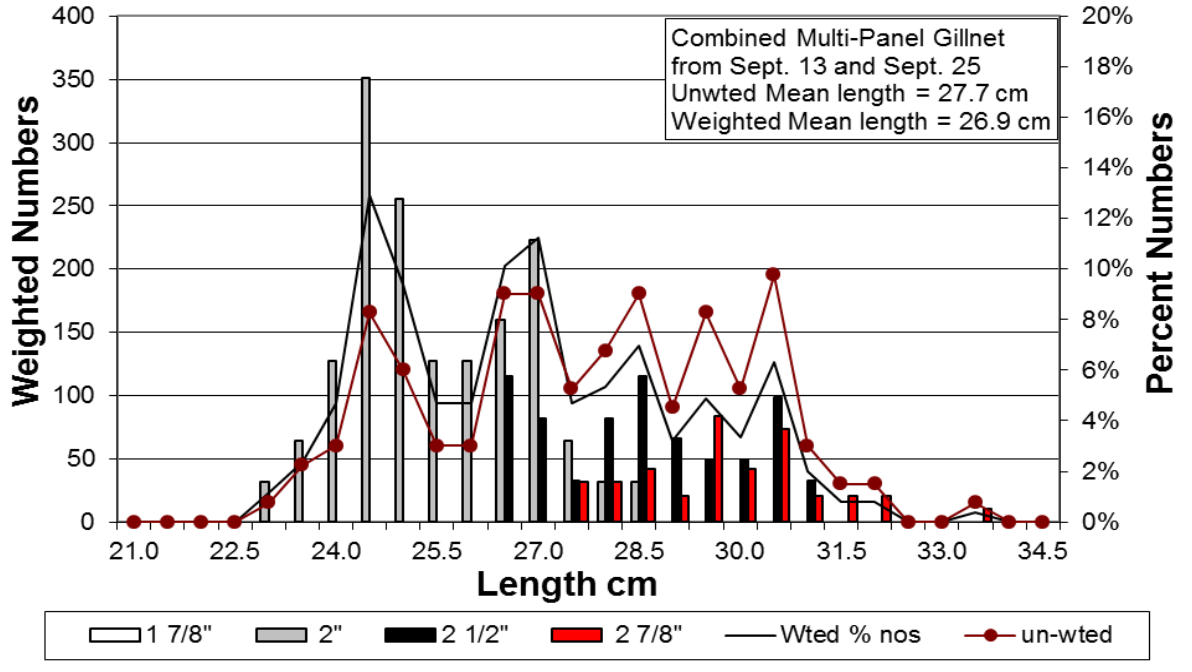

Figure 62B. Combined multi-panel herring gillnet sample collected on September 13 and September 25, for the Little Hope herring acoustic survey (#1) on September 20, 2014.

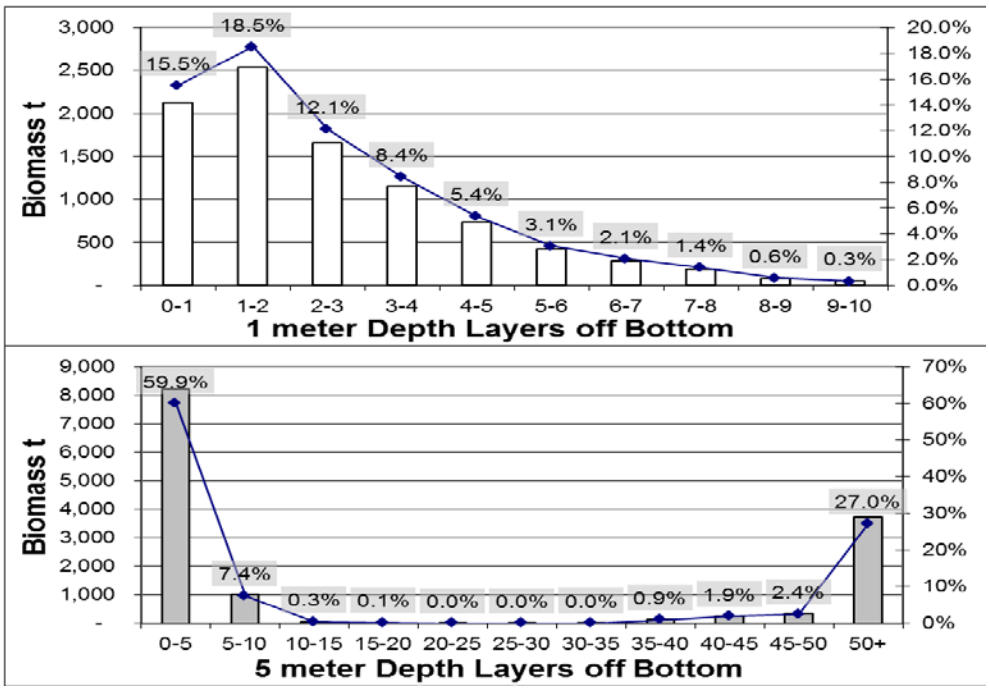

Figure 63A. Distribution of biomass by depth layer from bottom for the Little Hope acoustic survey (#1) on September 19, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

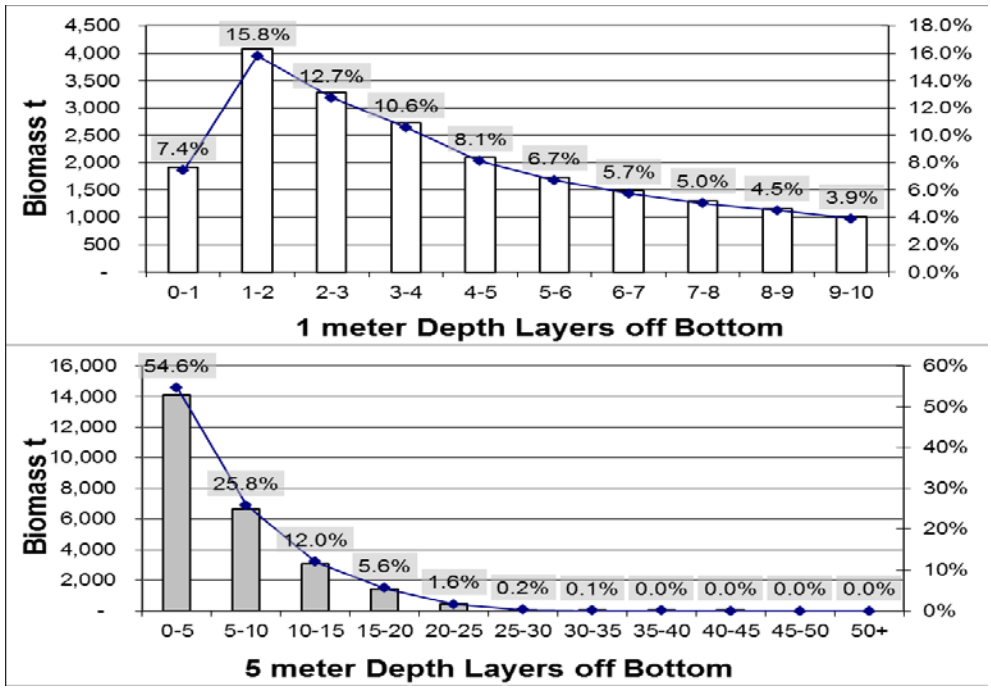

Figure 63B. Distribution of biomass by depth layer from bottom for the Little Hope acoustic survey (#1) on September 20, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

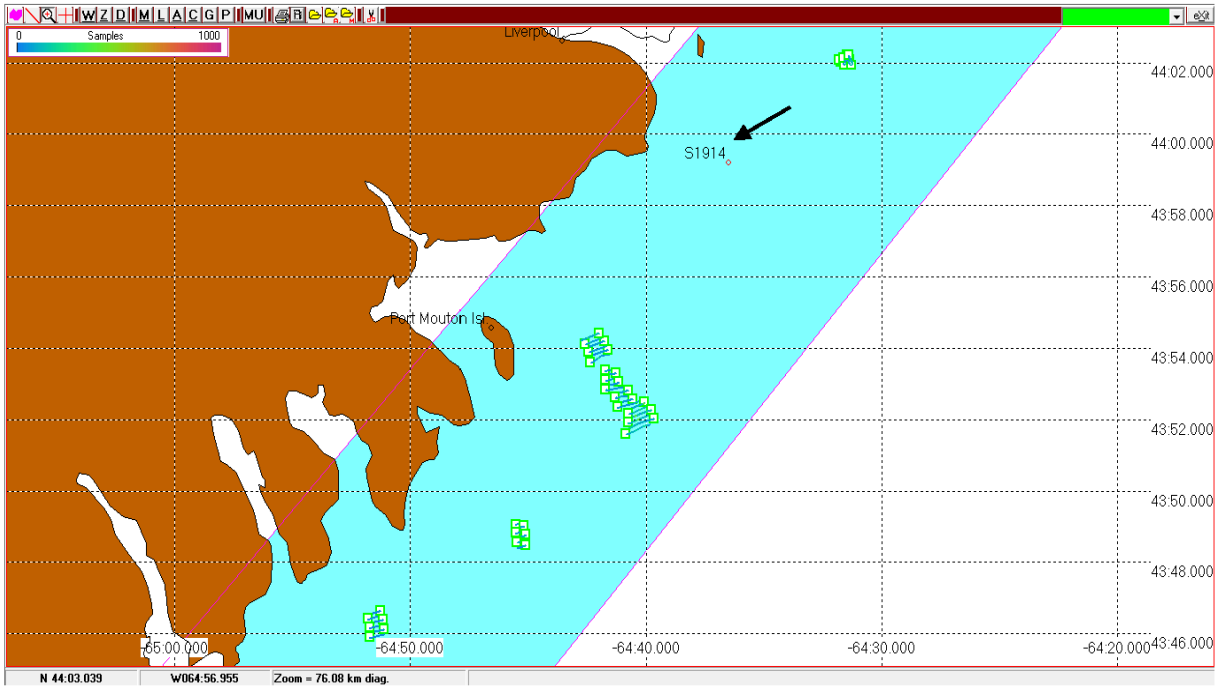

Figure 64A. Little Hope/Port Mouton acoustic survey (#2) on September 29, 2013, showing the main survey box (highlighted area), along with location (arrow) of multi-panel sample collected September 21, 2013.

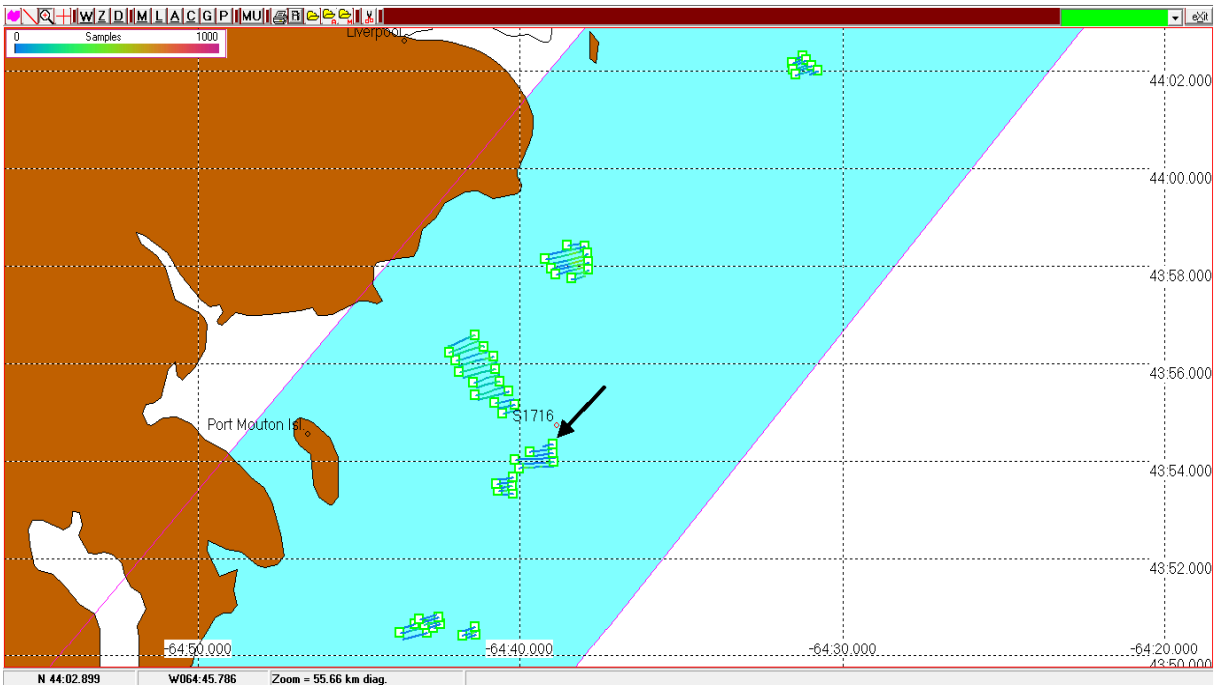

Figure 64B. Little Hope/Port Mouton acoustic survey (#2) on September 30, 2014, showing the main survey box (highlighted area), along with location (arrow) of multi-panel sample collected September 25, 2014.

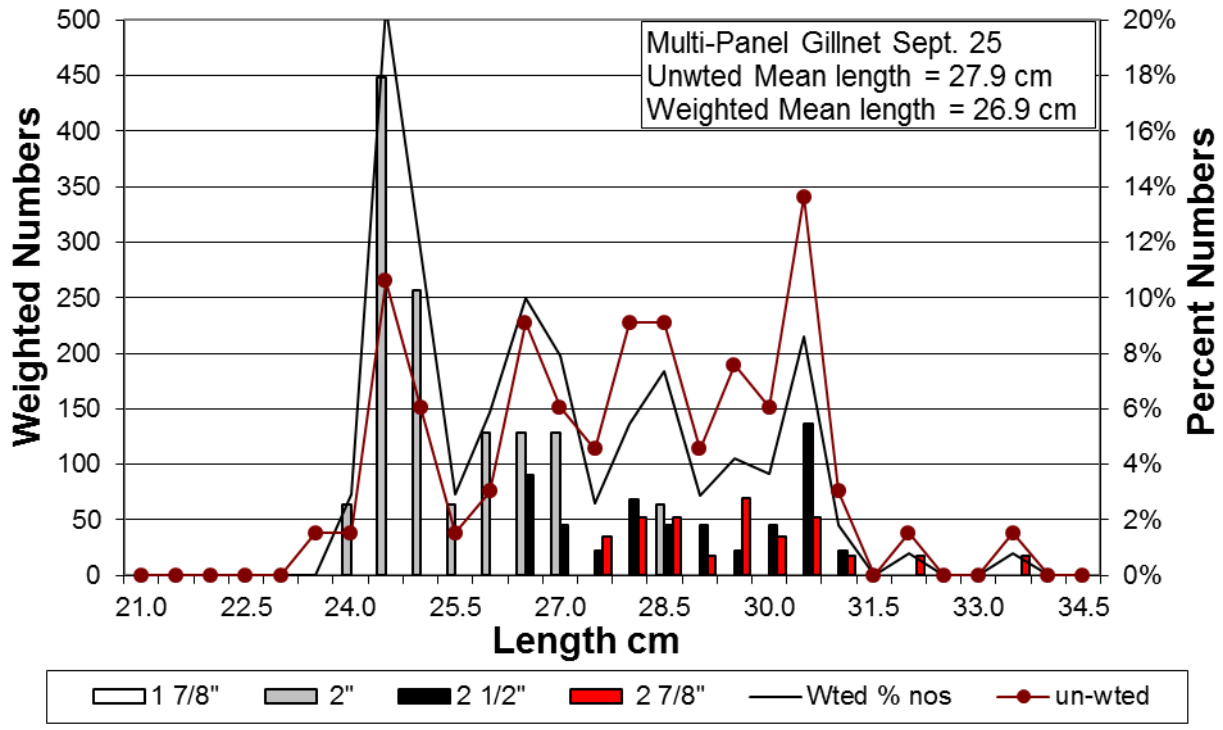

Figure 65. Multi-panel herring gillnet sample collected on September 25, 2014 for the Little Hope herring acoustic survey (#2) on September 30, 2014.

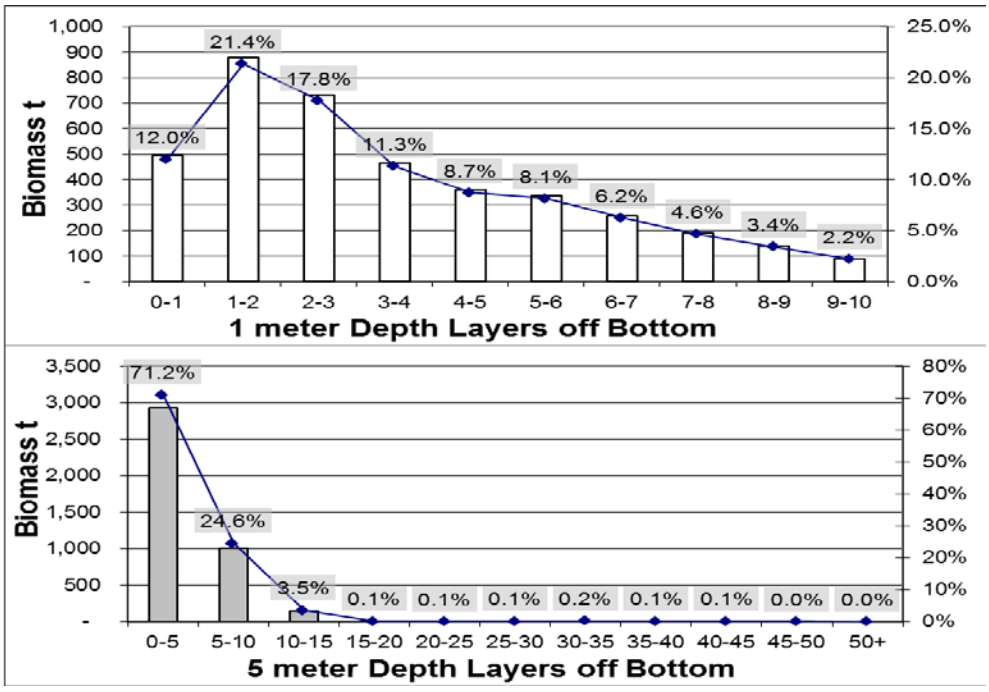

Figure 66A. Distribution of biomass by depth layer from bottom for the Little Hope acoustic survey (#2) on September 29, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

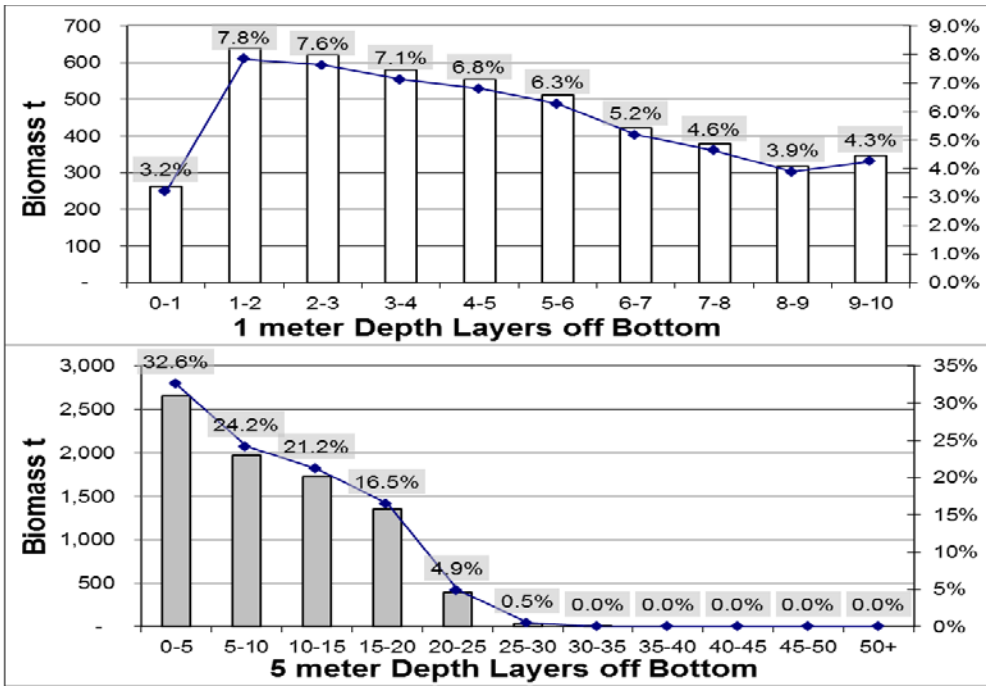

Figure 66B. Distribution of biomass by depth layer from bottom for the Little Hope acoustic survey (#2) on September 30, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

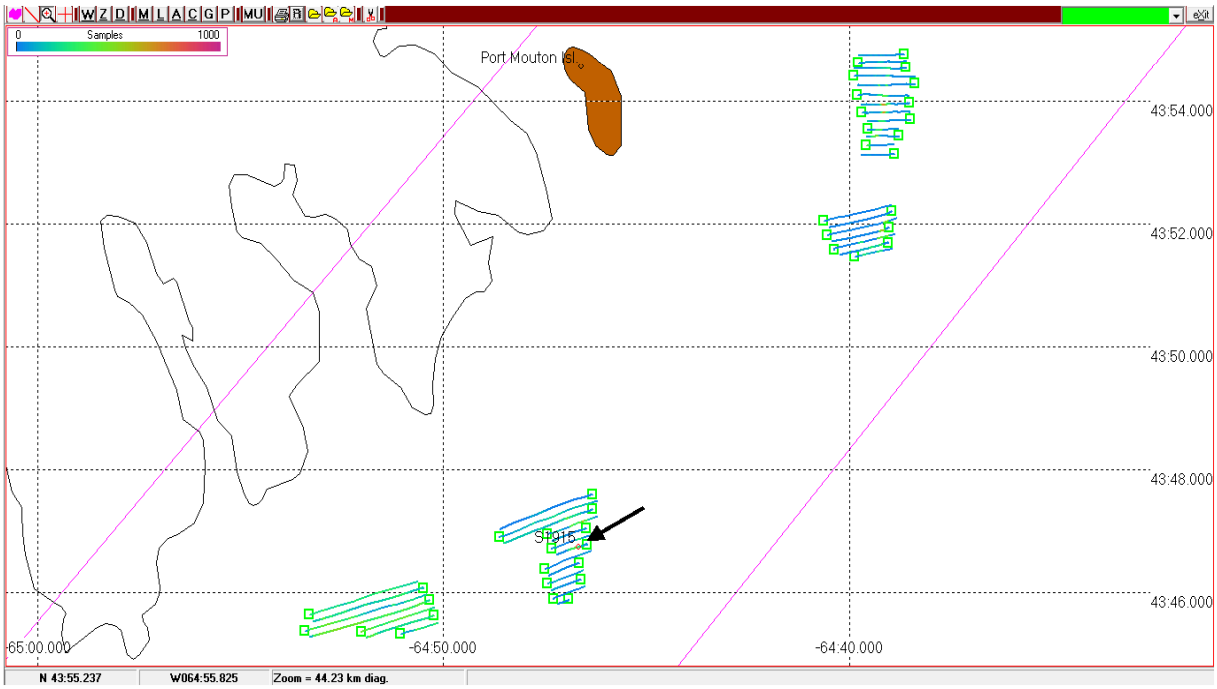

Figure 67A. Little Hope/Port Mouton acoustic survey (#3) on October 10, 2013, showing the main survey box (highlighted area), along with location (arrow) of multi-panel sample collected October 11, 2013.

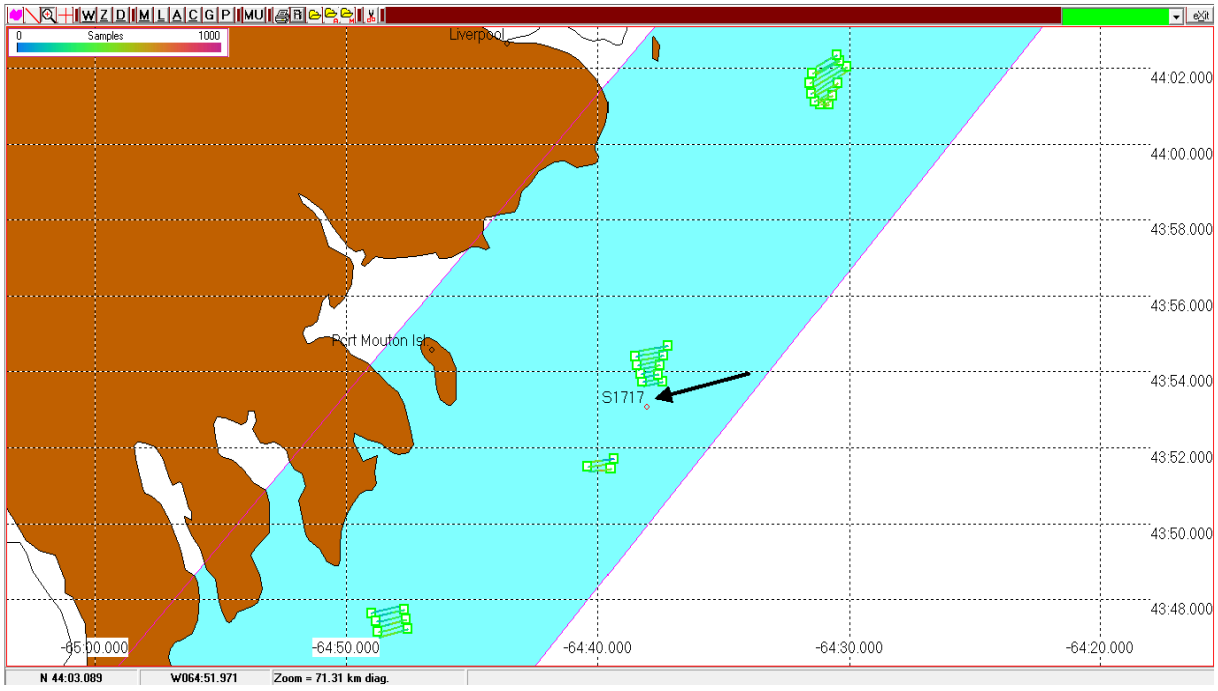

Figure 67B. Little Hope/Port Mouton acoustic survey (#3) on October 11, 2014, showing the main survey box (highlighted area), along with location of multi-panel sample collected October 11, 2014.

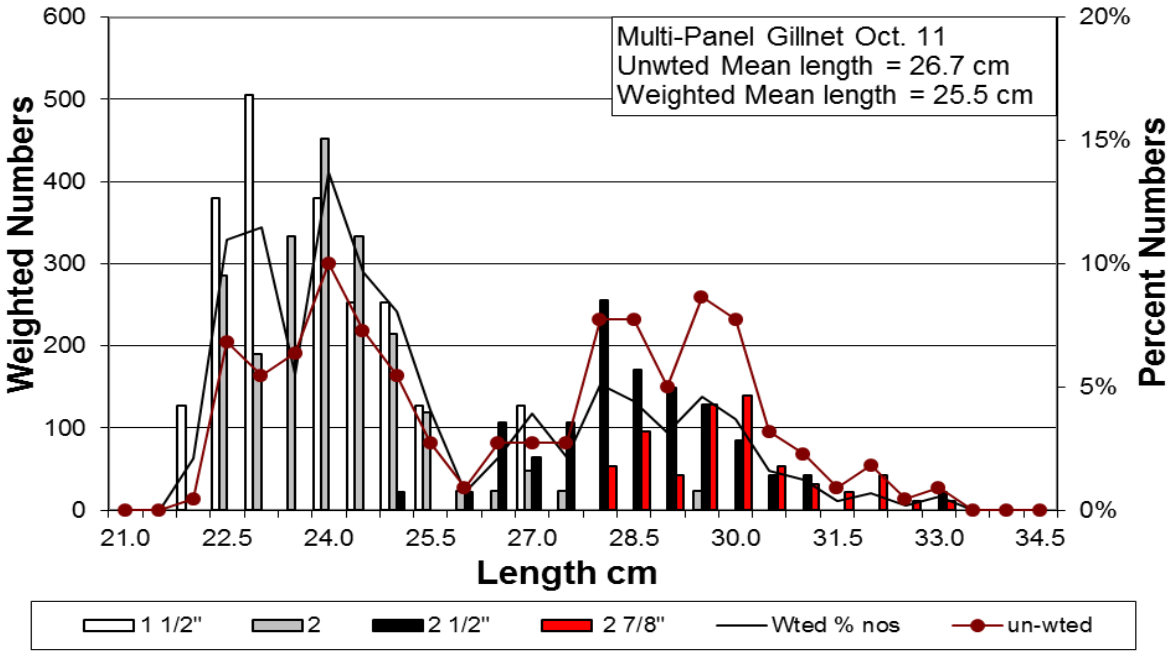

Figure 68A. Multi-panel herring gillnet sample collected October 11, 2013 for the Little Hope herring acoustic survey (#3 & 4) on October 10 and 21, 2013.

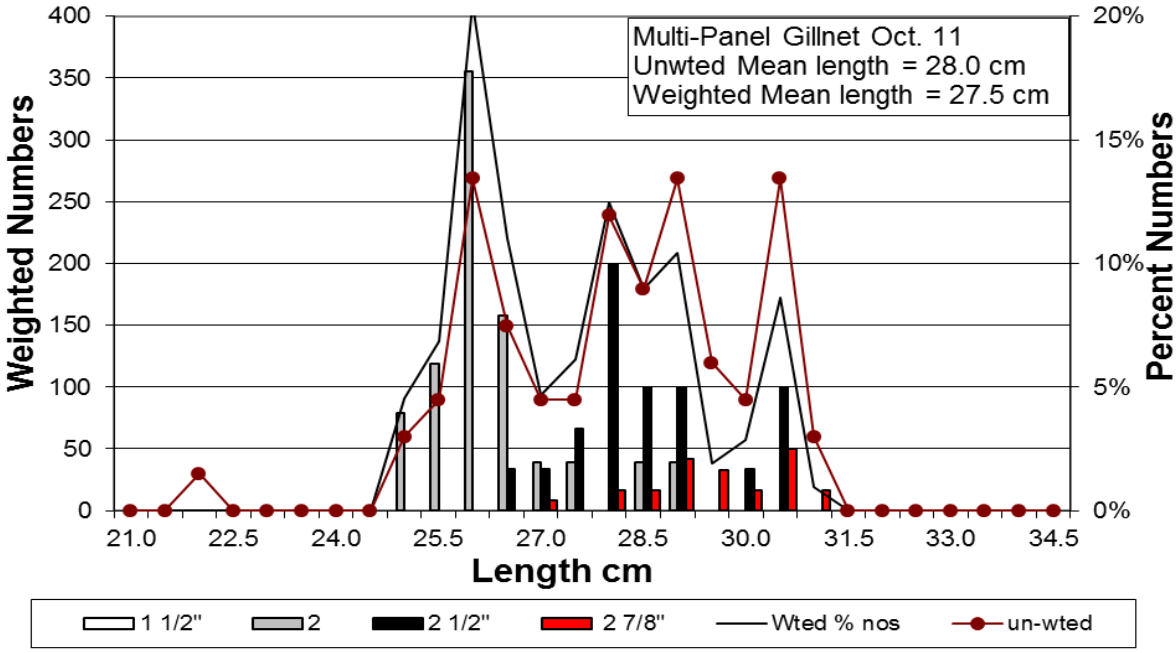

Figure 68B. Multi-panel herring gillnet sample collected October 11, 2014 for the Little Hope herring acoustic survey (#3 & 4) on October 11 and 25, 2014.

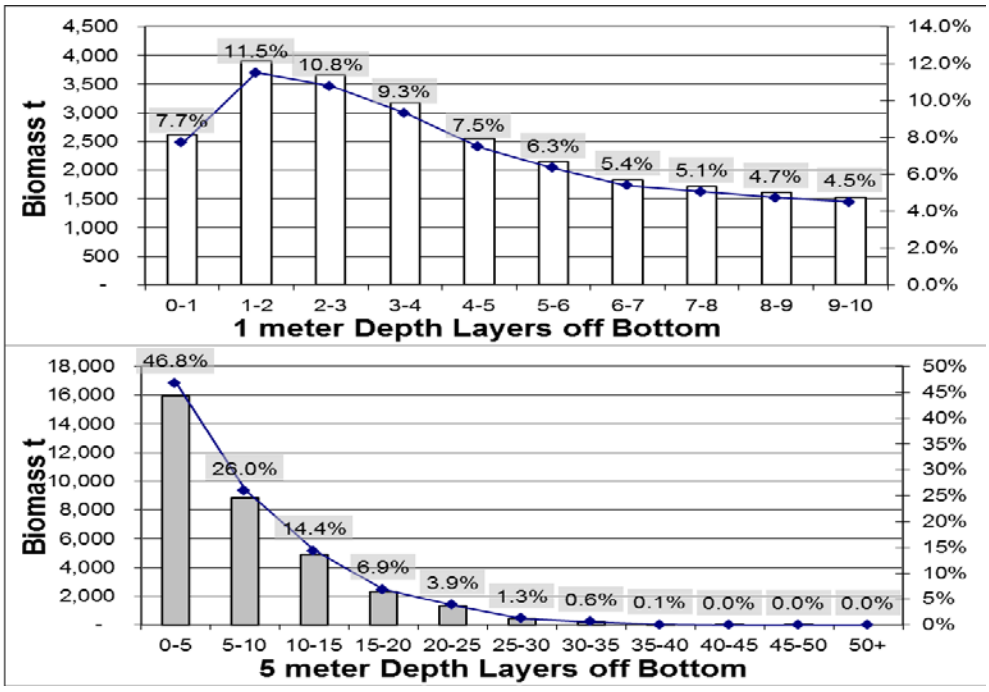

Figure 69A. Distribution of biomass by depth layer from bottom for the Little Hope acoustic survey (#3) on October 10, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

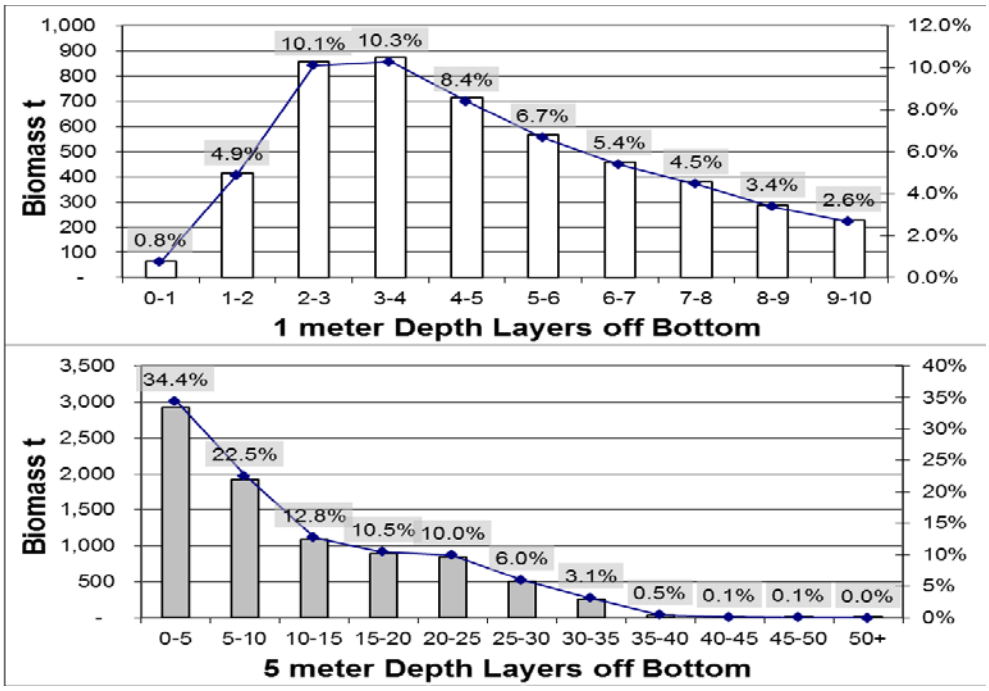

Figure 69B. Distribution of biomass by depth layer from bottom for the Little Hope acoustic survey (#3) on October 11, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

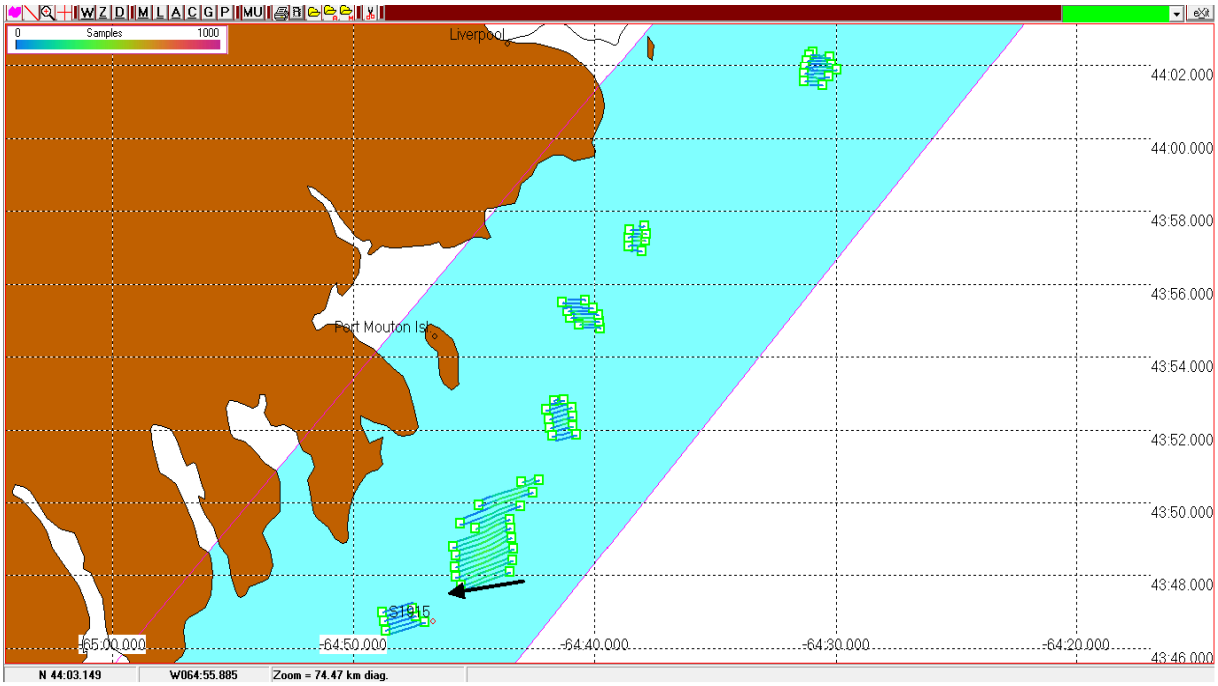

Figure 70A. Little Hope/Port Mouton acoustic survey (#4) on October 21, 2013, showing the main survey box (highlighted area), along with location (arrow) of multi-panel sample collected October 11, 2013.

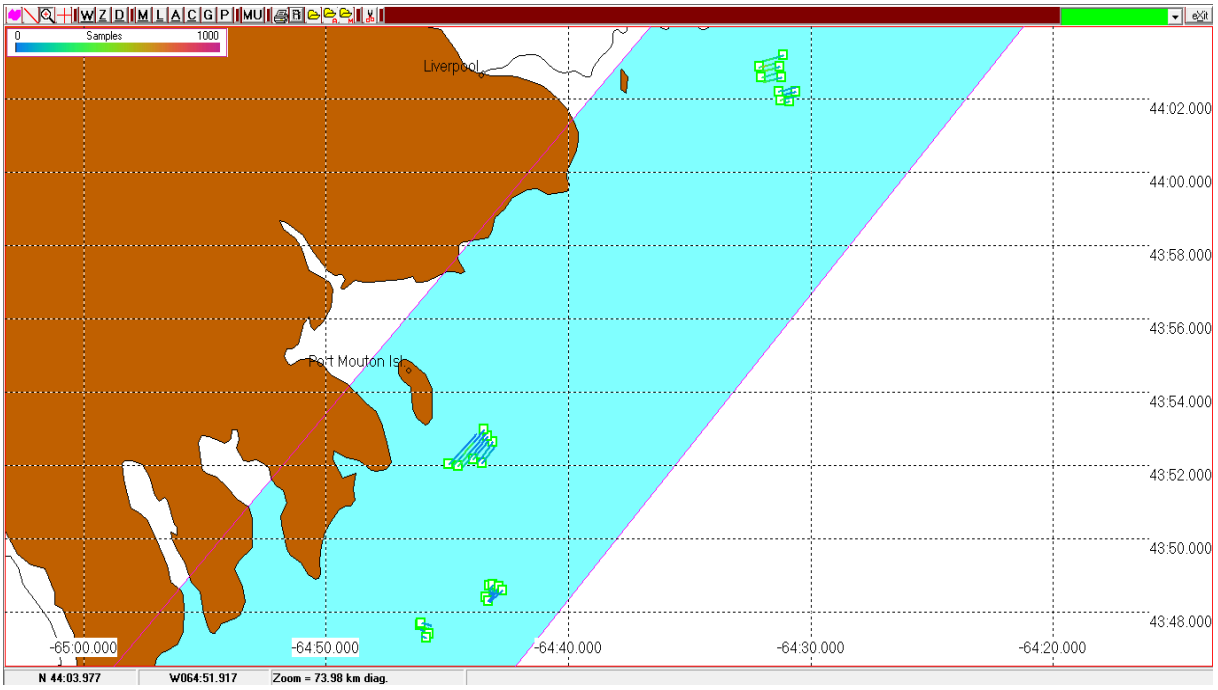

Figure 70B. Little Hope/Port Mouton acoustic survey (#4) on October 25, 2014, showing the main survey box (highlighted area). No samples were available. Standard TS used.

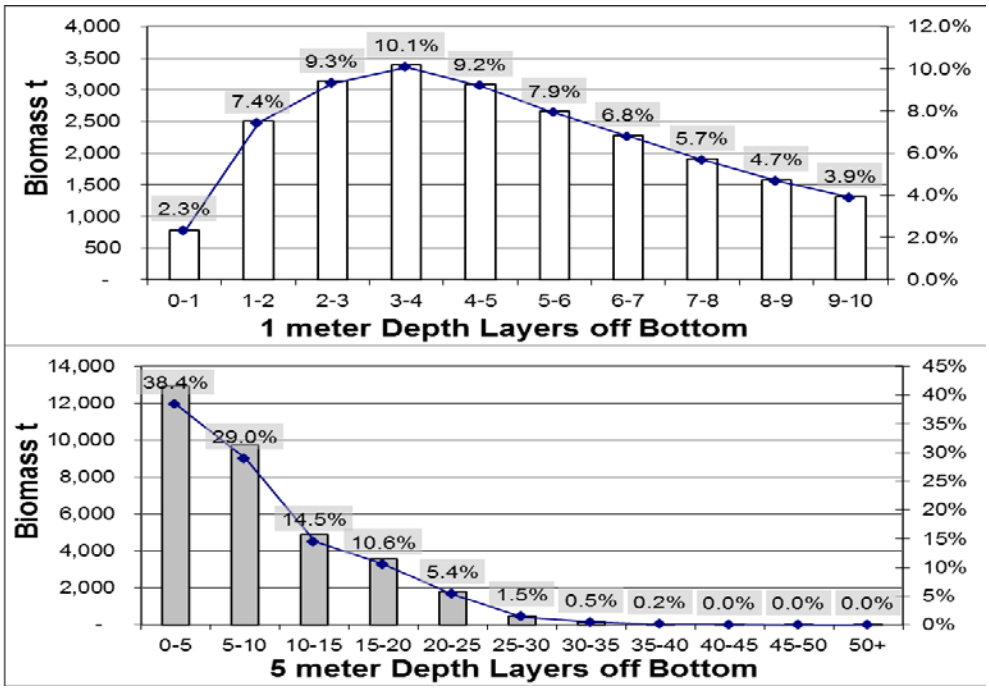

Figure 71A. Distribution of biomass by depth layer from bottom for the Little Hope acoustic survey (#4) on October 21, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

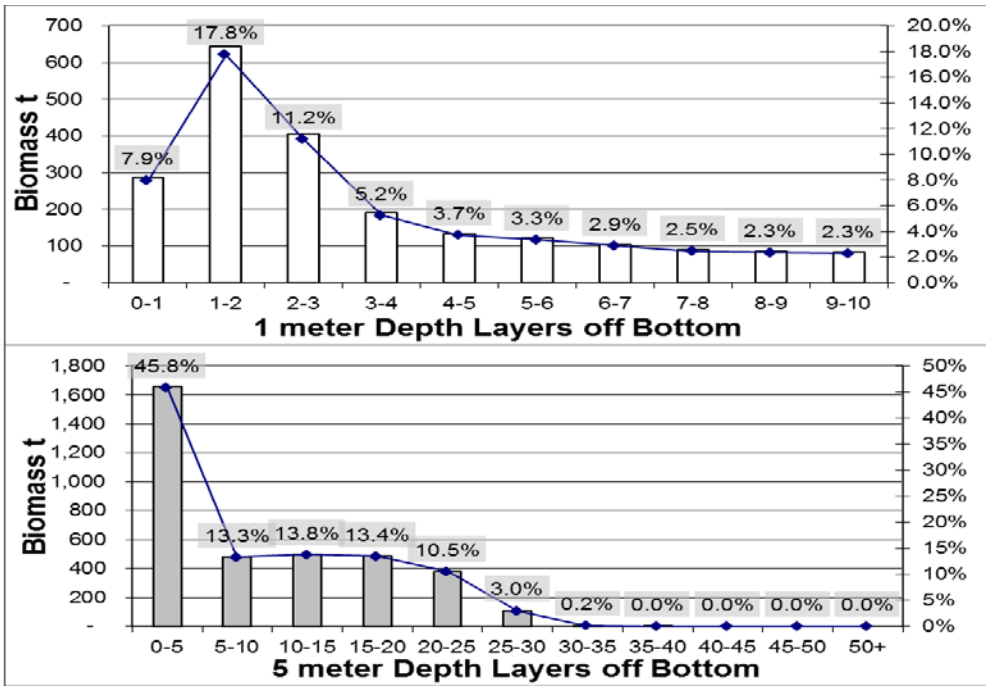

Figure 71B. Distribution of biomass by depth layer from bottom for the Little Hope acoustic survey (#4) on October 25, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

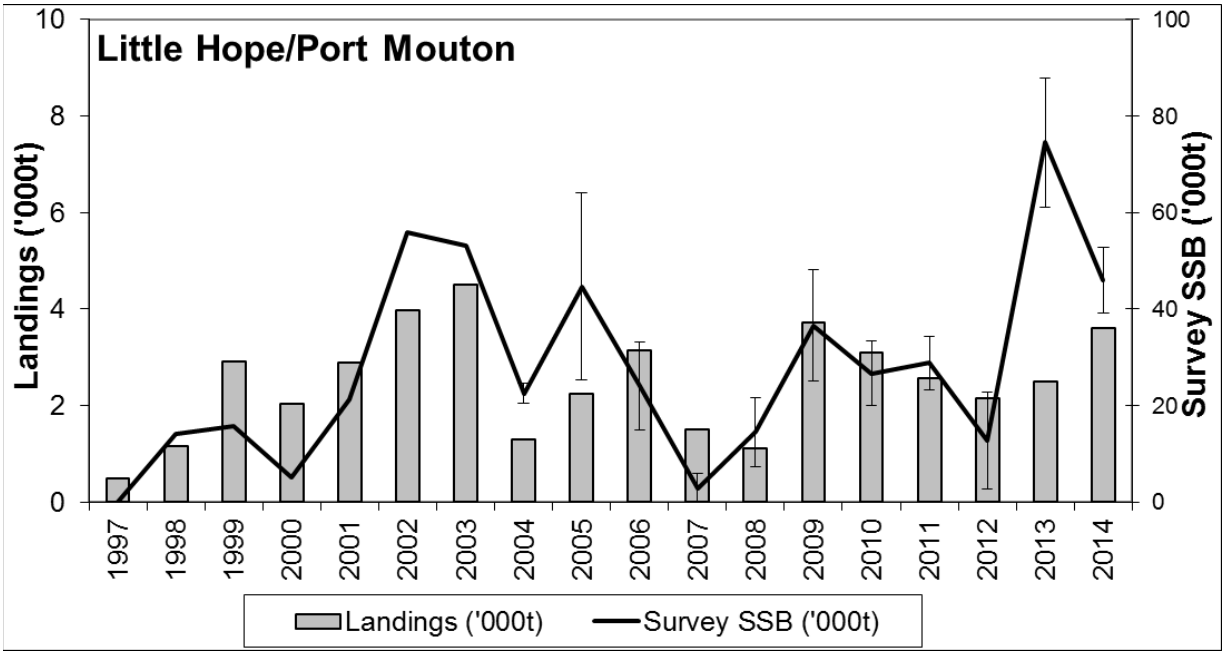

Figure 72. Herring landings and acoustic SSB ('000t) with 95% C.I. for the Little Hope/Port Mouton gillnet fishery from 1997-2014. No C.I. could be calculated for years prior to 2004.

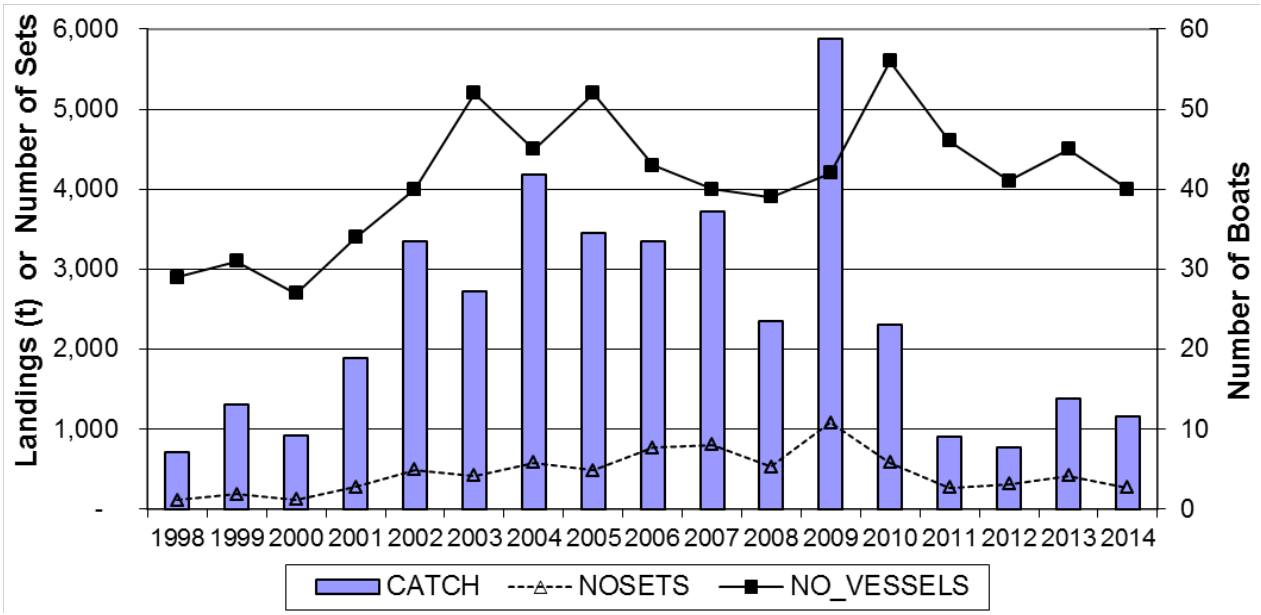

Figure 73. Herring gillnet total landings and total effort in number of vessels and number of sets for the Halifax/Eastern Shore area for 1998-2014. Data for statistical districts 18-21 inclusive.

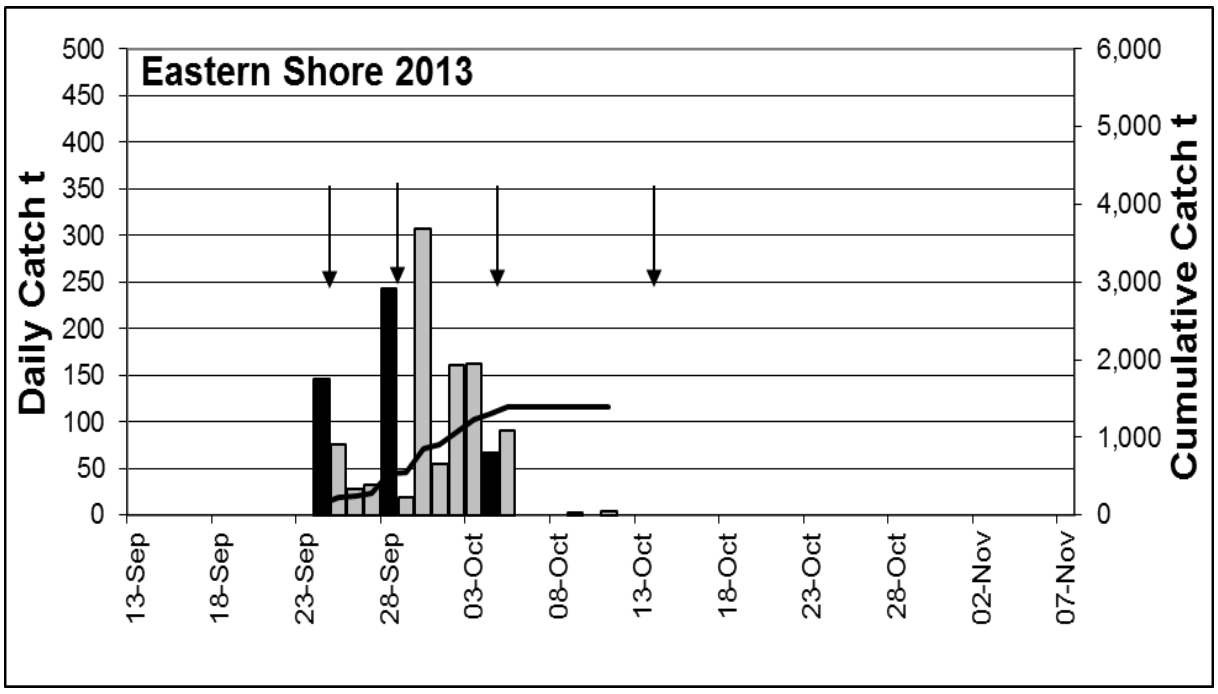

Figure 74A. Daily and cumulative catch for the 2013 Halifax/Eastern Shore herring gillnet fishery. Survey dates are identified by black columns or arrows indicating time of survey.

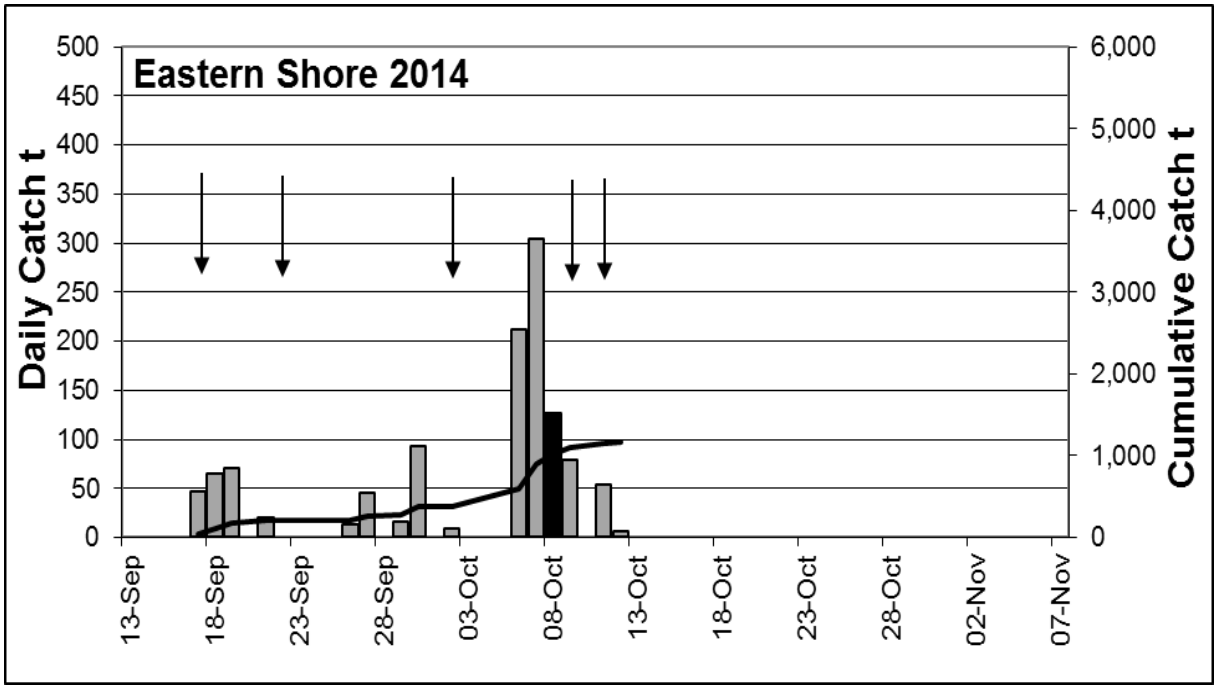

Figure 74B. Daily and cumulative catch for the 2014 Halifax/Eastern Shore herring gillnet fishery. Survey dates are identified by black columns or arrows indicating time of survey.

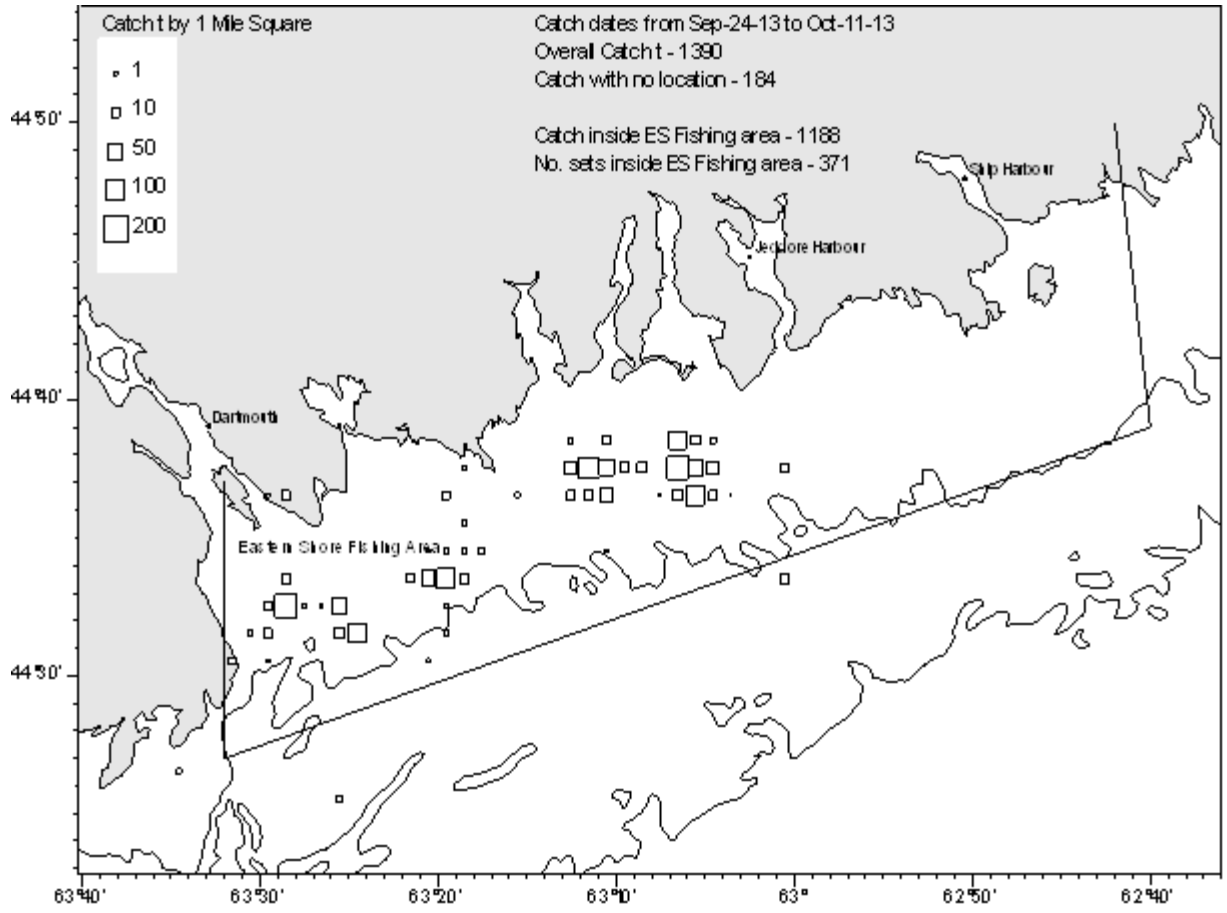

Figure 75A. Herring fishery gillnet catches for the Halifax/Eastern Shore area for 2013 (Districts 18 – 22).

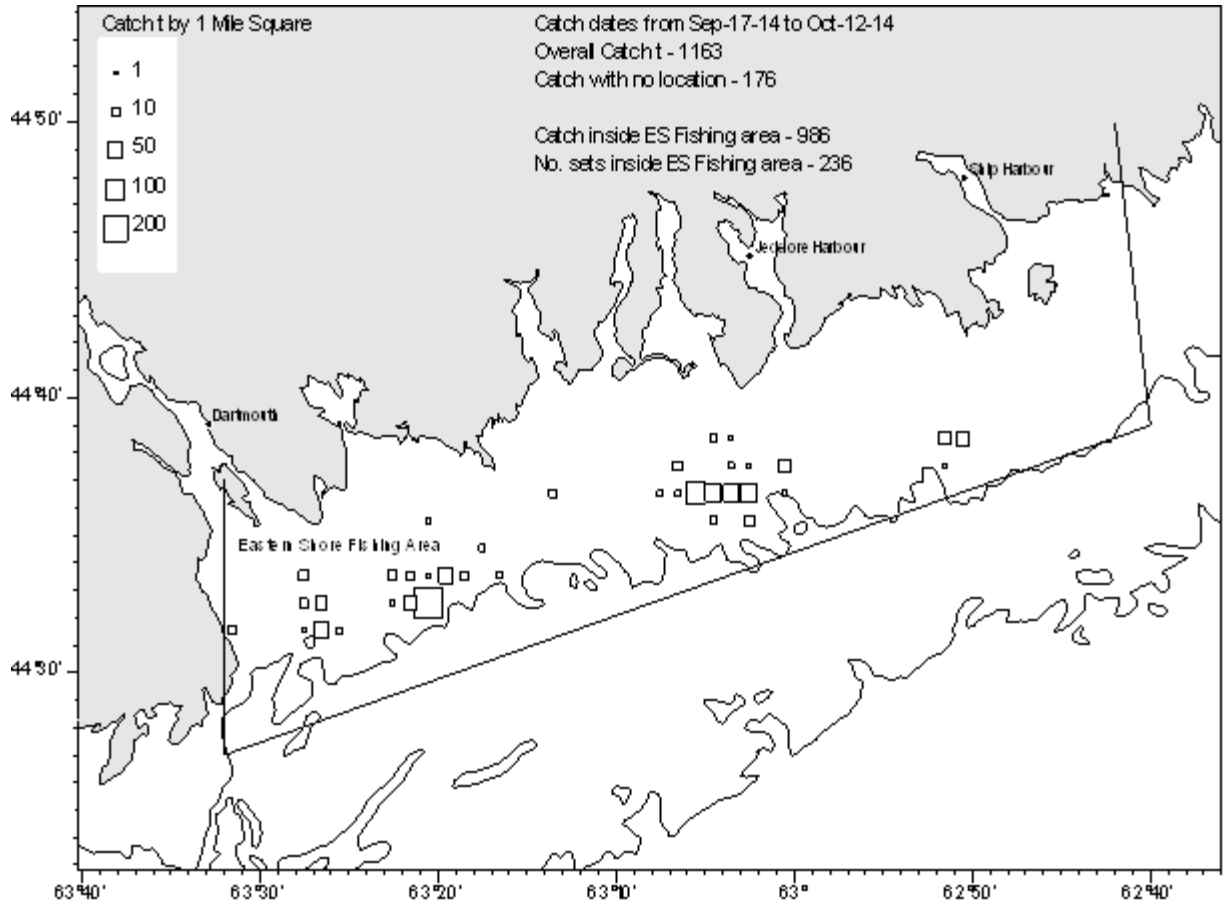

Figure 75B. Herring fishery gillnet catches for the Halifax/Eastern Shore area for 2014 (Districts 18 – 22).

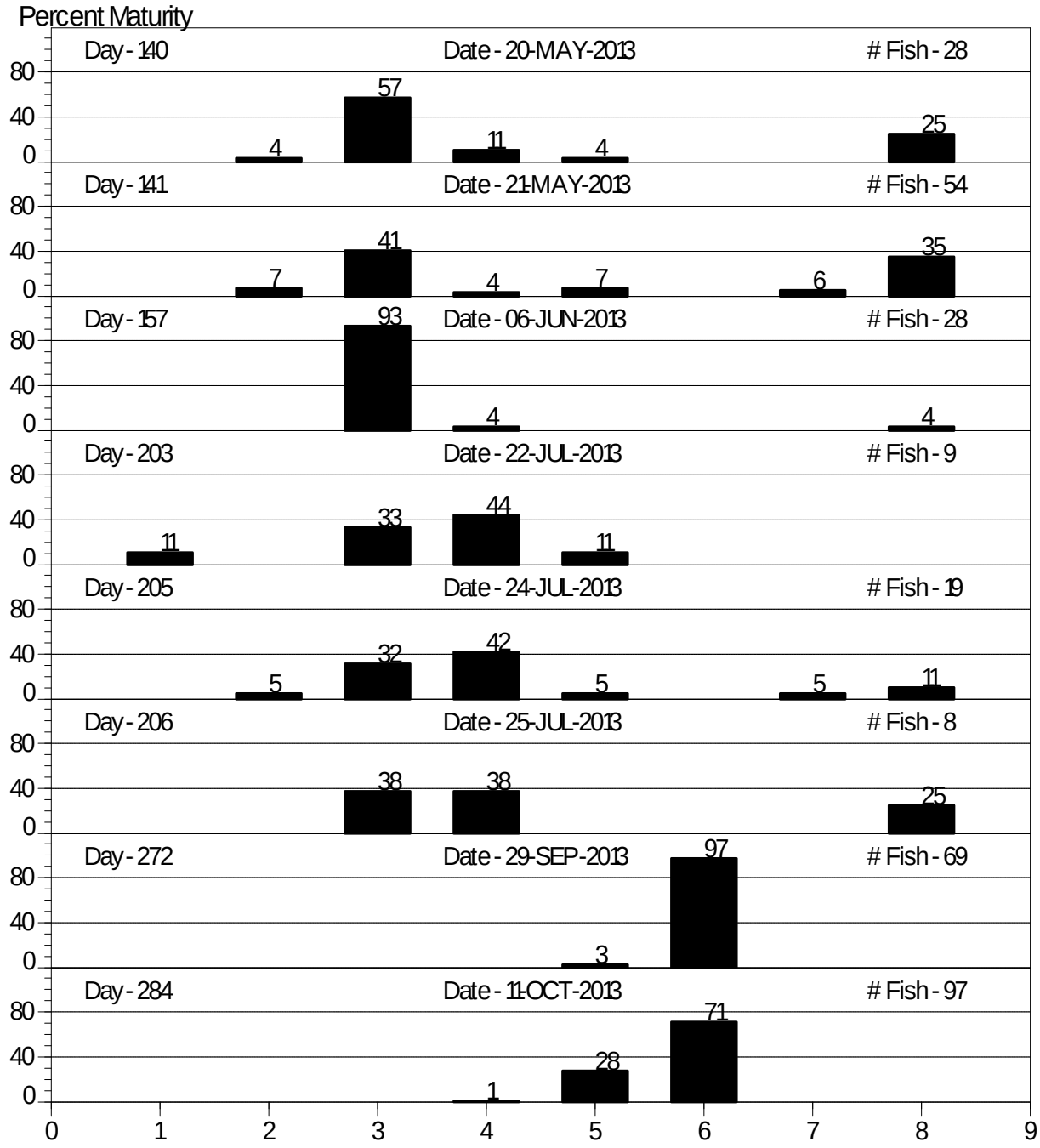

Figure 76A. Herring maturity samples collected from the Halifax/Eastern Shore area in 2013. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

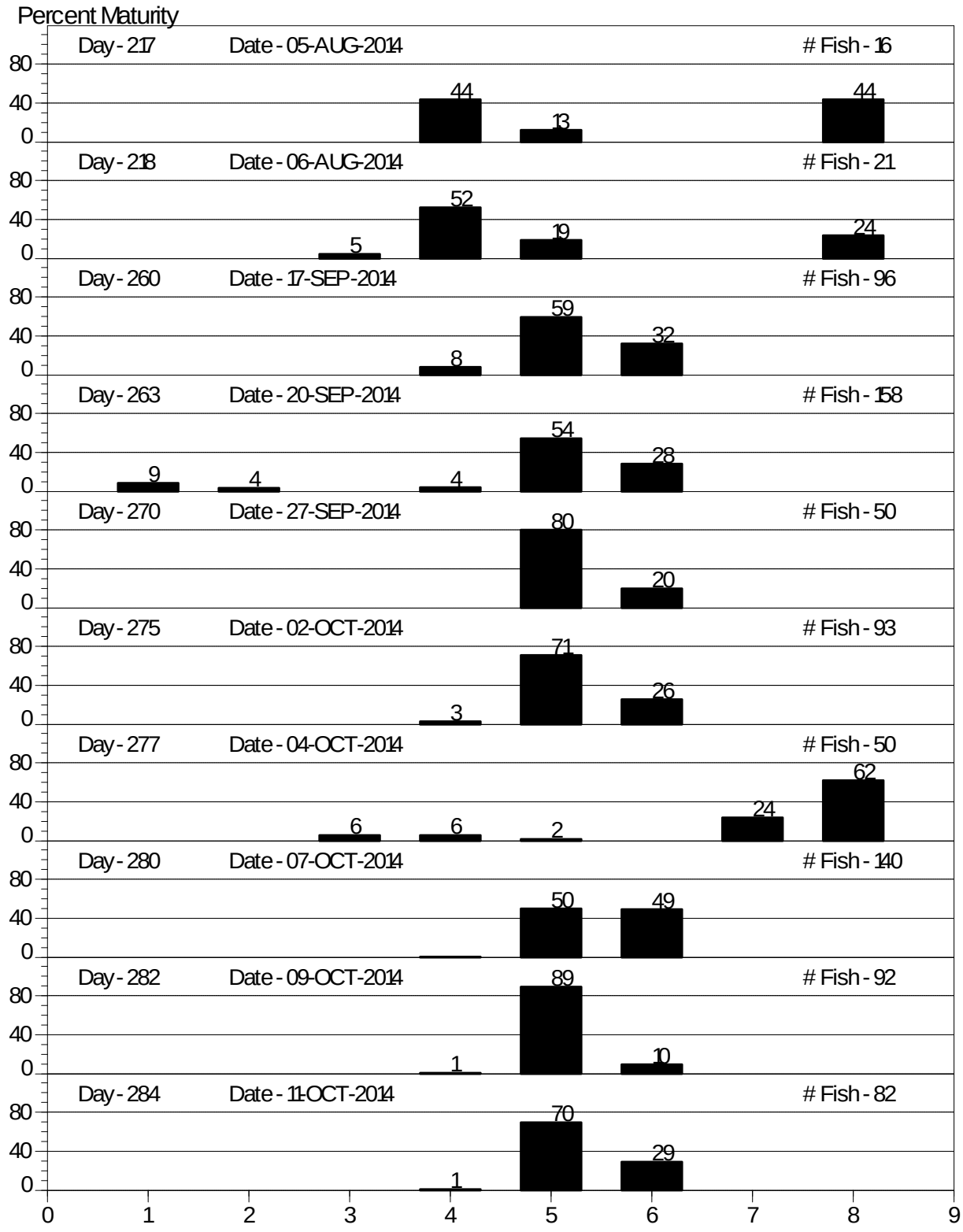

Figure 76B. Herring maturity samples collected from the Halifax/Eastern Shore area in 2014. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

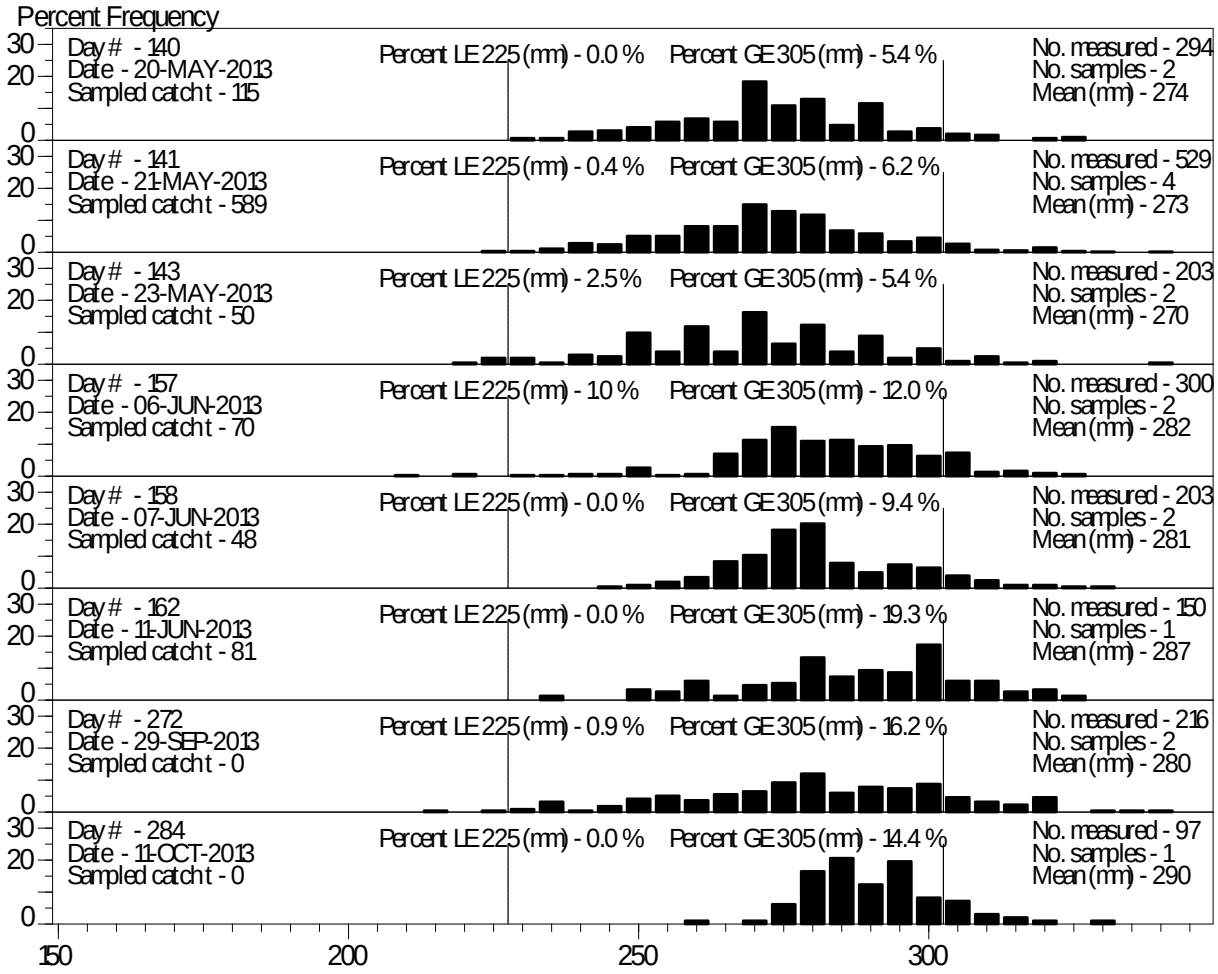

Figure 77A. Daily length frequency sampling from the Halifax/Eastern Shore area in 2013, with proportions <23cm and >30cm.

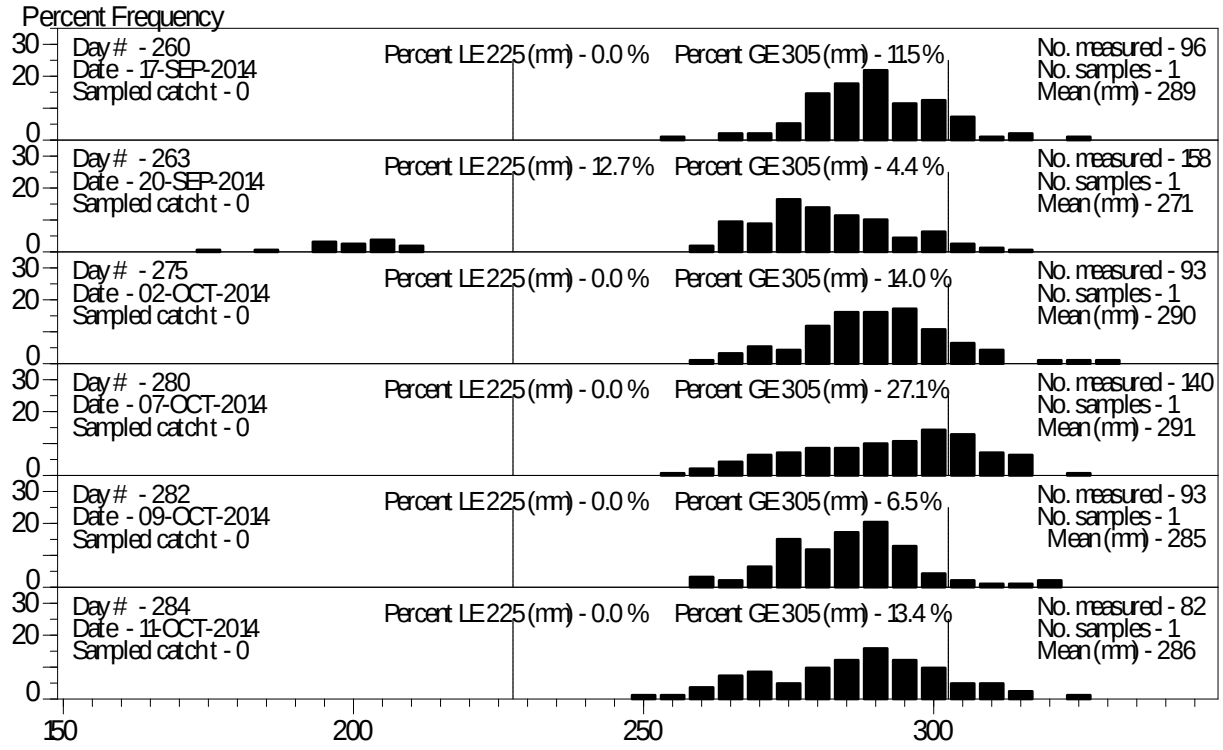

Figure 77B. Daily length frequency sampling from the Halifax/Eastern Shore area in 2014, with proportions <23cm and >30cm.

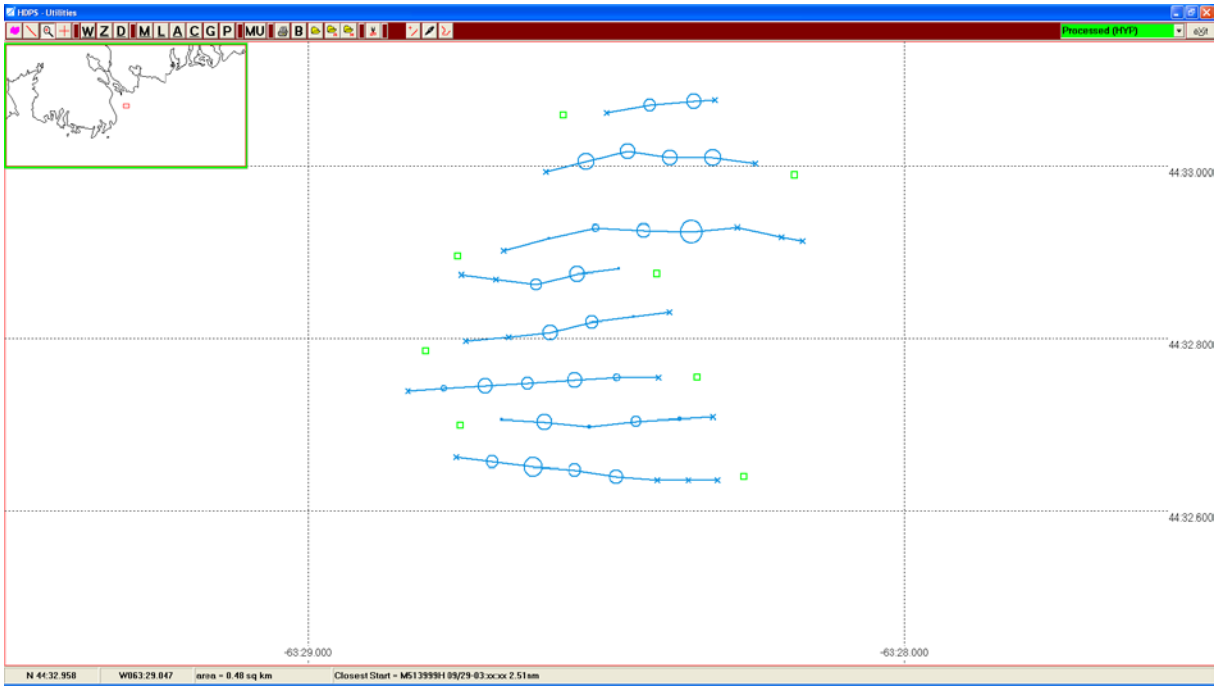

Figure 78A. Halifax/Eastern Shore acoustic transects for September 24, 2013, survey (#1) conducted by one acoustic survey vessels, the Miss Owls Head. No samples were available. Standard TS used.

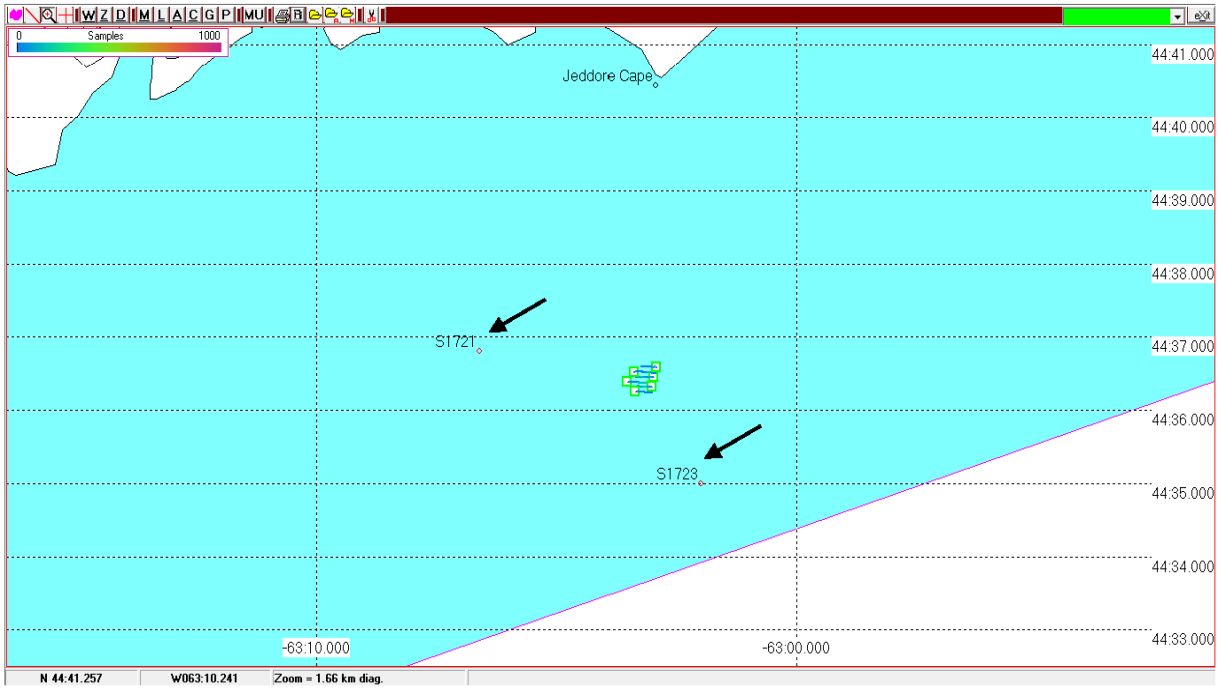

Figure 78B. Halifax/Eastern Shore acoustic transects for September 16, 2014, survey (#1) conducted by one acoustic survey vessel, the Bradley K, along with location (arrow) of two multi-panel herring gillnet samples collected on September 17 and 20, 2014.

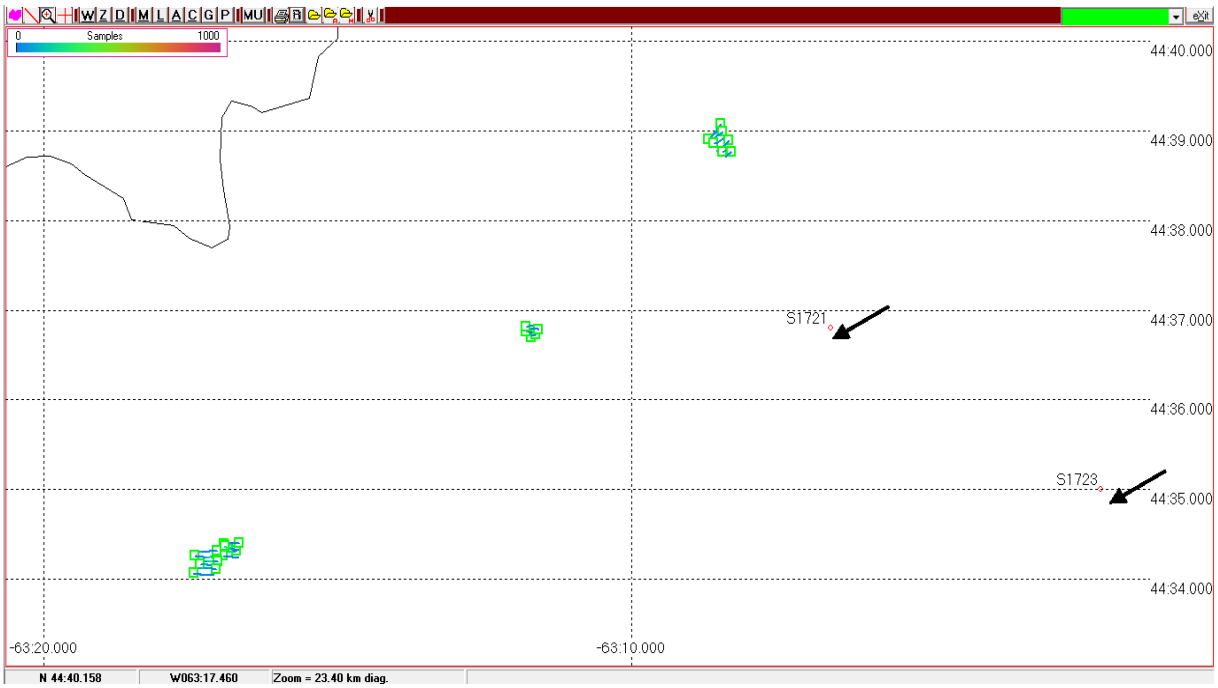

Figure 78C. Halifax/Eastern Shore acoustic transects for September 19, 2014, survey (#2) conducted by two acoustic survey vessels, the Bradley K and the Miss Owl Head, along with location (arrow) of two multi-panel herring gillnet samples collected on September 17 and 20, 2014.

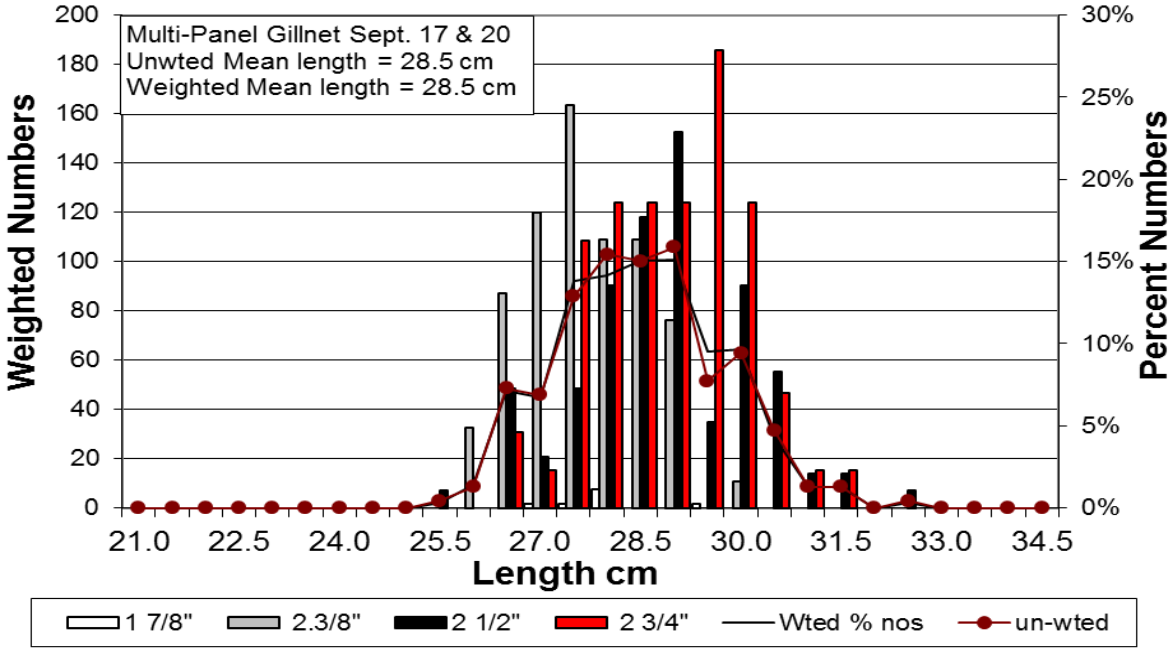

Figure 79. Two Multi-panel herring gillnet samples collected by the Bradley K on September 17 and 20, 2014, for the Halifax/Eastern Shore acoustic survey (#1 & 2) on September 16 and 19, 2014.

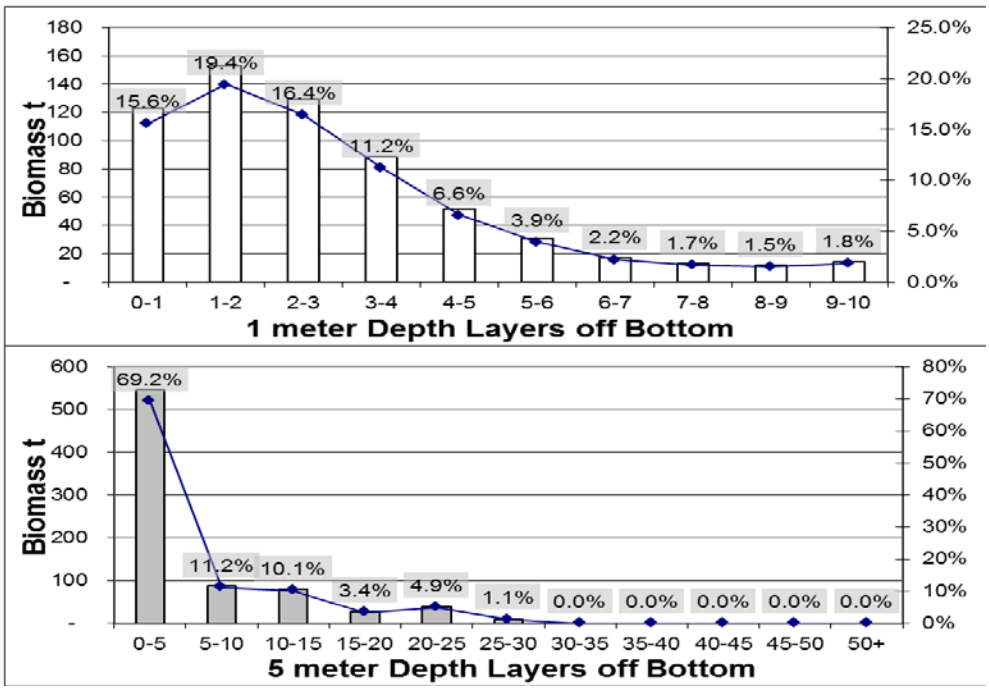

Figure 80A. Distribution of biomass by depth layer from bottom for the Eastern Shore acoustic survey (#1) on September 24, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

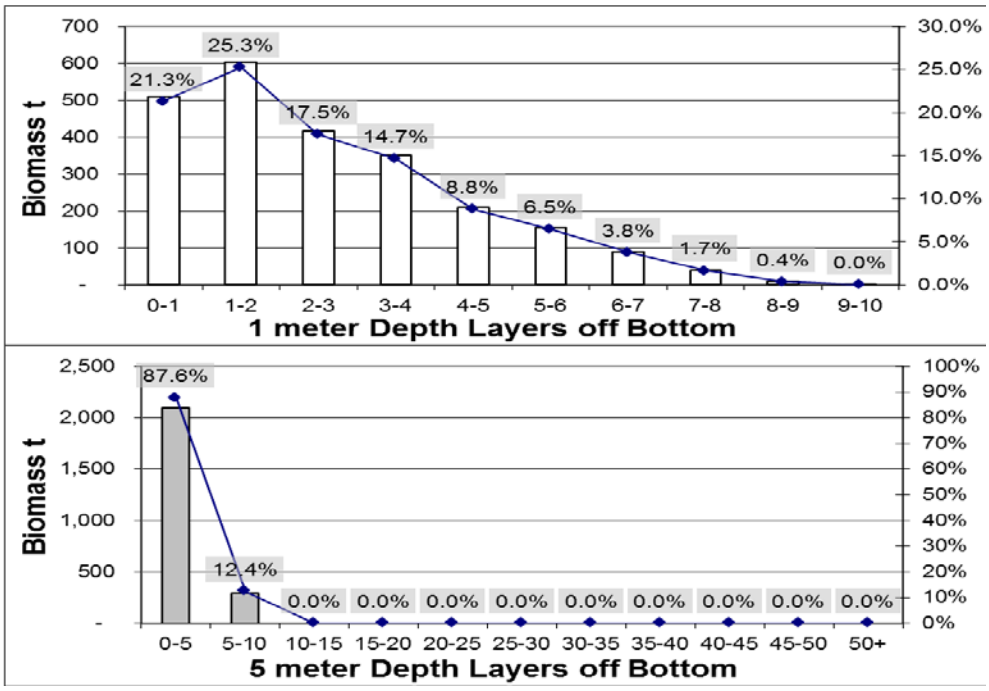

Figure 80B. Distribution of biomass by depth layer from bottom for the Eastern Shore acoustic survey (#1) on September 16, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

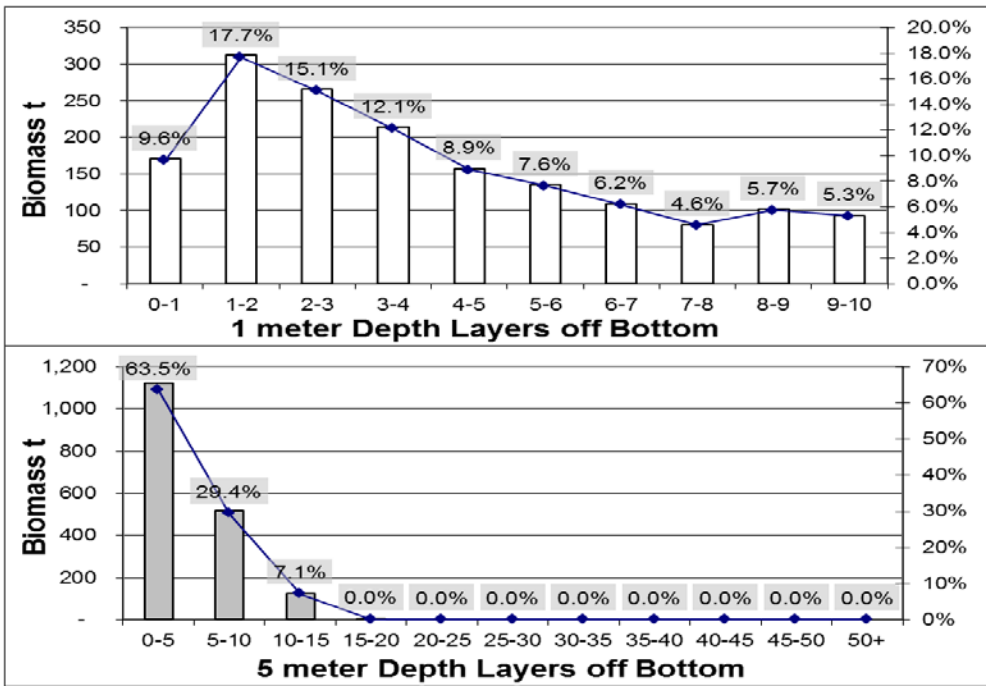

Figure 80C. Distribution of biomass by depth layer from bottom for the Eastern Shore acoustic survey (#2) on September 19, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

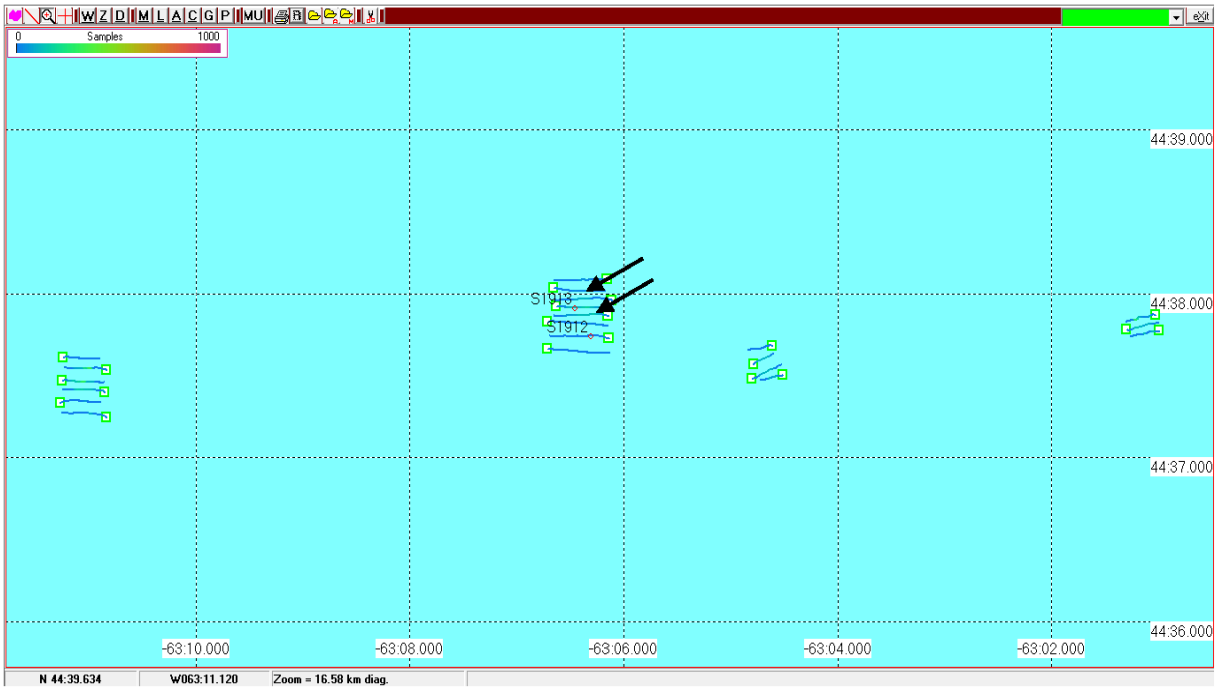

Figure 81A. Halifax/Eastern Shore acoustic transects for September 28, 2013, survey (#2) conducted by two acoustic survey vessels, the Bradley K and the Miss Owl Head, along with the location (arrow) of two multi-panel herring gillnet samples collected on September 29, 2013.

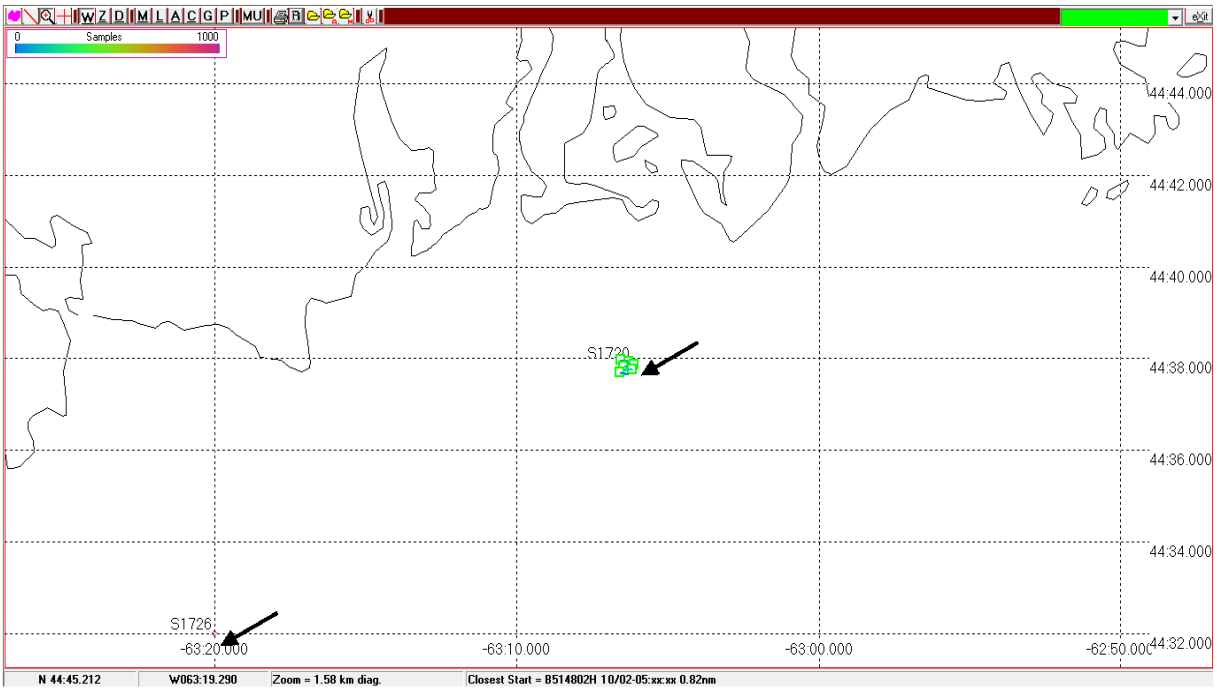

Figure 81B. Halifax/Eastern Shore acoustic transects for October 1, 2014, survey (#3) conducted by two acoustic survey vessels, the Bradley K and the Miss Owl Head, along with the location (arrow) of two multi-panel herring gillnet samples collected on October 2 and 7, 2014.

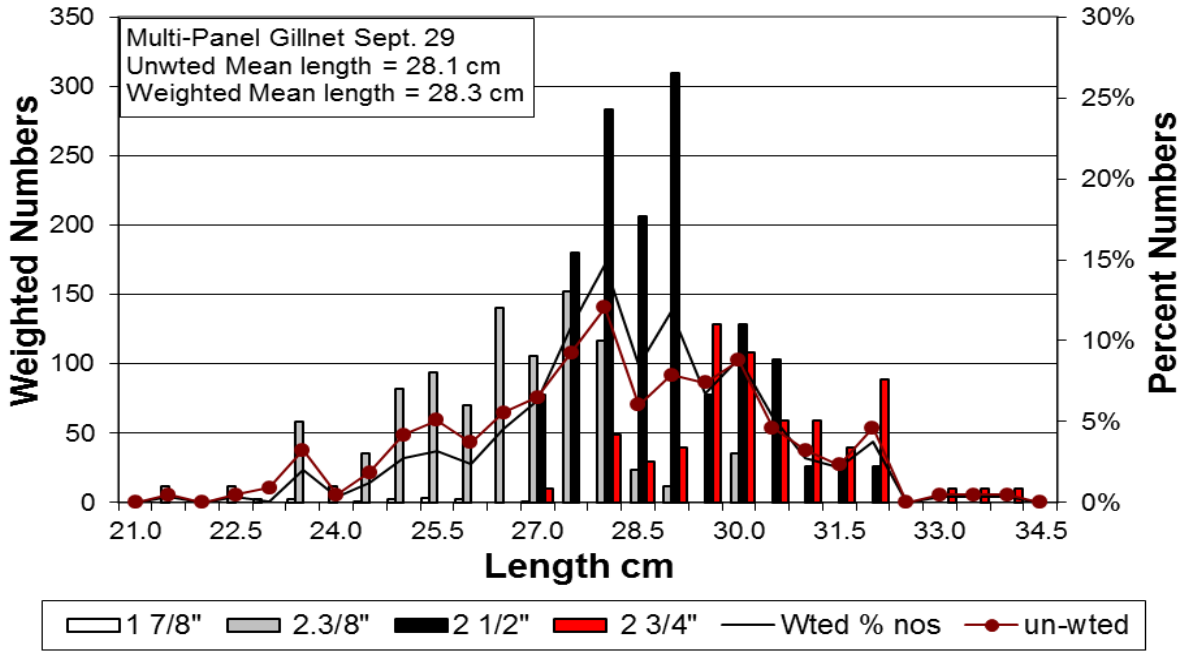

Figure 82A. Two multi-panel herring gillnet samples collected by the Bradley K and Miss Owl Head on September 29, 2013, for the Halifax/Eastern Shore acoustic survey (#2) on September 28.

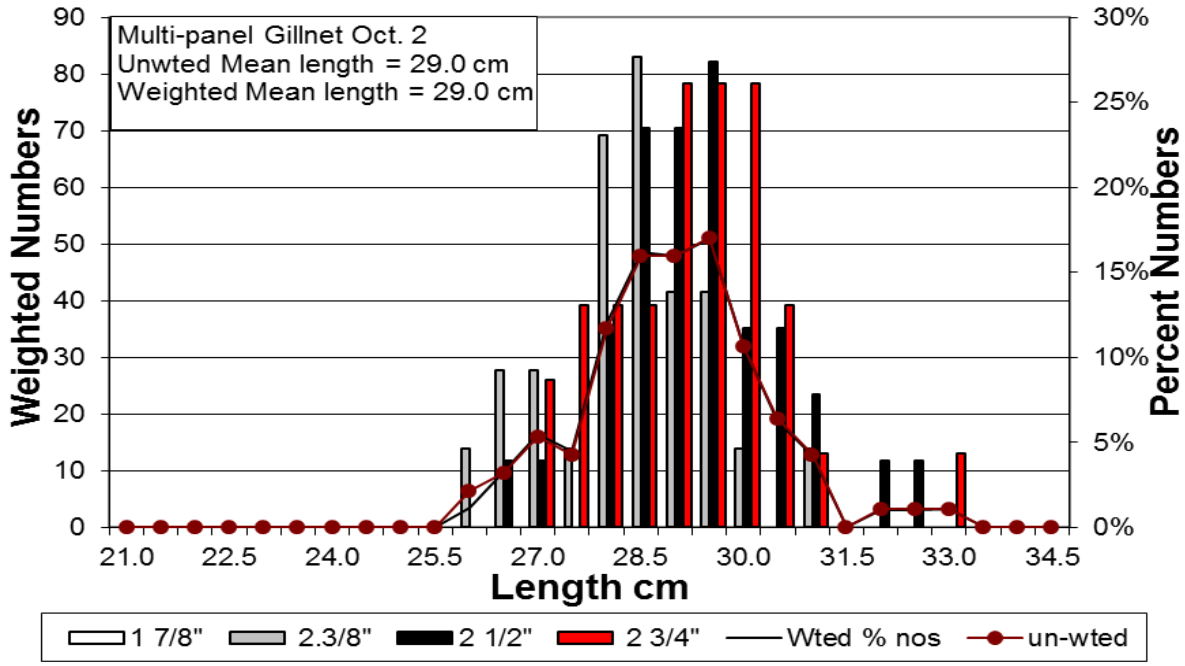

Figure 82B. One multi-panel herring gillnet sample collected by the Bradley K on October 2, 2014, for the Halifax/Eastern Shore acoustic survey (#3) on October 1.

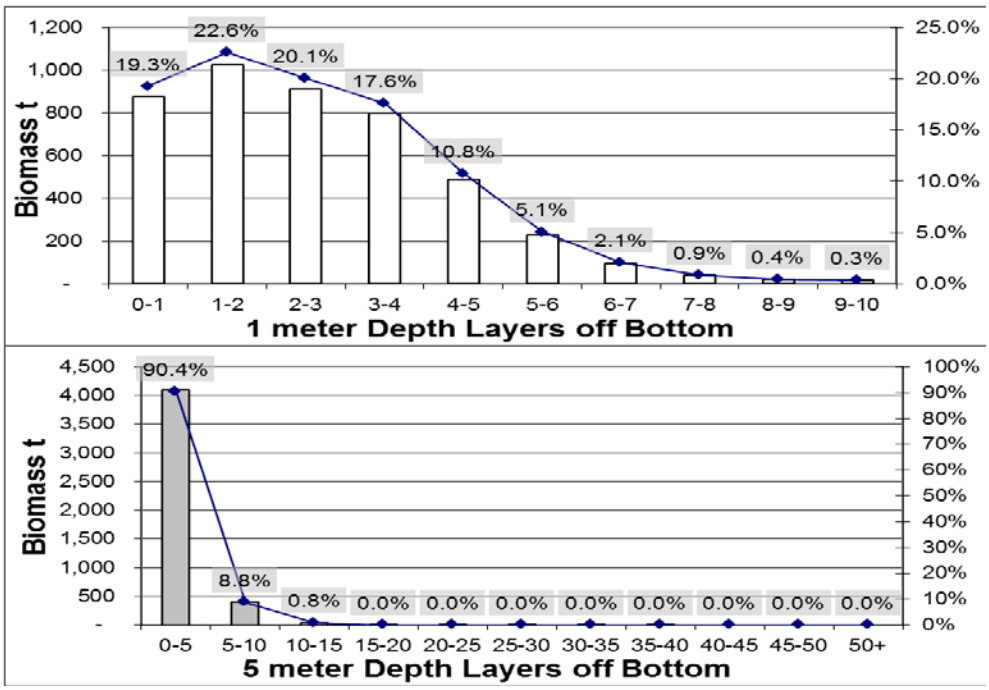

Figure 83A. Distribution of biomass by depth layer from bottom for the Eastern Shore acoustic survey (#2) on September 28, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

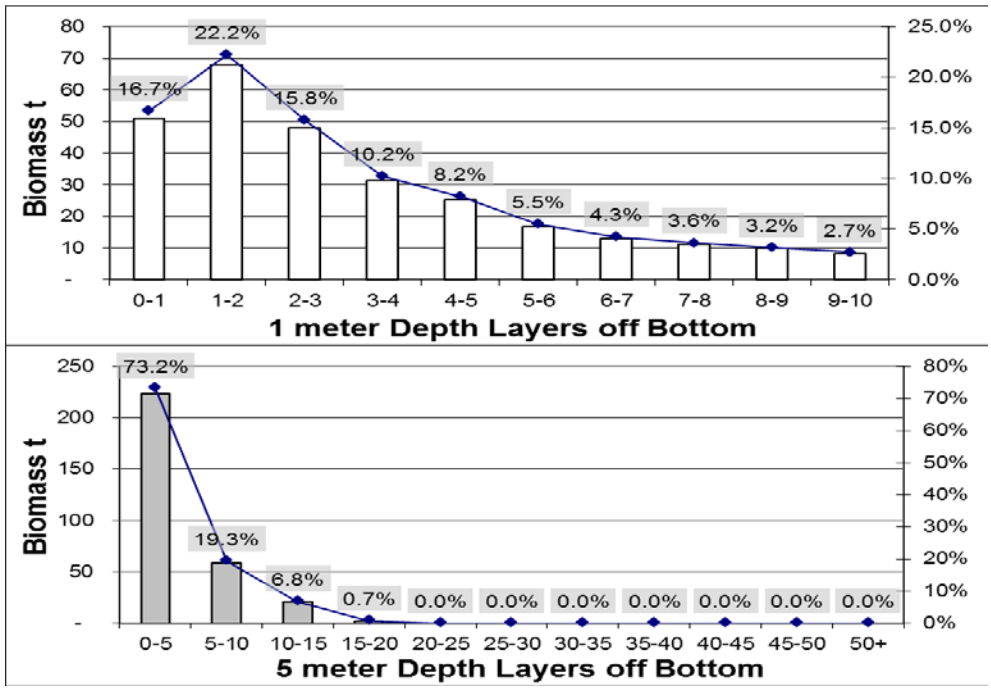

Figure 83B. Distribution of biomass by depth layer from bottom for the Eastern Shore acoustic survey (#3) on October 1, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

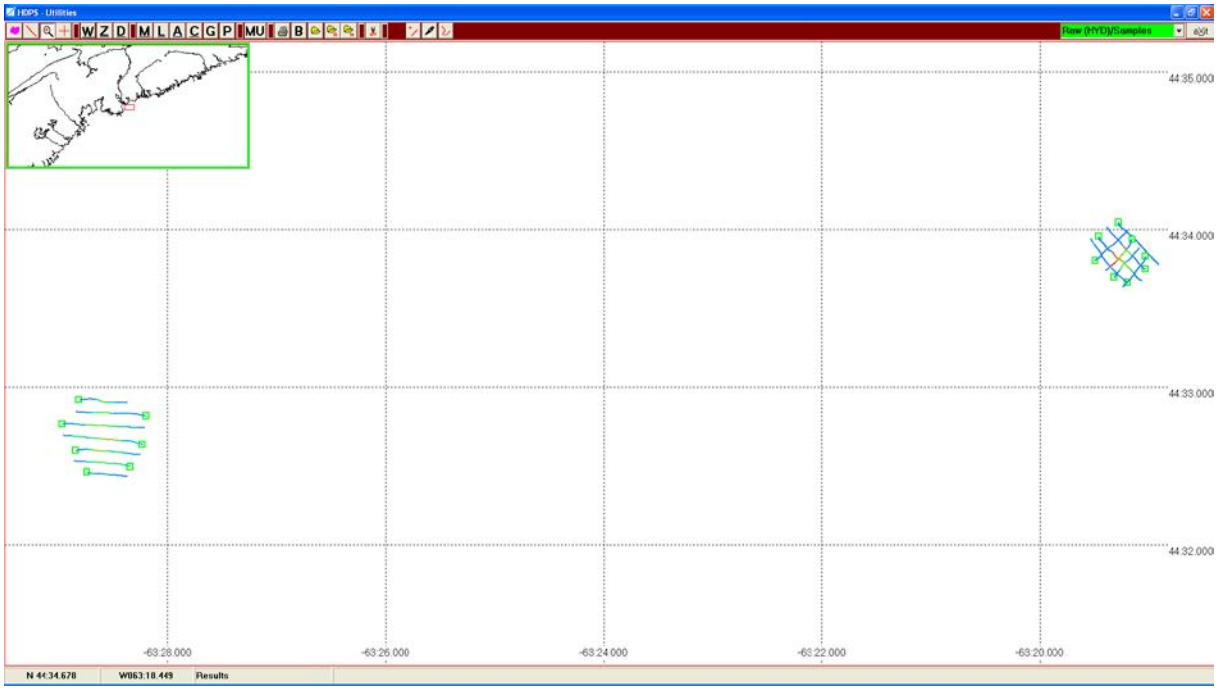

Figure 84A. Halifax/Eastern Shore acoustic transects for October 4, 2013, survey (#3) conducted by two acoustic survey vessels, the Miss Owl Head and the TBS. No samples were available. Standard TS used.

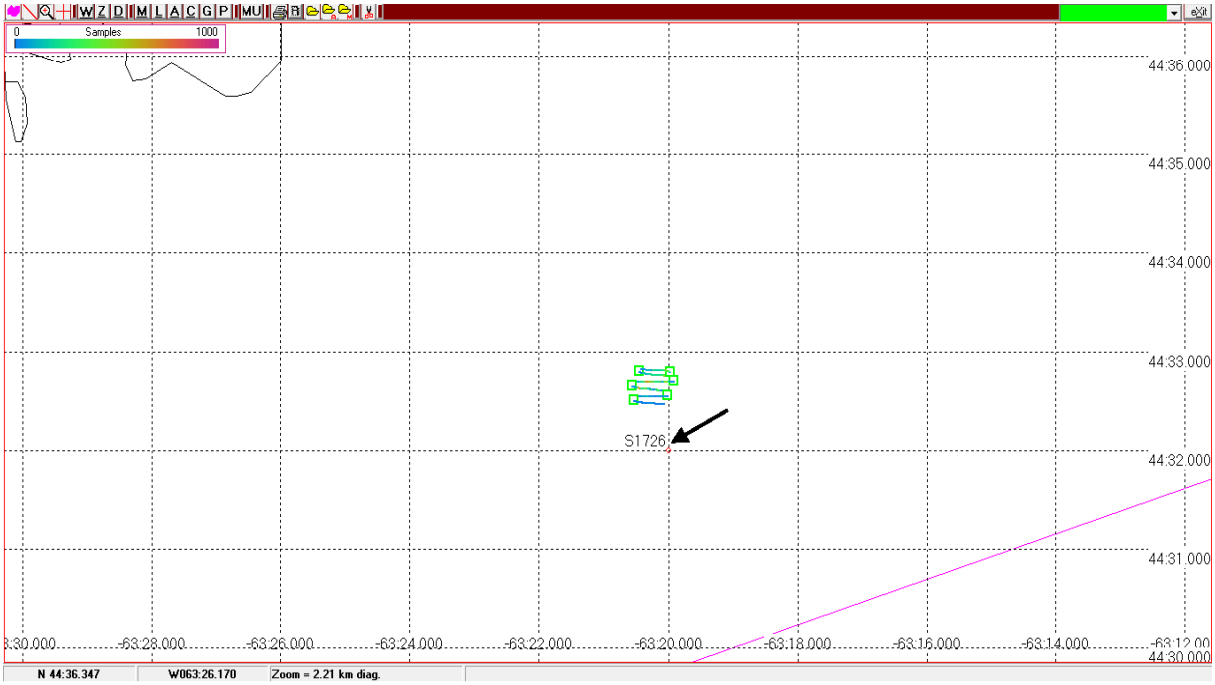

Figure 84B. Halifax/Eastern Shore acoustic transects for October 7, 2014, survey (#4) conducted by two acoustic survey vessels, the Bradley K and the Miss Owl Head, along with the location (arrow) of one multi-panel herring gillnet sample collected on October 7, 2014.

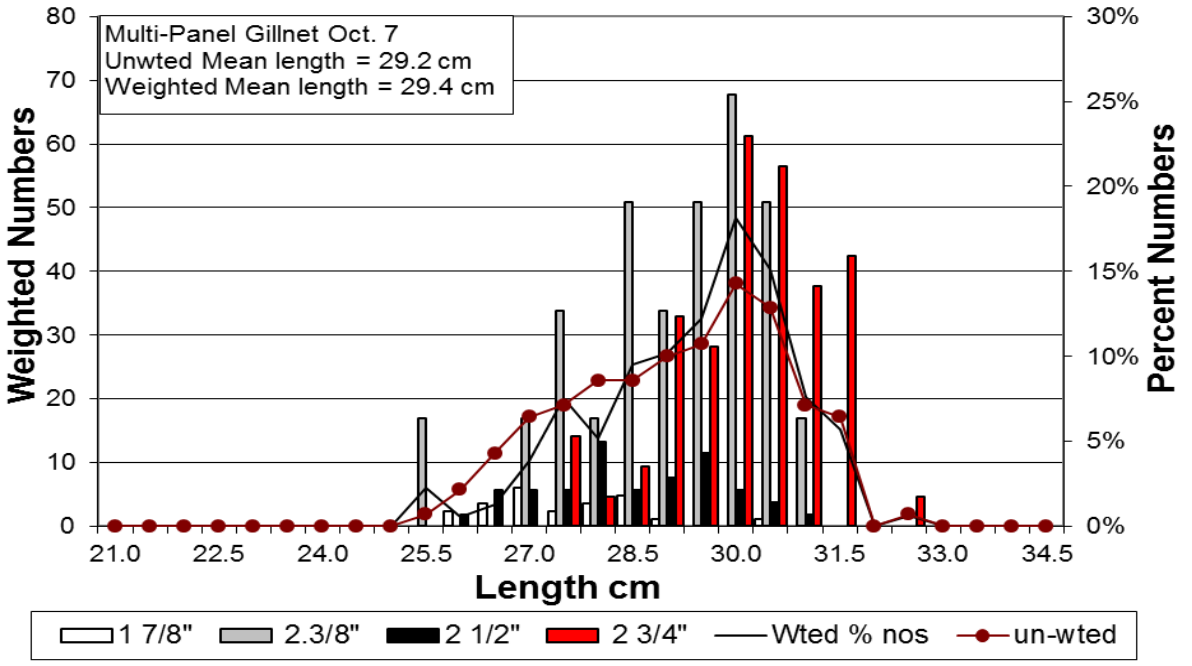

Figure 85. Multi-panel herring gillnet sample collected from the surveyed school of fish by the Miss Owl Head on October 7, 2014, for Halifax/Eastern Shore survey (#4) on October 7.

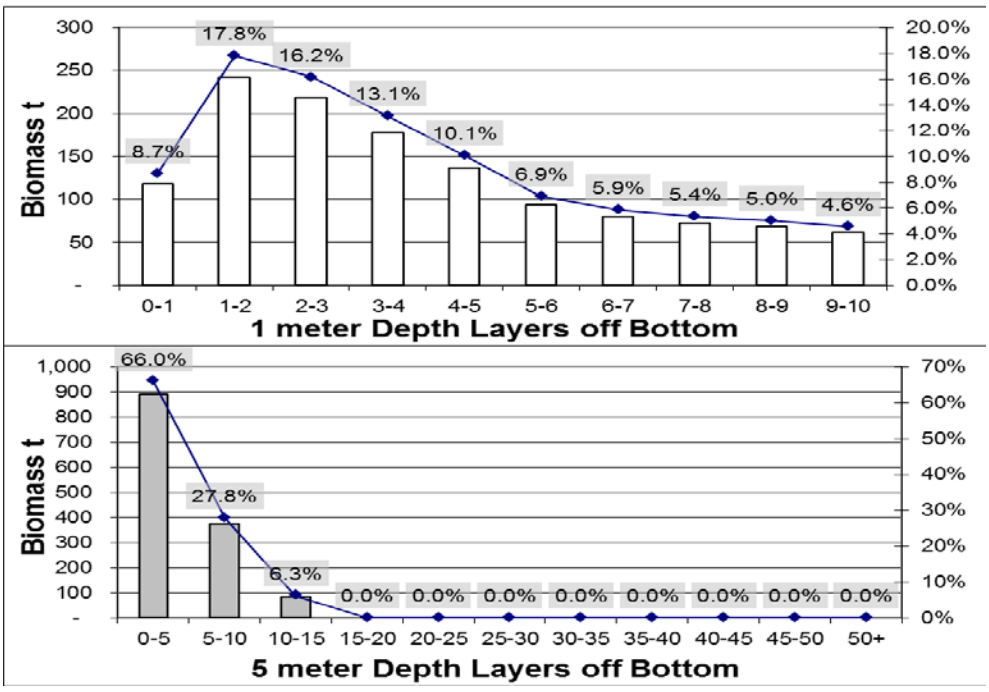

Figure 86A. Distribution of biomass by depth layer from bottom for the Eastern Shore acoustic survey (#3) on October 4, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

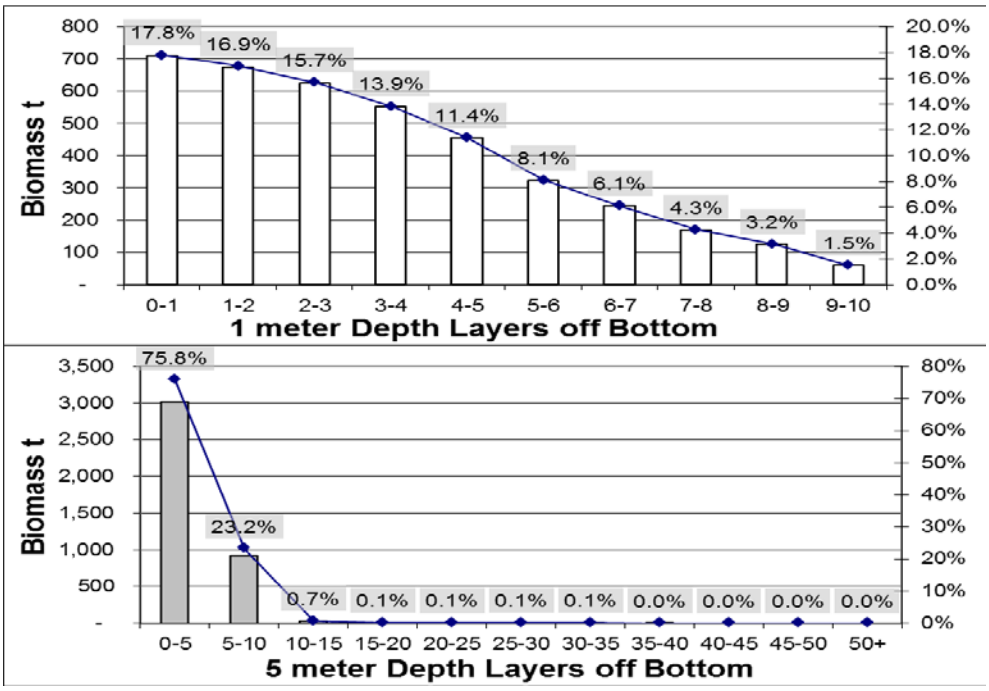

Figure 86B. Distribution of biomass by depth layer from bottom for the Eastern Shore acoustic survey (#4) on October 7, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

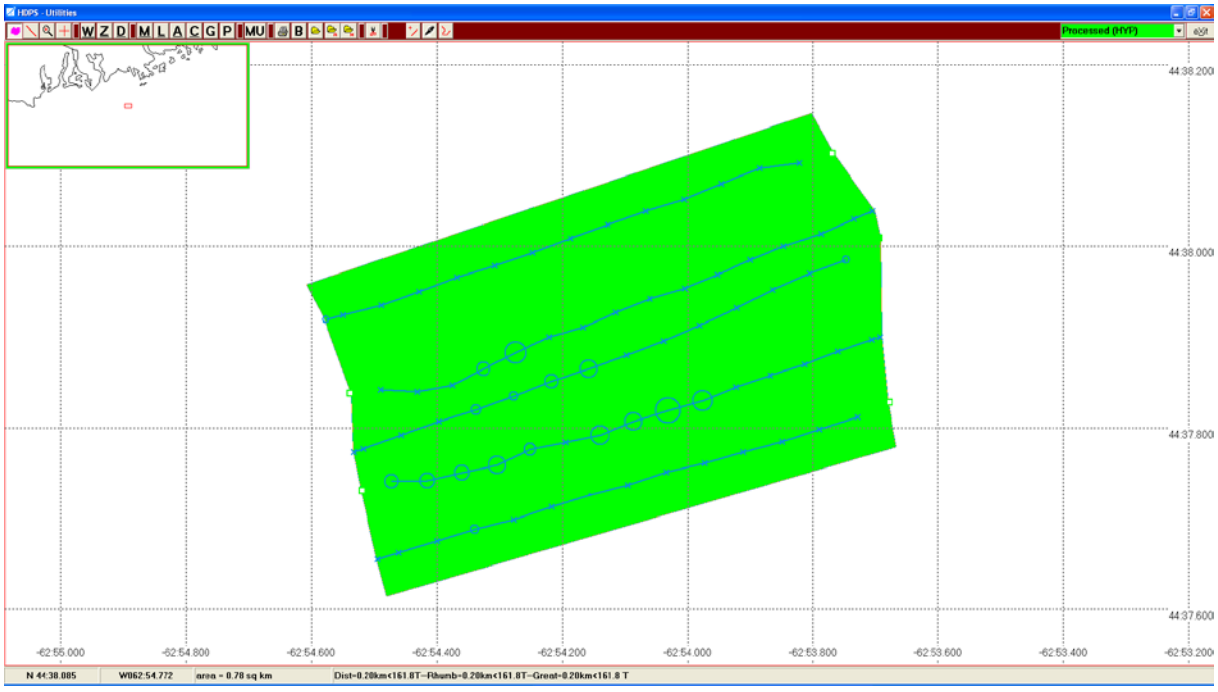

Figure 87A. Halifax/Eastern Shore acoustic transects for October 14, 2013, survey (#4) conducted by one acoustic survey vessel, the Bradley K. No samples were available. Standard TS used.

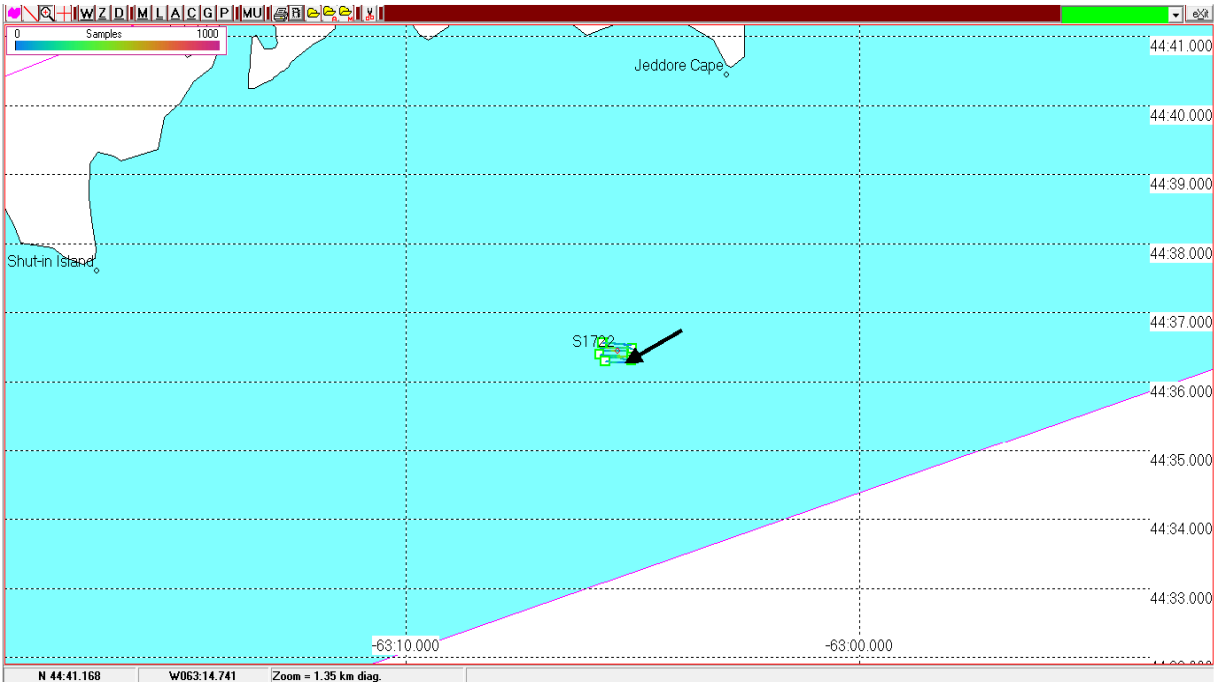

Figure 87B. Halifax/Eastern Shore acoustic transects for October 9, 2014, survey (#5) conducted by one acoustic survey vessel, the Bradley K, along with the location (arrow) of one multi-panel herring gillnet sample collected on October 9, 2014.

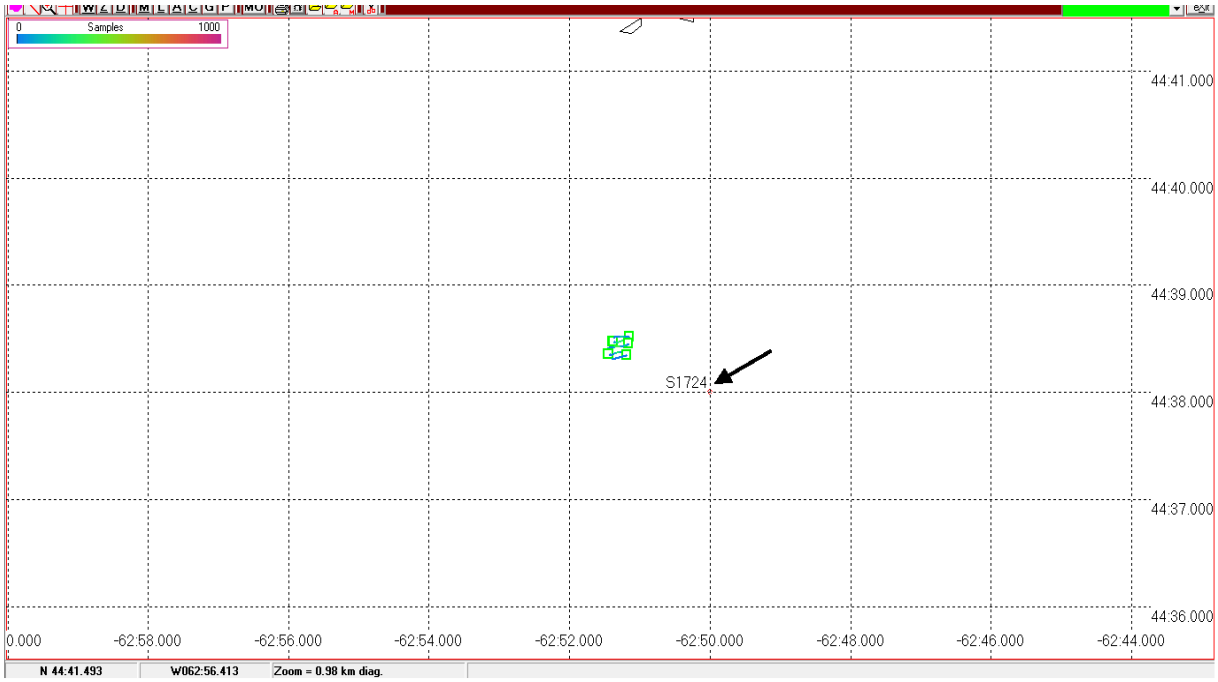

Figure 87C. Halifax/Eastern Shore acoustic transects for October 10, 2014, survey (#6) conducted by one acoustic survey vessel, the Miss Owl Head, along with the location (arrow) of one multi-panel herring gillnet sample collected on October 11, 2014.

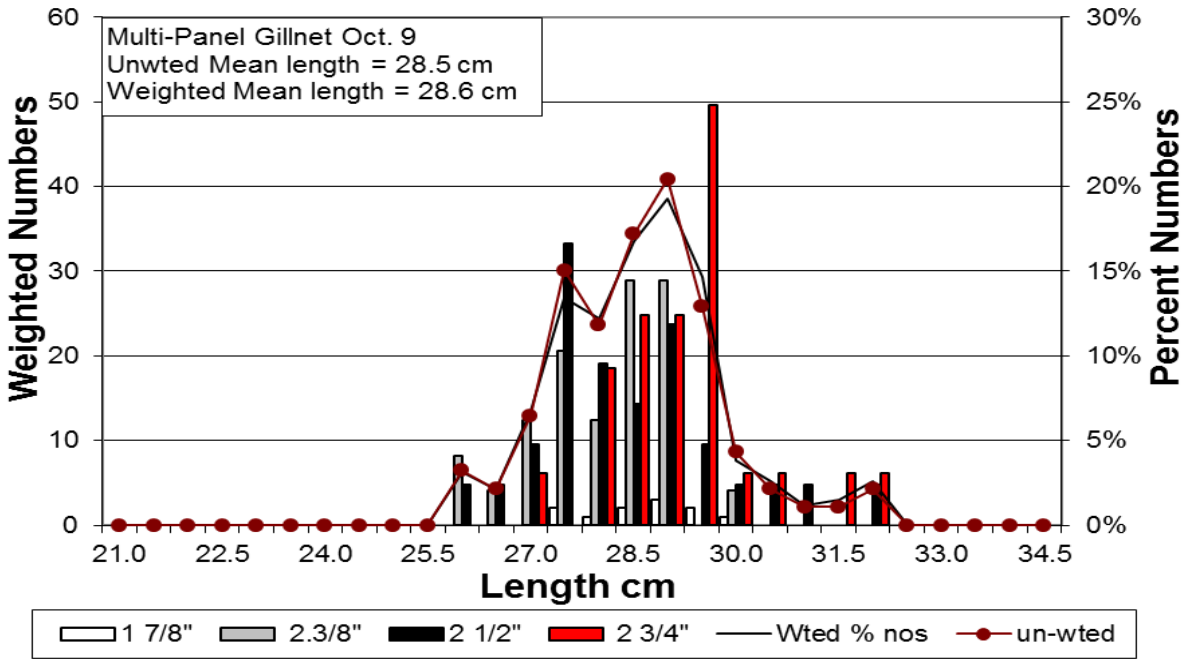

Figure 88A. Multi-panel herring gillnet sample collected by Bradley K on October 9, 2014, for the Halifax/Eastern Shore acoustic survey (#5) on October 9.

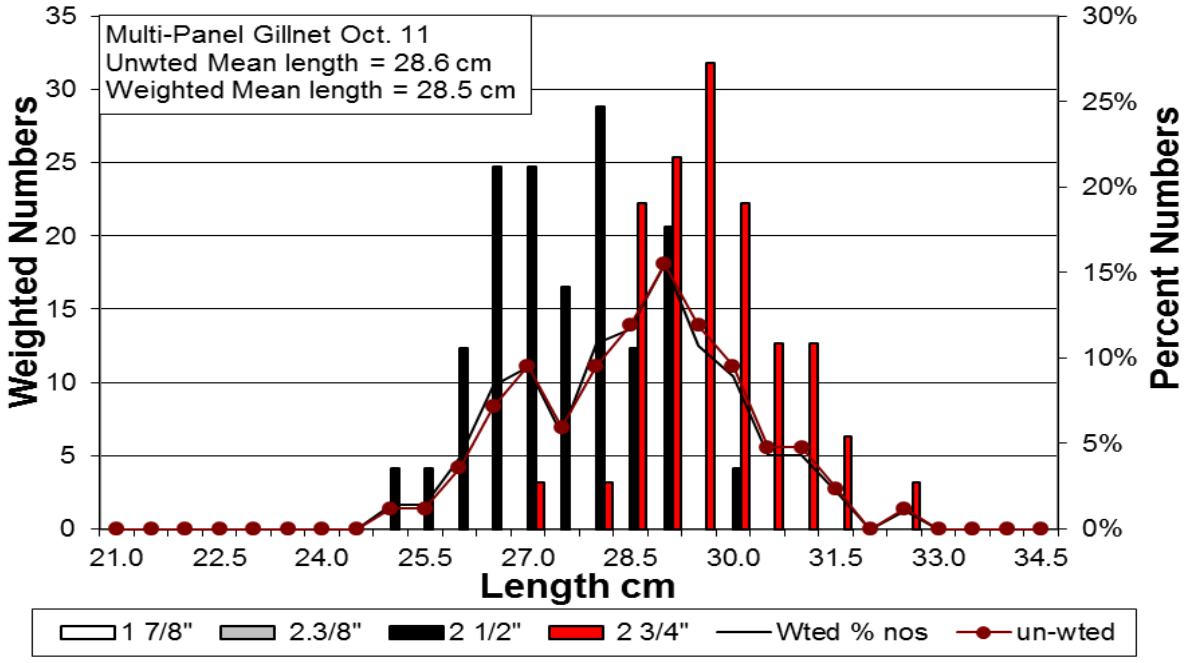

Figure 88B. Multi-panel herring gillnet sample collected by the Miss Owl Head on October 11, 2014, for the Halifax/Eastern Shore acoustic survey (#6) on October 10.

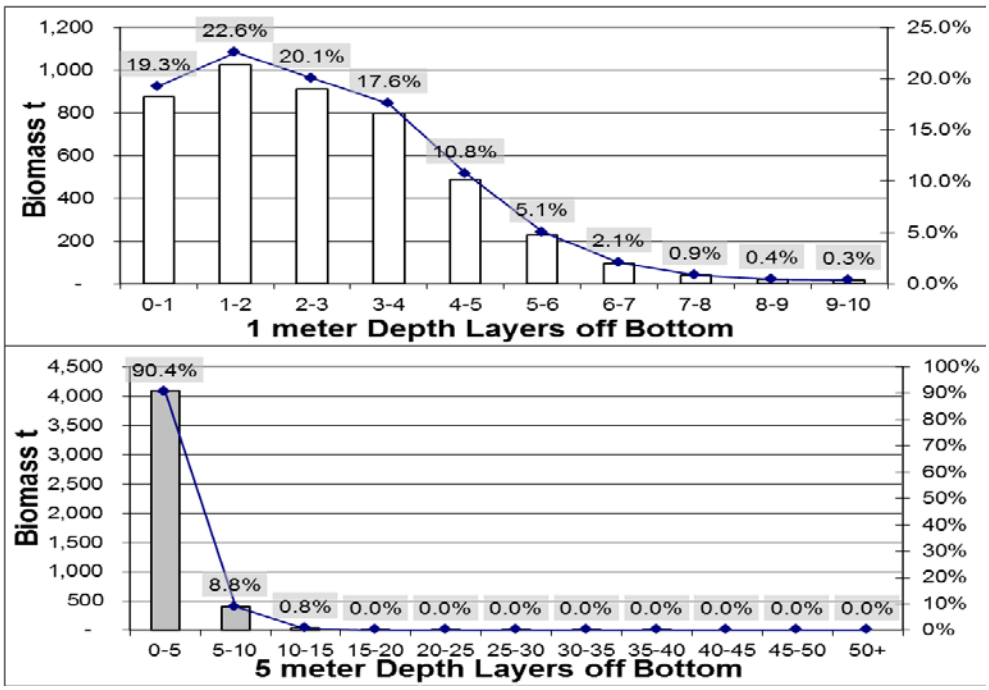

Figure 89A. Distribution of biomass by depth layer from bottom for the Eastern Shore acoustic survey (#4) on October 14, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

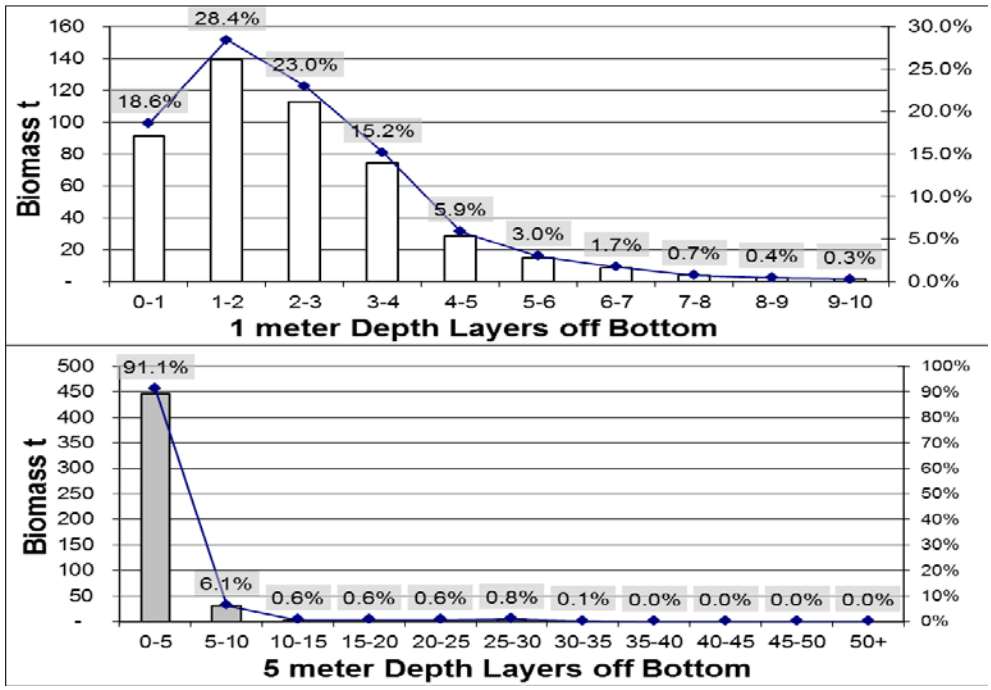

Figure 89B. Distribution of biomass by depth layer from bottom for the Eastern Shore acoustic survey (#5) on October 9, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

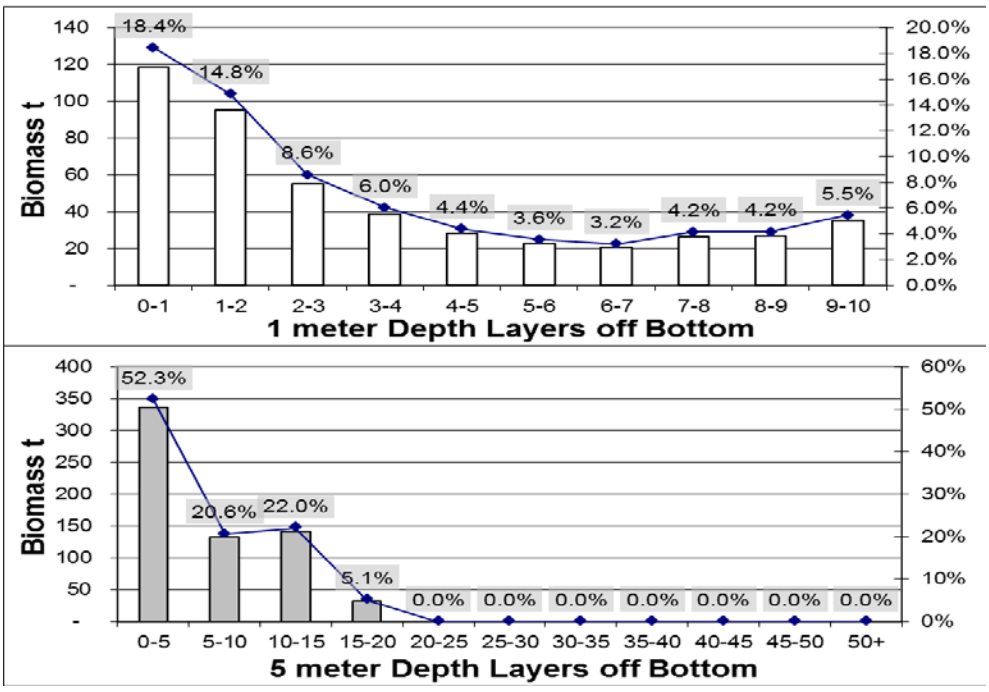

Figure 89C. Distribution of biomass by depth layer from bottom for the Eastern Shore acoustic survey (#6) on October 10, 2014. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

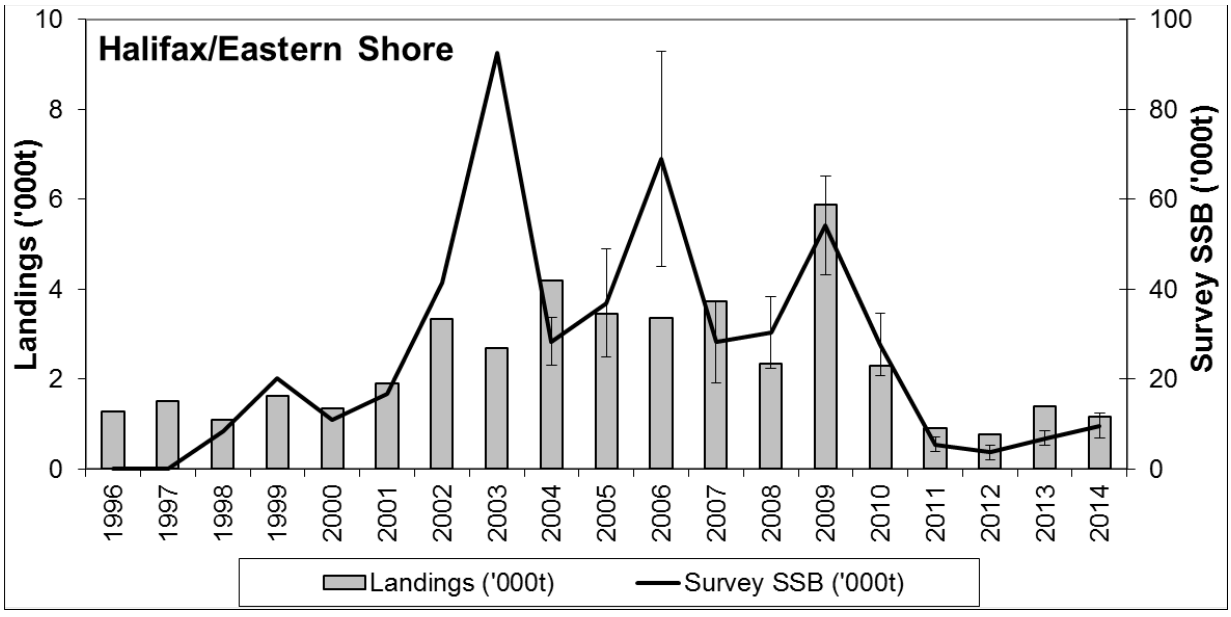

Figure 90. Herring landings and acoustic SSB ('000t) with 95% C.I. for the Halifax/Eastern Shore gillnet fishery from 1997-2014. No C.I. could be calculated for years prior to 2004.

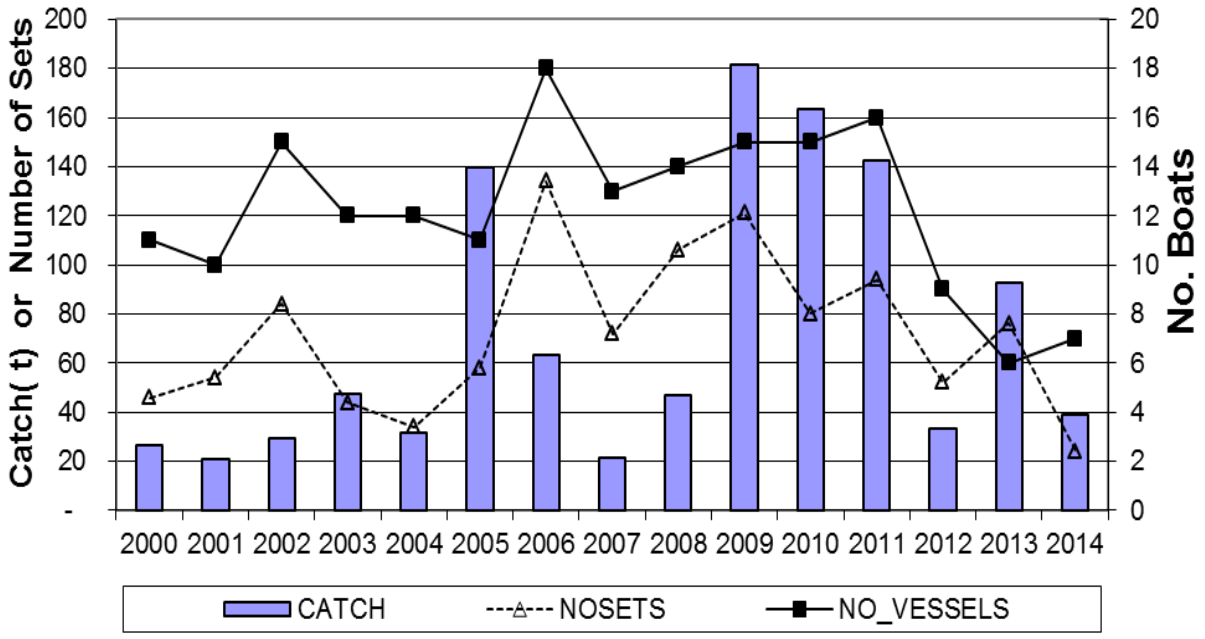

Figure 91. Herring gillnet total catch and total effort in number of vessels and number of sets for the Lunenburg Box area from Liverpool to Chebucto Head area (statistical districts 22-26) for 2000-2012. Note overlap of district 26 data with the Little Hope area used in Figure 53.

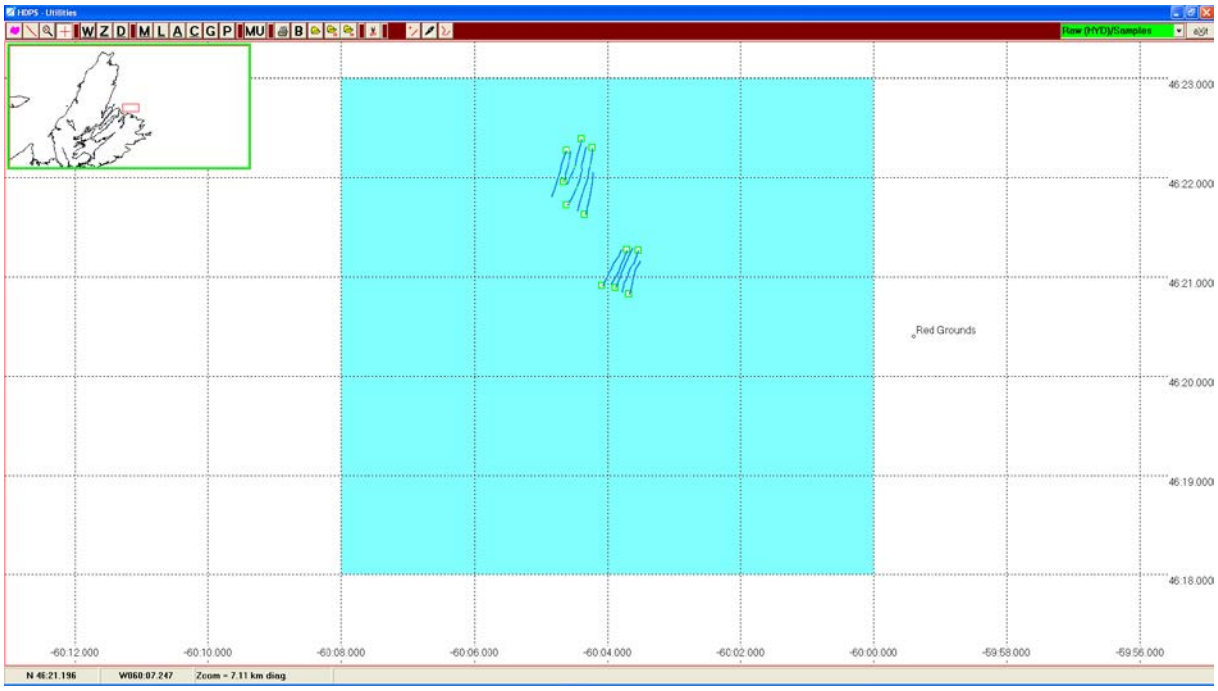

Figure 92. Glace Bay acoustic survey (#1) on September 11, 2013, showing the main survey box (highlighted area) and transects with backscatter (Sa). No multi-panel sample was collected; Standard TS used.

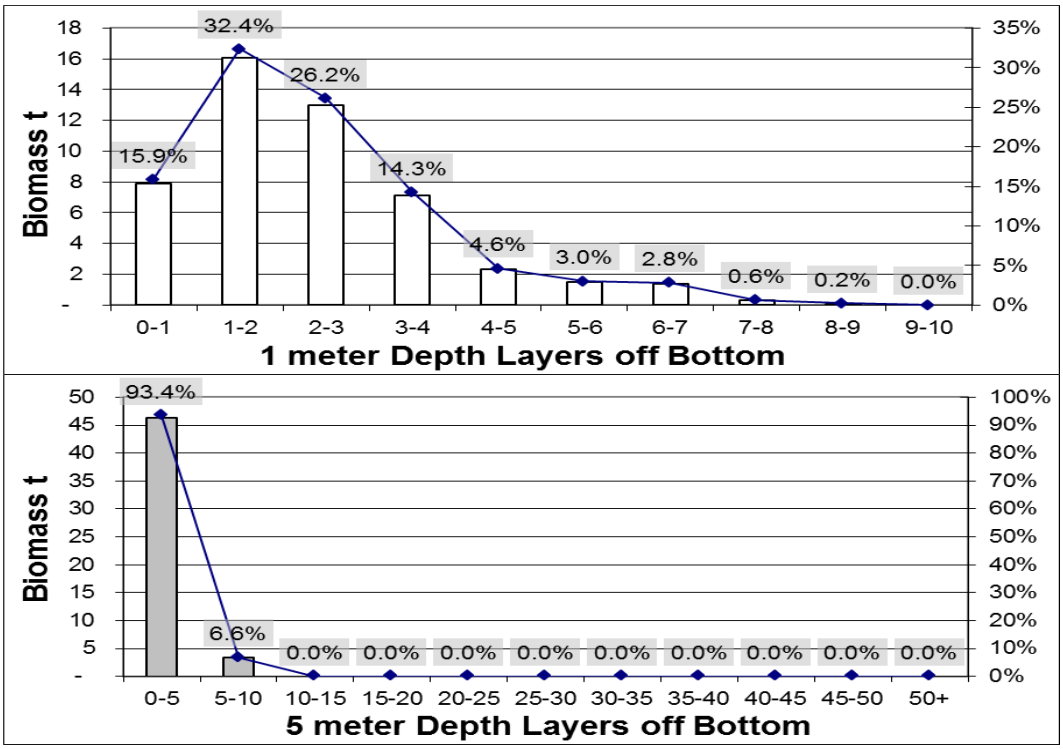

Figure 93. Distribution of biomass by depth layer from bottom for the Glace Bay acoustic survey (#1) on September 11, 2013. Biomass is shown as histogram bars and percent as a line for total biomass by 1m layers from 0m to 9m (top panel) and by 5m layers from bottom to surface (bottom panel).

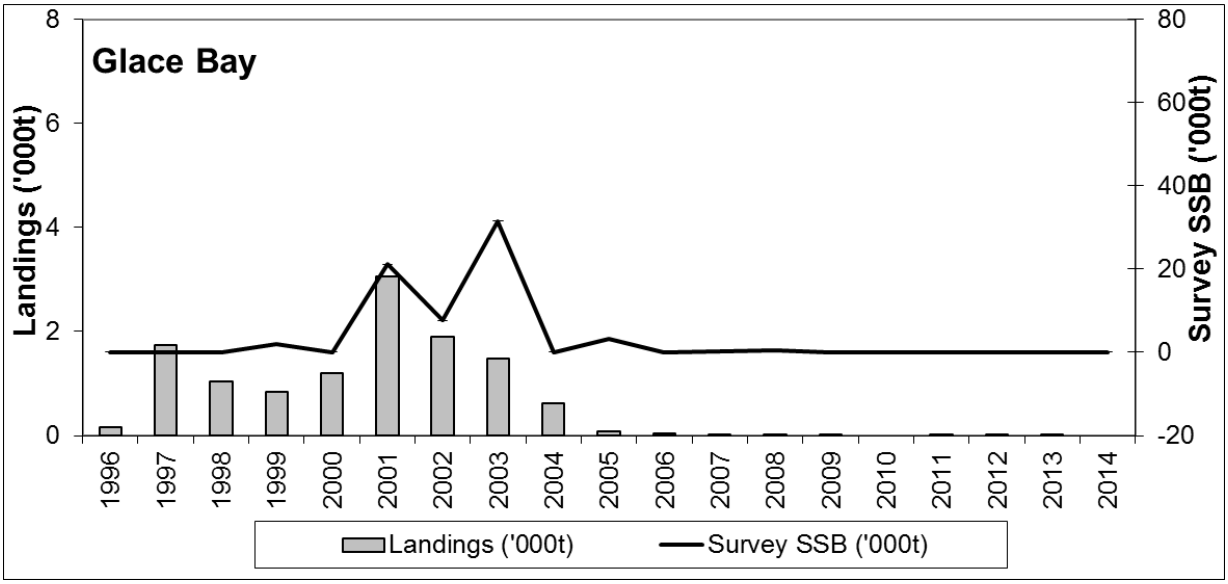

Figure 94. Glace Bay herring catches and acoustic survey biomass estimates from 1997-2014. (Acoustic survey SSB 1998-2002 'without' the CIF; 2003-2012 with the CIF). No C.I. could be calculated due to limited number of surveys.

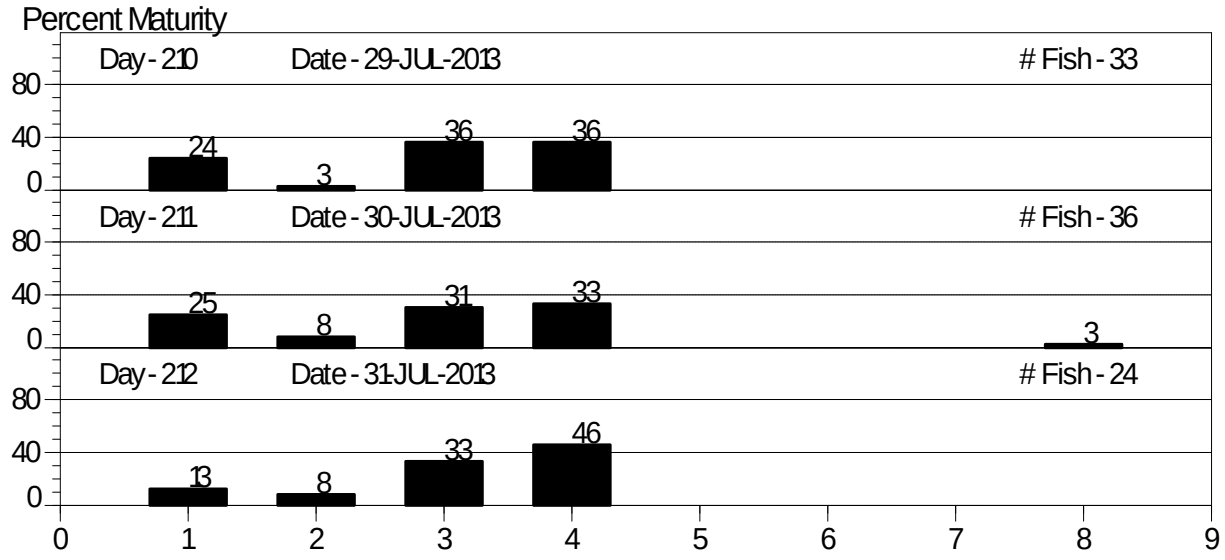

Figure 95A. Glace Bay herring maturity sample data in 2013. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

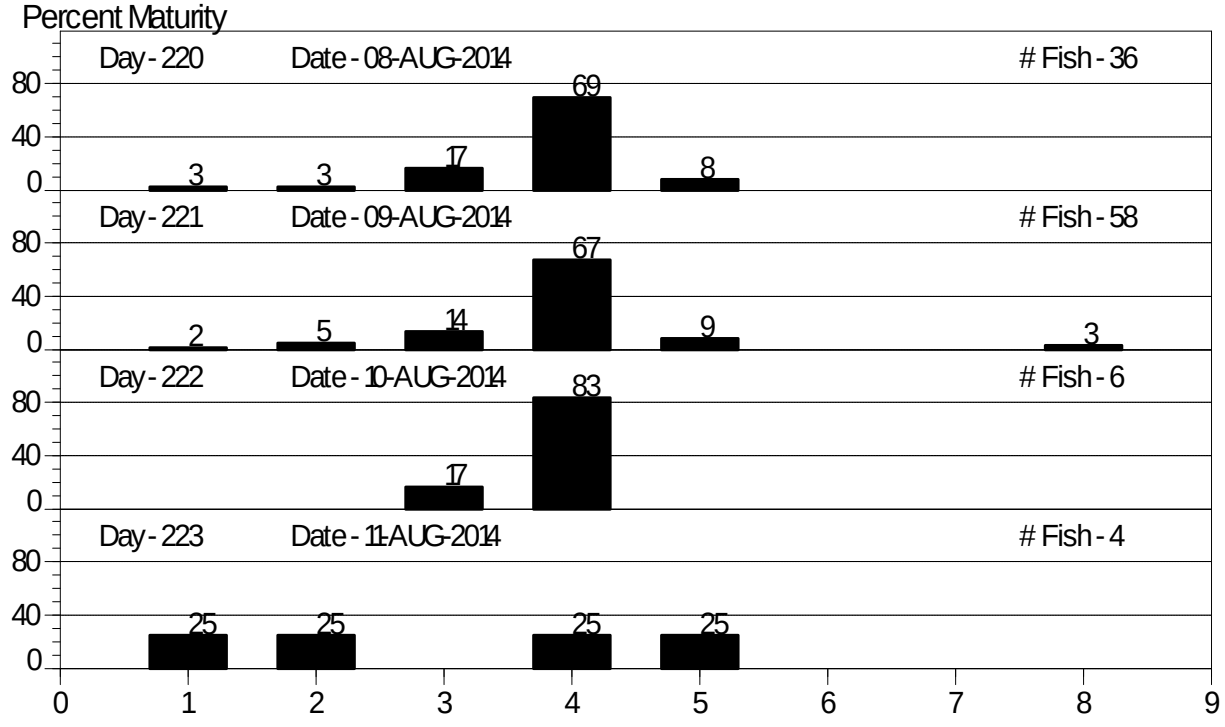

Figure 95B. Glace Bay herring maturity sample data in 2014. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

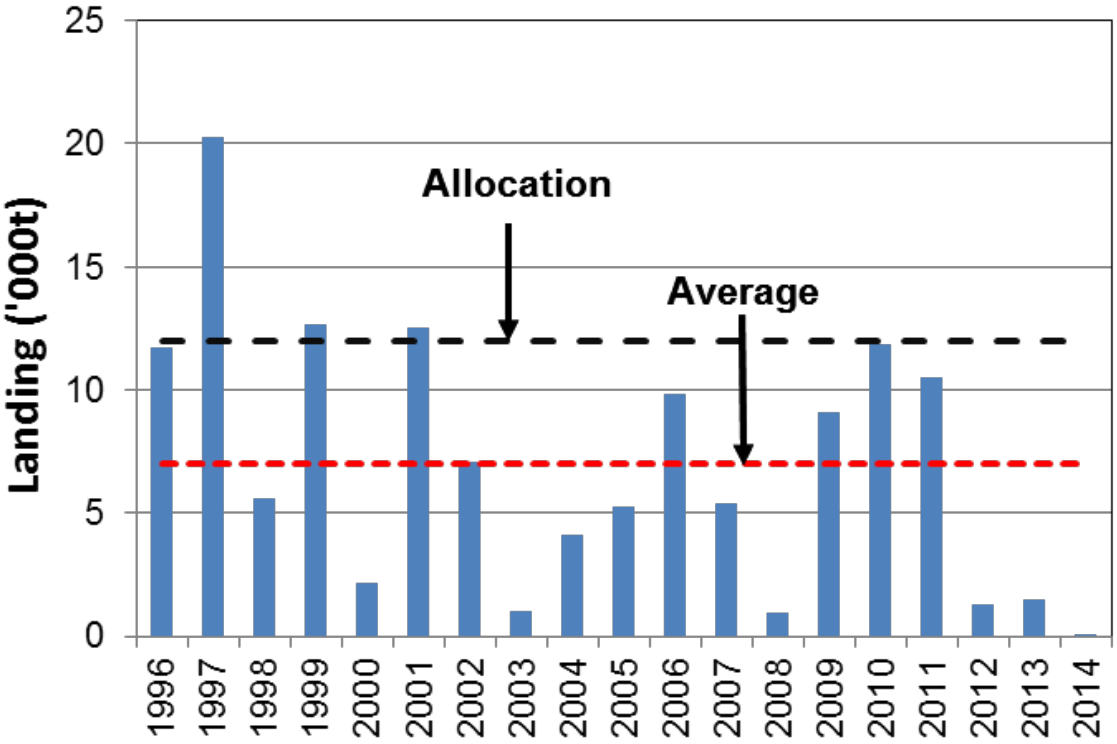

Figure 96. Offshore Scotian Shelf Component herring landings (includes bycatch in other fisheries) from 1996-2014 with12,000t allocation and the long term average.

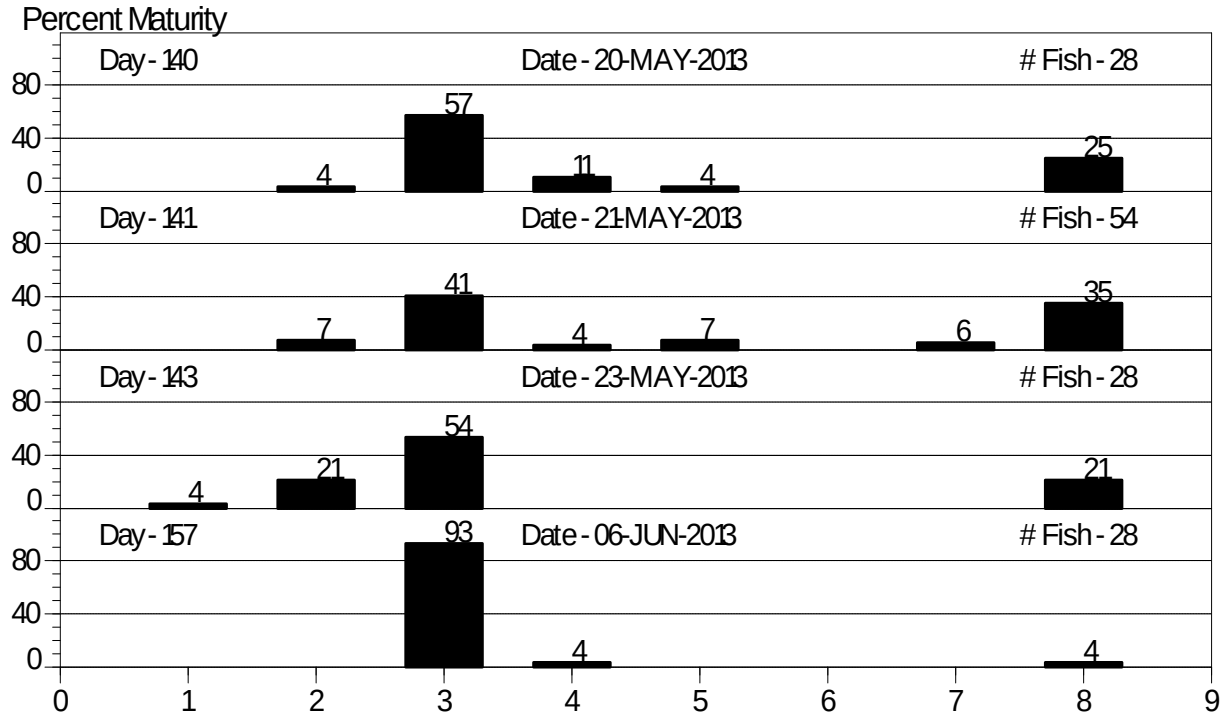

Figure 97A. Herring maturity samples collected from the Offshore Banks area in 2013. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

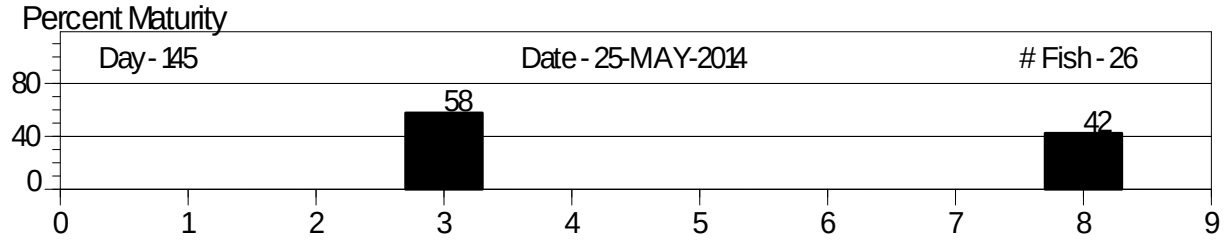

Figure 97B. Herring maturity samples collected from the Offshore Banks area in 2014. Staging codes are: 1-2=immature; 3-4-5=maturing/hard; 6=ripe and running; 7=spent; and 8=recovering.

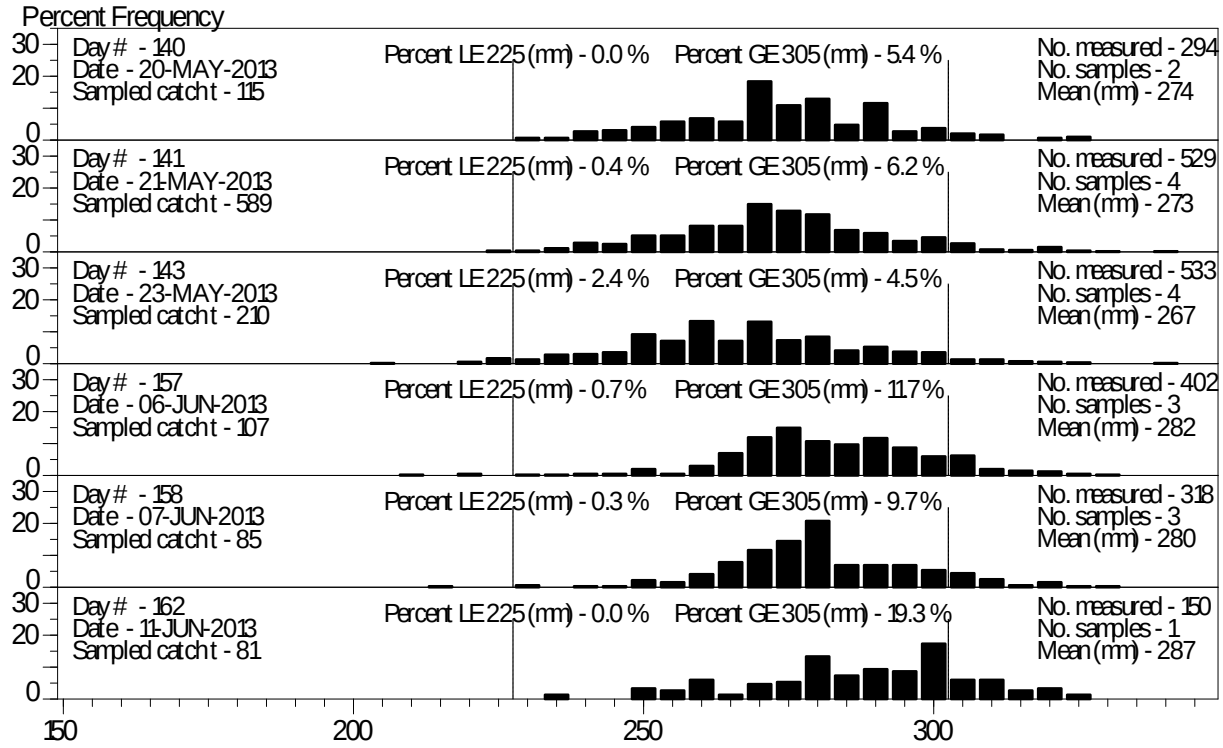

Figure 98A. Daily length frequency sampling collected from the Offshore Banks area in 2013, with proportions <23cm and >30cm.

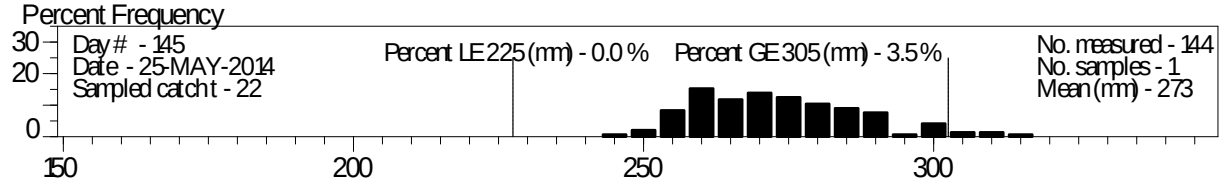

Figure 98B. Daily length frequency sampling collected from the Offshore Banks area in 2014, with proportions <23cm and >30cm.

APPENDIX

ACOUSTIC SURVEYS SUMMARY DETAILS BY SURVEY

Table A1. Scots Bay acoustic survey (#1) on June 22, 2013, using sample TS from fishery samples on June 23-25, 2013.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Main_box	-35.4	626	-52.253	0.020644	12,922.9	6,321	49
Western_edge_of_box	-35.28	38	-60.365	0.00310	118	67	57
North_box	-35.15	82	-61.192	0.00249	204	105	51
Total	-35.28	746	-52.903	0.01840	**13,245**	6,322	48%
Out_Box	-35.22	120	-60.913	0.00270	**322**	125	39%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Main_box	C213800H_2_In	41.828	-35.42	-61.816	0.00229
	C213801H_2_In	34.386	-35.42	-75.326	0.000102
	I413800H_2_In	46.17	-35.42	-62.386	0.002009
	I413801H_2_In	39.27	-35.42	-53.072	0.01715
	K413800H_2_In	45.152	-35.42	-63.133	0.001691
	K413801H_2_In	37.905	-35.42	-51.349	0.025506
	M423800H_2_In	43.033	-35.15	-56.062	0.008104
	M423801H_2_In	35.936	-35.15	-61.238	0.002461
	P413800H_2_In	44.149	-35.42	-48.091	0.054004
	P413801H_2_In	36.732	-35.42	-45.476	0.098595
Western_edge_of_box	C213800H_1_Out	2.776	-35.42	-1024.434	0
	C213801H_1_Out	3.096	-35.42	-1024.907	0
	I413800H_1_Out	2.452	-35.42	-69.538	0.000387
	I413801H_1_Out	2.614	-35.42	-53.744	0.014692
	K413800H_1_Out	2.575	-35.42	-72.046	0.000217
	K413801H_1_Out	2.808	-35.42	-1024.485	0
	M423800H_1_Out	2.444	-35.15	-54.077	0.0128
	M423801H_1_Out	3.504	-35.15	-60.398	0.002986
	P413800H_1_Out	2.626	-35.42	-63.938	0.001405
	P413801H_1_Out	2.964	-35.42	-69.554	0.000386
North_box	M413800H	17.94	-35.15	-57.300	0.006095
	M413801H	17.19	-35.15	-65.065	0.00102
	M413802H	15.76	-35.15	-66.610	0.001
	M413803H	9.47	-35.15	-64.120	0.001

Table A2. Scots Bay acoustic survey (#2) on July 6, 2013, using sample TS from fishery samples on July 8 and 9.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Scotsbay_2013_07_06	-35.47	626	-55.846	0.00916	5,736.1	1,589	28
W_edge_box	-35.39	49	-56.169	0.00836	409.6	133	32
North	-35.57	83	-62.845	0.00187	156	33	21
East	-35.31	145	-54.376	0.01239	1,797	1,331	74
Total	-35.44	903	-55.902	0.00900	**8,098**	2,077	26%
Out_Box	-35.42	277	-56.031	0.00850	**2,362**	1,338	57%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Scotsbay_2013_07_06	B413800H_NAV_2_In	40.24	-35.31	-55.54	0.009
	B413801H_NAV_2_In	33.06	-35.31	-58.05	0.005
	D413800H_2_In	42.77	-35.41	-57.80	0.006
	D413801H_1_In	35.43	-35.41	-63.13	0.002
	K413800H_2_In	45.67	-35.57	-61.45	0.003
	K413801H_1_In	38.07	-35.57	-52.58	0.020
	L413800H_2_In	41.55	-35.31	-52.85	0.018
	L413801H_1_In	34.39	-35.31	-59.99	0.003
	P413800H_2_In	44.15	-35.57	-50.89	0.029
	P413801H_1_In	36.62	-35.57	-56.95	0.007
	S413800H_2_In	45.62	-35.41	-67.12	0.001
	S413801H_1_In	39.04	-35.41	-58.73	0.005
W_edge_box	B413800H_NAV_1_Out	2.67	-35.31	-59.49	0.004
	B413801H_NAV_1_Out	2.72	-35.31	-60.42	0.003
	D413800H_1_Out	2.48	-35.41	-56.99	0.007
	D413801H_2_Out	3.55	-35.41	-61.72	0.002
	K413800H_1_Out	2.51	-35.57	-60.46	0.003
	K413801H_2_Out	2.77	-35.57	-53.60	0.016
	L413800H_1_Out	3.86	-35.31	-49.90	0.035
	L413801H_2_Out	3.27	-35.31	-59.47	0.004
	P413800H_1_Out	2.66	-35.57	-61.65	0.002
	P413801H_2_Out	2.90	-35.57	-59.50	0.004
	S413800H_1_Out	3.12	-35.41	-62.13	0.002
	S413801H_2_Out	2.96	-35.41	-55.55	0.010
North	C213800H	18.58	-35.57	-66.10	0.001
	C213801H	17.43	-35.57	-61.69	0.002
	C213802H	16.08	-35.57	-63.31	0.002
	C213803H	15.19	-35.57	-61.37	0.003
East	M413800H	9.89	-35.31	-66.96	0.001
	M413801H	11.83	-35.31	-68.13	0.001
	M413802H	14.72	-35.31	-65.39	0.001
	M413803H	16.93	-35.31	-49.57	0.037

Table A3. Scots Bay acoustic survey (#3) on July 20, 2013, using sample TS from fishery samples on July 22 and 23.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Inbox_jul_21	-35.390	626	-52.701	0.018565	11,621.6	3,934	34
Western_edge_of_box	-35.390	30	-61.694	0.002341	70.2	12	18
North	-35.300	49	-58.093	0.00526	257.6	74	29
East	-35.570	129	-1031.718	0.00000	0.0	0	8
Scots_2013_07_20	-35.413	834	-53.824	0.01430	**11,949**	3,935	33%
Out_Box	-35.420	208	-63.343	0.00160	**328**	75	23%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Inbox_jul_21	I413800H_2_In	45.313	-35.41	-59.545	0.003857
	I413801H_1_In	38.751	-35.41	-50.733	0.029335
	K413800H_2_In	43.639	-35.57	-56.402	0.008248
	K413801H_1_In	36.291	-35.57	-52.783	0.018982
	L413800H_2_In	44.266	-35.3	-52.371	0.019628
	L413801H_1_In	37.968	-35.3	-57.821	0.005596
	M413800H_2_In	40.101	-35.3	-54.813	0.011187
	M413801H_1_In	33.951	-35.3	-55.509	0.009531
	M423800H_2_In	41.062	-35.3	-45.139	0.10377
	M423801H_1_In	34.611	-35.3	-57.446	0.006102
	P413800H_2_In	42.024	-35.57	-49.513	0.040296
	P413801H_2_In	35.768	-35.57	-58.062	0.005629
	S413800H_2_In	39.847	-35.41	-60.466	0.003119
	S413801H_1_In	33.345	-35.41	-64.423	0.001254
	S513800H_2_In	43.635	-35.41	-53.682	0.014878
	S513801H_1_In	37.395	-35.41	-56.951	0.007008
Western_edge_of_box	I413800H_1_Out	1.942	-35.41	-59.835	0.003608
	I413801H_2_Out	1.968	-35.41	-72.898	0.000178
	K413800H_1_Out	1.966	-35.57	-65.830	0.000941
	K413801H_2_Out	1.961	-35.57	-70.057	0.000356
	L413800H_1_Out	1.942	-35.3	-60.673	0.002902
	L413801H_2_Out	1.942	-35.3	-65.794	0.000892
	M413800H_1_Out	1.964	-35.3	-59.066	0.004201
	M413801H_2_Out	1.934	-35.3	-59.019	0.004247
	M423800H_1_Out	1.97	-35.3	-59.234	0.004042
	M423801H_2_Out	2.028	-35.3	-61.105	0.002627
	P413800H_1_Out	1.99	-35.57	-62.691	0.001939
	P413801H_1_Out	1.941	-35.57	-58.215	0.005434
	S413800H_1_Out	2.025	-35.41	-95.743	0.000001
	S413801H_2_Out	1.968	-35.41	-61.593	0.002407
	S513800H_1_Out	1.94	-35.41	-61.670	0.002
	S513801H_2_Out	1.95	-35.41	-63.790	0.001
North	B413800H_NAV	18.18	-35.30	-60.410	0.003
	B413801H_NAV	17.51	-35.30	-59.480	0.004
	B413802H_NAV	16.78	-35.30	-55.440	0.010
	B413803H_NAV	8.90	-35.30	-59.100	0.004
East	C213800H_SONAR	12.16	-35.57	-1030.85	0.000
	C213801H_SONAR	14.09	-35.57	-1031.49	0.000
	C213802H_SONAR	15.74	-35.57	-1031.97	0.000
	C213803H_SONAR	17.42	-35.57	-1032.41	0.000

Table A4. Scots Bay acoustic survey (#4) on August 3, 2013, using sample TS from fishery samples on August 5.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Main_box_aug_03	-35.250	626	-54.492	0.01190	7447	2,103	28
Western_edge_of_box	-35.240	44	-53.560	0.01472	648	342	53
North	-35.180	63	-50.964	0.02642	1664	1,005	60
East	-35.450	131	-1031.796	0.00000	0	-	9
Scotsbay_2013_08_03	-35.280	864	-54.706	0.01130	**9759**	2,356	24%
Out_Box	-35.290	238	-55.324	0.00970	**2,312**	1,062	46%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Main_box_aug_03	D413800H_2_In	45.182	-35.29	-51.550	0.023659
	D413801H_1_In	38.401	-35.29	-61.153	0.002592
	K413800H_2_In	43.223	-35.45	-60.820	0.002904
	K413801H_1_In	36.641	-35.45	-59.558	0.003883
	M413800H_2_In	40.255	-35.18	-48.255	0.049294
	M413801H_1_In	34.001	-35.18	-51.599	0.022826
	M423800H_2_In	41.364	-35.18	-52.086	0.020403
	M423801H_1_In	35.212	-35.18	-57.753	0.005533
	P413800H_2_In	42.488	-35.45	-56.091	0.008625
	P413801H_1_In	36.181	-35.45	-58.298	0.005189
	S413800H_2_In	39.404	-35.29	-57.060	0.006653
	S413801H_1_InA	12.705	-35.29	-59.279	0.003991
	S413801H_1_InB	14.847	-35.29	-63.037	0.00168
	S513800H_2_In	44.528	-35.29	-58.583	0.004685
	S513801H_1_In	37.724	-35.29	-60.504	0.00301
Western_edge_of_box	D413800H_1_Out	2.678	-35.29	-60.563	0.00297
	D413801H_2_Out	4.458	-35.29	-61.069	0.002643
	K413800H_1_Out	2.782	-35.45	-55.750	0.00933
	K413801H_2_Out	3.182	-35.45	-66.778	0.000736
	M413800H_1_Out	2.61	-35.18	-54.577	0.011498
	M413801H_2_Out	2.512	-35.18	-60.253	0.003112
	M423800H_1_Out	2.546	-35.18	-54.268	0.012346
	M423801H_2_Out	3.157	-35.18	-44.614	0.113999
	P413800H_1_Out	2.735	-35.45	-58.057	0.005485
	P413801H_2_Out	3.038	-35.45	-52.592	0.019306
	S413800H_1_Out	2.227	-35.29	-56.572	0.007443
	S413801H_2_Out	2.953	-35.29	-66.090	0.000832
	S513800H_1_Out	2.802	-35.29	-58.528	0.004745
	S513801H_2_Out	3.711	-35.29	-56.800	0.007064
North	B413800H	18.045	-35.18	-53.082	0.01622
	B413801H	17.461	-35.18	-54.430	0.011892
	B413802H	16.588	-35.18	-46.446	0.074766
	B413803H	18.134	-35.18	-57.168	0.006331
East	C213800H	12.131	-35.45	-1030.839	0
	C213801H	14.327	-35.45	-1031.562	0
	C213802H	16.23	-35.45	-1032.10	0.000
	C213803H	17.79	-35.45	-1032.50	0.000

Table A5. Scots Bay acoustic survey (#5) on August 17, 2013, using sample TS from fishery samples on August 19.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
In_box	-35.390	626	-52.228	0.021	12,961	2,808	22
Western_edge_of_box	-35.390	47	-49.101	0.043	1,998	628	31
North	-35.460	75	-63.838	0.001	109	26	24
Total	-35.413	748	-52.348	0.020	**15,068**	2,877	19%
Out_Box	-35.425	122	-53.017	0.0175	**2,107**	629	30%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
In_box	B413800H_2_In	39.508	-35.35	-50.101	0.0335
	B413801H_1_In	13.658	-35.35	-53.519	0.015248
	B413801H_2_In	13.75	-35.35	-50.488	0.03064
	C213800H_2_In	41.016	-35.62	-62.985	0.001833
	C213801H_1_In	34.365	-35.62	-1035.361	0
	I413800H_2_In	43.695	-35.46	-52.191	0.021222
	I413801H_1_In	37.52	-35.46	-48.800	0.046329
	L413800H_2_In	45.171	-35.35	-53.530	0.015208
	L413801H_1_In	39.05	-35.35	-58.169	0.005226
	M413800H_2_In	41.854	-35.35	-50.064	0.03378
	M413801H_1_In	38.417	-35.35	-51.049	0.02693
Western_edge_of_box	B413800H_1_Out	3.439	-35.35	-50.255	0.032332
	B413801H_6_Out	2.05	-35.35	-52.638	0.018677
	C213800H_1_Out	2.788	-35.62	-1024.452	0
	C213801H_2_Out	2.782	-35.62	-1024.444	0
	I413800H_1_Out	2.727	-35.46	-49.988	0.035243
	I413801H_2_Out	3.036	-35.46	-45.705	0.094502
	L413800H_1_Out	2.6	-35.35	-50.423	0.031101
	L413801H_2_Out	2.708	-35.35	-44.201	0.130319
	M413800H_1_Out	2.917	-35.35	-47.819	0.056645
	M413801H_2_Out	2.08	-35.35	-55.140	0.011
North	S413800H_1_Out	18.48	-35.46	-62.220	0.002
	S413801H_1_Out	17.31	-35.46	-63.900	0.001
	S413802H_1_Out	16.08	-35.46	-63.270	0.002
	S413803H_1_Out	15.06	-35.46	-68.910	0.000

Table A6. Scots Bay acoustic survey (#6) on August 31, 2013, using sample TS from fishery samples on September 2.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Inbox	-35.42	626	-52.372	0.0202	12,634	5,875	47
Western_edge_of_box	-35.40	47	-51.035	0.0273	1,283	906	71
Total	-35.41	673	-52.264	0.0207	**13,917**	5,944	43%
Out_box	-35.40	47	-51.035	0.0273	**1,283**	906	71%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Inbox	B413800H_2_In	39.883	-35.4	-46.138	0.084291
	B413801H_1_In	33.515	-35.4	-53.181	0.016654
	C213800H_2_In	41.27	-35.66	-55.757	0.009783
	C213801H_1_In	35.047	-35.66	-57.409	0.006689
	M413800H_2_In	43.405	-35.4	-53.979	0.013857
	M413801H_1_In	36.53	-35.4	-52.516	0.019408
	M423800H_2_In	44.949	-35.4	-1036.53	0
	M423801H_1_In	38.43	-35.4	-54.718	0.011689
Western_edge_of_box	B413800H_1_Out	3.07	-35.40	-43.37	0.159
	B413801H_2_Out	3.28	-35.40	-53.02	0.017
	C213800H_1_Out	2.90	-35.66	-77.89	0.000
	C213801H_2_Out	2.78	-35.66	-1024.44	0.000
	M413800H_1_Out	2.73	-35.40	-57.54	0.006
	M413801H_2_Out	2.46	-35.40	-57.13	0.007
	M423800H_1_Out	2.37	-35.40	-1023.74	0.000
	M423801H_2_Out	2.88	-35.40	-54.63	0.012

Table A7. Scots Bay acoustic survey (#7) on September 14, 2013, using standard TS (no samples).

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Inbox	-35.590	450	-56.574	0.0080	3,589	1,203	34
Western_edge_of_box	-35.580	35	-53.292	0.0169	592	306	52
Total	-35.585	485	-56.234	0.0086	**4,181**	1,241	30%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Inbox	A413800H_2_In	42.229	-35.62	-52.891	0.018733
	A413801H_1_In	37.282	-35.62	-59.280	0.00430
	C213800H_2_In	41.201	-35.78	-57.550	0.00665
	C213801H_1_In	36.695	-35.78	-1035.646	0.00000
	D413800H_2_In	43.374	-35.62	-58.430	0.00523
	D413801H_1_In	38.696	-35.62	-62.997	0.00183
	L413800H_2_In	39.704	-35.51	-52.434	0.02031
	L413801H_1_In	35.177	-35.51	-58.470	0.00506
Western_edge_of_box	A413800H_1_Out	2.511	-35.62	-53.318	0.01698
	A413801H_2_Out	2.774	-35.62	-47.485	0.06505
	C213800H_1_Out	2.647	-35.78	-61.679	0.00257
	C213801H_2_Out	2.879	-35.78	-1024.593	0.00000
	D413800H_1_Out	2.739	-35.62	-68.521	0.00051
	D413801H_2_Out	3.484	-35.62	-59.740	0.00387
	L413800H_1_Out	3.456	-35.51	-48.922	0.04558
	L413801H_2_Out	3.844	-35.51	-61.621	0.00245

Table A8. German Bank acoustic survey (#1) on August 19, 2013, using sample TS from fishery samples on August 20.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
German_inbox	-35.42	646	-46.267	0.082	53,174	15,875	30
German_outbox	-35.4	188	-62.89	0.001783	335.2	175	52
Total_German_2013_08_13	-35.41	834	-47.349	0.0642	**53,509**	15,876	30%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
German_inbox	D413800H	37.04	-35.44	-42.05	0.218
	I413800H	37.09	-35.44	-43.98	0.140
	I413801H	37.04	-35.44	-46.40	0.080
	K413800H	37.21	-35.60	-45.32	0.107
	K413801H	37.25	-35.60	-62.91	0.002
	L413800H	37.12	-35.33	-41.19	0.259
	L413801H	36.80	-35.33	-47.06	0.067
	M423800H	37.11	-35.33	-59.33	0.004
	P413800H	37.22	-35.60	-51.79	0.024
	P413801H	37.34	-35.60	-59.15	0.004
	S413800H	37.20	-35.44	-48.00	0.055
	S513800H	37.01	-35.44	-51.01	0.028
German_outbox	D413801H	37.41	-35.44	-59.24	0.004
	M423801H	37.38	-35.33	-61.76	0.002
	S413801H	37.28	-35.44	-67.37	0.001
	S513801H	36.344	-35.44	-1035.604	0

Table A9. German Bank acoustic survey (#2) on September 3, 2013, using sample TS from fishery samples September 4.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
German_inbox	-35.31	646	-42.912	0.174	112,241.4	66,714	59
German_outbox	-35.3	142	-49.156	0.041173	5,846.5	1974	34
Total_2013_09_03	-35.31	788	-43.554	0.1499	**118,088**	66,743	57%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
German_inbox	D413800H	37.26	-35.37	-49.17	0.042
	I413800H	37.57	-35.37	-42.91	0.176
	I413801H	36.52	-35.37	-62.64	0.002
	K413800H	37.29	-35.53	-50.56	0.031
	K413801H	37.18	-35.53	-52.33	0.021
	L413800H	37.89	-35.27	-34.30	1.249
	L413801H	37.19	-35.27	-49.24	0.040
	M423800H	36.72	-35.27	-49.91	0.034
	P413800H	37.33	-35.53	-52.38	0.021
	P413801H	37.23	-35.53	-52.97	0.018
	S513800H	37.21	-35.37	-39.31	0.404
	S513801H	36.83	-35.37	-52.16	0.021
German_outbox	D413801H	37.10	-35.37	-51.02	0.027
	M423801H	37.07	-35.27	-47.86	0.055

Table A10. German Bank acoustic survey (#3) on September 17, 2013, using sample TS from fishery samples on September 18 and 19.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
German_inbox	-35.02	646	-46.608	0.0693	44,789.4	25,455	57
German_outbox	-34.92	152	-61.469	0.0022	336.5	144	43
Total_2013_09_17	-34.97	798	-47.492	0.0565	**45,126***	25,455	56%
*Total Strata biomass (t) adjusted for 16% juveniles to 37,906.							

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
German_inbox	D413800H	36.63	-34.92	-60.08	0.003
	I413800H	36.64	-34.92	-40.81	0.257
	I413801H	36.86	-34.92	-56.58	0.007
	K413800H	36.93	-35.08	-45.46	0.092
	K413801H	37.85	-35.08	-53.98	0.013
	L413800H	36.89	-34.81	-56.62	0.007
	L413801H	37.04	-34.81	-53.78	0.013
	M423800H	37.11	-34.81	-52.80	0.016
	M423801H	37.42	-34.81	-52.97	0.015
	P413800H	37.30	-35.08	-37.89	0.523
	P413801H	36.49	-35.08	-57.13	0.006
	S413800H	37.05	-34.92	-62.81	0.002
	S513800H	37.36	-34.92	-70.99	0.000
	T413800H	36.76	-34.92	-52.93	0.016
German_outbox	D413801H	37.03	-34.92	-58.320	0.005
	S413801H	36.024	-34.92	-64.096	0.001209
	S513801H	36.164	-34.92	-71.113	0.00024
	T413801H	36.981	-34.92	-60.507	0.002763

Table A11. German Bank acoustic survey (#4) on September 29, 2013, using sample TS from fishery samples on September 30.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Gernam_inbox	-34.970	595	-46.233	0.0748	44,501.6	30,572	69
Gernam_outbox	-35.000	235	-52.781	0.0167	3917	2527	65
Total_2013-09-29	-34.985	830	-47.315	0.0583	**48,419**	30,676	63%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Gernam_inbox	D413800H_02_In	33.45	-35.04	-58.82	0.004
	I413800H_02_In	33.42	-35.04	-41.15	0.245
	I413801H_01_In	33.25	-35.04	-65.11	0.001
	K413800H_02_In	33.55	-35.20	-59.93	0.003
	K413801H_01_In	33.35	-35.20	-60.18	0.003
	L413800H_02_In	33.59	-34.94	-37.62	0.539
	L413801H_01_In	33.34	-34.94	-61.38	0.002
	M423800H_02_In	33.50	-34.94	-54.47	0.011
	P413800H_02_In	33.51	-35.20	-57.90	0.005
	P413801H_01_In	33.20	-35.20	-64.09	0.001
	S413800H_02_In	32.44	-35.04	-63.26	0.002
Gernam_outbox	D413800H_01_Out	3.23	-35.04	-51.92	0.021
	D413801H_01_Out	36.66	-35.04	-57.43	0.006
	I413800H_01_Out	3.42	-35.04	-51.51	0.023
	I413801H_02_Out	3.61	-35.04	-58.94	0.004
	K413800H_01_Out	2.88	-35.20	-51.95	0.021
	K413801H_02_Out	3.57	-35.20	-53.49	0.015
	L413800H_01_Out	3.01	-34.94	-45.85	0.081
	L413801H_02_Out	3.62	-34.94	-53.01	0.016
	M423800H_01_Out	3.58	-34.94	-45.65	0.085
	M423801H_01_Out	37.40	-34.94	-51.91	0.020
	P413800H_01_Out	3.81	-35.20	-50.53	0.029
	P413801H_02_Out	3.69	-35.20	-54.11	0.013
	S413800H_01_Out	3.19	-35.04	-43.53	0.142
	S413801H_01_Out	36.48	-35.04	-67.50	0.001

Table A12. German Bank acoustic survey (#5) on October 14, 2013, using sample TS from fishery samples on October 11.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
German_inbox	-35.30	646	-55.351	0.0099	6,381.3	1,829	29
German_outbox	-35.30	188	-64.531	0.0012	224.6	100	45
Total_2013-10-14	-35.30	834	-56.310	0.0079	**6,606**	1,831.732	28%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
German_inbox	D413800H	37.033	-35.30	-61.01	0.00269
	K413800H	37.024	-35.46	-58.24	0.00527
	K413801H	37.065	-35.46	-60.98	0.00281
	L413800H	37.527	-35.20	-51.40	0.02396
	L413801H	37.081	-35.20	-54.17	0.01266
	M423800H	37.494	-35.20	-53.46	0.01492
	M423801H	36.517	-35.20	-56.88	0.00679
	P413800H	37.143	-35.46	-51.46	0.02514
	P413801H	37.025	-35.46	-60.04	0.00348
	S413800H	37.054	-35.30	-66.68	0.00073
German_outbox	D413801H	37.270	-35.30	-62.93	0.00173
	S413801H	36.938	-35.30	-67.123	0.000658

Table A13. Stratum/school summary results for Trinity Ledge acoustic survey (#1) on August 12, 2013, using sample TS from multi-panel gillnet sample of August 12 and commercial fishery samples on August 14.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Trinity_2013_08_12	-35.74	0.13	-27.239	7.081	**921**	197	21

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Trinity_2013_08_12	W413800H	0.246	-35.74	-40.4	0.340742
	W413801H	0.366	-35.74	-41.4	0.272192
	W413802H	0.32	-35.74	-24.4	13.630326
	W413803H	0.314	-35.74	-27.7	6.349079
	W413804H	0.229	-35.74	-27.5	6.612254
	W413805H	0.233	-35.74	-26.6	8.266107
	W413806H	0.313	-35.74	-27.1	7.360179
	W413807H	0.28	-35.74	-26.0	9.48108
	W413808H	0.281	-35.74	-25.0	11.910013

Table A14. Stratum/school summary results for Trinity Ledge acoustic survey (#2) on September 16, 2013, using standard TS (no samples were collected).

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Trinity_2013_09_16	-35.96	0.09	-41.075	0.308	**29**	11	38

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Trinity_2013_09_16	W413800H	0.271	-35.96	-40.0	0.393319
	W413801H	0.252	-35.96	-38.0	0.621242
	W413802H	0.158	-35.96	-52.3	0.023242
	W413803H	0.119	-35.96	-1011	0
	W413804H	0.27	-35.96	-42.3	0.2319

Table A15. Stratum/school summary results for Little Hope acoustic survey (#1) on September 19, 2013, using sample TS from multi-panel gillnet sample of September 18 and 21.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
E8_sch01_pass01	-35.7	1.71	-33.046	1.84176	3,149.4	2,260	72
E8_sch01_pass02	-35.7	3	-33.354	1.71569	5,147.1	2,133	41
E8_sch01_pass03	-35.7	3.02	-30.818	3.0764	**9,291**	3,452	37
As_sch01_pass01	-35.7	4.43	-42.451	0.2112	**936**	177	19
As_sch02_pass01	-35.7	9.84	-40.204	0.3543	**3,487**	1,304	37
EasternS_2013_09_19	-35.7	17.29	-36.705	0.7931	**13,713**	3,694	27%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
E8_sch01_pass01	E413800H	0.973	-35.7	-54.204	0.014107
	E413801H	0.886	-35.7	-52.086	0.022971
	E413802H	1.003	-35.7	-38.476	0.527462
	E413803H	1.217	-35.7	-27.341	6.849392
	E413804H	1.026	-35.7	-38.792	0.490416
E8_sch01_pass02	E413805H	0.829	-35.7	-62.196	0.00224
	E413806H	0.974	-35.7	-37.988	0.590135
	E413807H	1.087	-35.7	-61.394	0.002694
	E413808H	1.033	-35.7	-29.379	4.284493
	E413809H	1.29	-35.7	-31.014	2.940105
	E413810H	1.512	-35.7	-33.115	1.812543
E8_sch01_pass03	E413811H	2.15	-35.70	-28.94	4.736
	E413812H	2.09	-35.70	-27.77	6.205
	E413813H	1.98	-35.70	-33.58	1.627
	E413814H	1.75	-35.70	-33.92	1.505
	E413815H	1.46	-35.70	-53.11	0.018
As_sch01_pass01	A513800H	3.61	-35.70	-42.78	0.196
	A513801H	2.15	-35.70	-40.51	0.331
	A513802H	2.65	-35.70	-41.25	0.278
	A513803H	3.02	-35.70	-43.45	0.168
	A513804H	2.34	-35.70	-45.48	0.105
As_sch02_pass01	A513805H	0.45	-35.70	-59.53	0.004
	A513806H	1.96	-35.70	-40.74	0.313
	A513807H	1.69	-35.70	-34.53	1.310
	A513808H	1.90	-35.70	-38.00	0.588
	A513809H	2.26	-35.70	-36.47	0.838
	A513810H	3.99	-35.70	-41.31	0.274
	A513811H	4.89	-35.70	-36.10	0.912
	A513812H	4.42	-35.70	-47.32	0.069
	A513813H	6.19	-35.70	-45.17	0.113
	A513814H	4.64	-35.70	-48.44	0.053
	A513815H	3.81	-35.70	-48.98	0.047

Table A16. Stratum/school summary results for Little Hope acoustic survey (#2) on September 29, 2013, using sample TS from multi-panel gillnet sample of September 18 and 21. One school was surveyed twice by the Atlantic Star; the pass with the lower biomass was excluded from estimate (grey cells).

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
As_sch01_pass01	-35.7	3.93	-36.412	0.84834	3,334	1,404	42
As_sch02_pass01	-35.7	0.72	-40.608	0.322814	232	232	100
As_sch03_pass01	-35.7	1.13	-57.341	0.00685	8	5	66
As_sch01_pass02	-35.7	1.68	-42.627	0.202813	341	268	79
E8_sch01_pass01	-35.7	0.37	-36.557	0.821	304	348	115
LH_2013_09_29	-35.96	6.15	-37.701	0.631	**3,878**	1,489	38%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
As_sch01_pass01	A513800H	0.669	-35.7	-60.634	0.003209
	A513801H	0.606	-35.7	-59.003	0.004671
	A513802H	0.77	-35.7	-56.640	0.00805
	A513803H	0.765	-35.7	-61.277	0.002768
	A513804H	1.286	-35.7	-60.614	0.003224
	A513805H	0.731	-35.7	-53.697	0.015851
	A513806H	0.969	-35.7	-47.993	0.058948
	A513807H	0.857	-35.7	-60.215	0.003534
	A513808H	1.613	-35.7	-47.354	0.068295
	A513809H	0.998	-35.7	-31.312	2.745512
	A513810H	1.153	-35.7	-37.708	0.629463
	A513811H	1.373	-35.7	-31.427	2.673477
	A513812H	1.507	-35.7	-29.281	4.382021
	A513813H	1.694	-35.7	-57.289	0.006933
	A513814H	1.463	-35.7	-57.707	0.006297
As_sch02_pass01	A513815H	0.509	-35.7	-32.832	1.93471
	A513816H	0.466	-35.7	-62.765	0.001965
	A513817H	0.586	-35.7	-61.130	0.002863
	A513818H	0.475	-35.7	-59.978	0.003732
	A513819H	0.507	-35.7	-59.350	0.004313
	A513820H	0.547	-35.7	-54.974	0.011814
As_sch03_pass01	A513821H	0.726	-35.7	-61.883	0.002407
	A513822H	0.897	-35.7	-64.051	0.001461
	A513823H	0.755	-35.7	-63.310	0.001733
	A513824H	0.897	-35.7	-63.434	0.001684
	A513825H	0.847	-35.7	-51.036	0.029253
	A513826H	0.837	-35.7	-59.727	0.003954
As_sch01_pass02	A513827H	1.258	-35.7	-35.812	0.974166
	A513828H	1.009	-35.7	-61.146	0.002852
	A513829H	1.111	-35.7	-60.663	0.003188
	A513830H	1.01	-35.70	-60.440	0.003
	A513831H	1.06	-35.70	-59.960	0.004
	A513832H	1.12	-35.70	-46.610	0.081
E8_sch01_pass01	E413800H	0.42	-35.70	-59.380	0.004
	E413801H	0.43	-35.70	-28.960	4.715
	E413802H	0.56	-35.70	-59.290	0.004
	E413803H	0.56	-35.70	-55.100	0.011
	E413804H	0.50	-35.70	-58.530	0.005

Table A17. Stratum/school summary results for Little Hope acoustic survey (#3) on October 10, 2013, using sample TS from multi-panel gillnet sample of October 11 and 14.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
E8_sch01	-35.35	4.77	-29.501	3.845	18,340	3,648	20
As_sch01	-35.35	4.96	-36.344	0.795	3,945	3,060	78
As_sch02	-35.35	5.08	-38.321	0.504596	2,563	259	10
As_sch03	-35.35	2.96	-30.447	3.092531	9,154	2,369	26
LH_2013_10_10	-35.35	17.77	-32.532	1.9135	**34,002***	5,325	0.157%
*Total Strata biomass (t) adjusted for 10% juveniles to 30,602.							

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
E8_sch01	E413800H	1.546	-35.35	-62.126	0.002101
	E413801H	1.586	-35.35	-35.250	1.023303
	E413802H	1.713	-35.35	-27.570	5.998561
	E413803H	2.036	-35.35	-36.371	0.790559
	E413804H	1.905	-35.35	-30.423	3.109505
	E413805H	1.707	-35.35	-27.987	5.449403
	E413806H	1.628	-35.35	-28.195	5.193657
	E413807H	1.6	-35.35	-27.820	5.662244
	E413808H	1.441	-35.35	-28.318	5.048933
	E413809H	1.014	-35.35	-26.744	7.254756
	E413810H	1.11	-35.35	-26.273	8.085152
	E413811H	0.921	-35.35	-28.496	4.845878
	E413812H	1.125	-35.35	-57.985	0.005451
As_sch01	A513800H	0.431	-35.35	-55.007	0.010822
	A513801H	1.097	-35.35	-48.733	0.045888
	A513802H	1.054	-35.35	-48.287	0.050852
	A513803H	1.24	-35.35	-46.945	0.069258
	A513804H	1.067	-35.35	-51.508	0.024223
	A513805H	1.61	-35.35	-40.741	0.289002
	A513806H	1.086	-35.35	-26.266	8.098531
	A513807H	1.358	-35.35	-31.707	2.313425
	A513808H	1.195	-35.35	-40.277	0.32159
	A513809H	1.717	-35.35	-35.980	0.865026
	A513810H	3.134	-35.35	-38.142	0.525758
	A513811H	3.413	-35.35	-40.639	0.295876
	A513812H	3.235	-35.35	-52.764	0.018137
As_sch02	A513813H	1.274	-35.35	-38.828	0.448912
	A513814H	2.35	-35.35	-38.518	0.48218
	A513815H	2.497	-35.35	-37.821	0.566106
	A513816H	4.147	-35.35	-36.505	0.766474
	A513817H	4.174	-35.35	-38.709	0.461384
	A513818H	3.821	-35.35	-39.774	0.361079
	A513819H	3.714	-35.35	-39.325	0.40036
As_sch03	A513820H	1.246	-35.35	-28.383	4.973864
	A513821H	1.646	-35.35	-28.737	4.58461
	A513822H	2.061	-35.35	-27.824	5.657648
	A513823H	1.95	-35.35	-30.133	3.324191
	A513824H	2.352	-35.35	-29.832	3.562672
	A513825H	2.131	-35.35	-62.428	0.00196
	A513826H	2.267	-35.35	-35.999	0.86129

Table A18 (continued below). Stratum/school summary results for Little Hope acoustic survey (#4) on October 21, 2013, using sample TS from multi-panel gillnet sample of October 11 and 14.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
As_sch01	-35.35	2.72	-32.252	2.04078	5,550.9	2,256	41
As_sch02	-35.35	13.78	-35.28	1.016261	14,004.1	1,414	10
As_sch03	-35.35	2.55	-36.944	0.692822	1,766.7	900	51
E8_sch01	-35.35	2.21	-40.121	0.333333	736.7	266	36
E8_sch02	-35.35	1.18	-34.767	1.143545	1,349.4	438	32
E8_sch03	-35.35	2.26	-31.214	2.591966	5,857.8	894	15
LH_2013_10_21	-35.96	24.7	-34.613	1.36320	**29,266***	995.53	3%
*Total Strata biomass (t) adjusted for 10% juveniles to 26,339.							

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
As_sch01	A513800H	0.528	-35.35	-54.844	0.011235
	A513801H	1.024	-35.35	-31.229	2.582612
	A513802H	1.493	-35.35	-50.062	0.033789
	A513803H	1.309	-35.35	-38.317	0.504967
	A513804H	1.353	-35.35	-49.748	0.036327
	A513805H	1.357	-35.35	-28.696	4.628244
	A513806H	1.302	-35.35	-26.405	7.843974
	A513807H	1.174	-35.35	-37.819	0.566428
	A513808H	1.355	-35.35	-30.666	2.940437
	A513809H	1.175	-35.35	-46.88	0.070305
As_sch02	A513810H	1.061	-35.35	-42.199	0.206608
	A513811H	3.494	-35.35	-38.470	0.487535
	A513812H	3.179	-35.35	-37.646	0.589436
	A513813H	4.27	-35.35	-37.915	0.553993
	A513814H	3.593	-35.35	-39.019	0.429666
	A513815H	2.669	-35.35	-36.438	0.778466
	A513816H	2.038	-35.35	-33.870	1.405898
	A513817H	3.353	-35.35	-33.288	1.607793
	A513818H	3.414	-35.35	-33.666	1.473628
	A513819H	3.267	-35.35	-33.504	1.529546
	A513820H	3.347	-35.35	-33.766	1.440036
	A513821H	3.373	-35.35	-34.314	1.269511
	A513822H	3.477	-35.35	-33.916	1.391296
	A513823H	3.436	-35.35	-34.864	1.118492
	A513824H	3.325	-35.35	-35.213	1.03207
	A513825H	3.033	-35.35	-35.683	0.926162
	A513826H	2.866	-35.35	-35.116	1.055342
	A513827H	3.066	-35.35	-37.076	0.672046
As_sch03	A513828H	2.123	-35.35	-32.326	2.006405
	A513829H	1.863	-35.35	-33.941	1.383399
	A513830H	1.705	-35.35	-39.998	0.342915
	A513831H	1.723	-35.35	-68.053	0.000537
	A513832H	1.578	-35.35	-67.975	0.000546
	A513833H	1.725	-35.35	-74.979	0.000109

Table A18 (continued from above). Stratum/school summary results for Little Hope acoustic survey (#4) on October 21, 2013, using sample TS from multi-panel gillnet sample of October 11 and 14.

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
E8_sch01	E413800H	1.185	-35.35	-42.993	0.172067
	E413801H	1.134	-35.35	-42.745	0.182199
	E413802H	1.556	-35.35	-35.802	0.901223
	E413803H	1.565	-35.35	-35.690	0.924664
	E413804H	1.726	-35.35	-42.011	0.215729
	E413805H	1.435	-35.35	-39.844	0.355315
	E413806H	1.693	-35.35	-52.684	0.018474
	E413807H	1.302	-35.35	-62.122	0.002103
	E413808H	0.96	-35.35	-55.563	0.009522
E8_sch02	E413809H	0.653	-35.35	-65.893	0.000882
	E413810H	0.972	-35.35	-33.780	1.435439
	E413811H	0.9	-35.35	-31.318	2.530537
	E413812H	0.969	-35.35	-33.113	1.673815
	E413813H	0.955	-35.35	-34.780	1.140153
	E413814H	0.861	-35.35	-47.855	0.056168
	E413815H	0.329	-35.35	-48.215	0.051705
E8_sch03	E413816H	0.192	-35.35	-40.834	0.28291
	E413817H	1.15	-35.35	-33.944	1.382336
	E413818H	1.223	-35.35	-33.169	1.652257
	E413819H	1.363	-35.35	-29.612	3.748082
	E413820H	1.452	-35.35	-29.987	3.437943
	E413821H	1.758	-35.35	-30.678	2.932215
	E413822H	1.798	-35.35	-31.702	2.316588
	E413823H	1.371	-35.35	-31.376	2.497141
	E413824H	1.378	-35.35	-30.030	3.404086
	E413825H	1.018	-35.35	-29.853	3.545729
	E413826H	0.728	-35.35	-60.712	0.002909

Table A19. Stratum/school summary results for Eastern Shore acoustic survey (#1) on September 24, 2013, using standard TS (no samples were collected).

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Esfpa_2013_09_24	-35.96	0.48	-33.809	1.641	**788**	71	9

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Esfpa_2013_09_24	M513800H	0.64	-35.96	-33.05	1.955
	M513801H	0.56	-35.96	-35.17	1.200
	M513802H	0.64	-35.96	-34.20	1.499
	M513803H	0.55	-35.96	-35.48	1.117
	M513804H	0.44	-35.96	-34.79	1.310
	M513805H	0.77	-35.96	-33.09	1.938
	M513806H	0.56	-35.96	-32.32	2.313
	M513807H	0.34	-35.96	-34.13	1.524

Table A20. Stratum/school summary results for Eastern Shore acoustic survey (#2) on September 28, 2013, using sample TS from multi-panel gillnet sample of September 29.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Sch01_bk	-35.90	0.40	-29.255	4.6202	1,848.1	905	49
Sch02_bk	-35.90	0.67	-30.777	3.2544	2,180.4	1119	51
Sch03_moh	-35.90	0.10	-30.964	3.1173	311.7	202	65
Sch04_moh	-35.90	0.16	-35.076	1.2095	193.5	91	47
Esfpa_2013_09_28	-35.9	1.33	-30.576	3.4089	**4,534**	221.6	5%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Sch01_bk	B513800H	0.58	-35.90	-37.54	0.685
	B513801H	0.50	-35.90	-41.51	0.275
	B513802H	0.53	-35.90	-25.93	9.947
	B513803H	0.51	-35.90	-24.80	12.899
	B513804H	0.54	-35.90	-30.17	3.743
	B513805H	0.46	-35.90	-77.16	0.000
Sch02_bk	B513806H	0.77	-35.90	-61.74	0.003
	B513807H	0.74	-35.90	-60.61	0.003
	B513808H	0.75	-35.90	-43.26	0.184
	B513809H	0.67	-35.90	-25.50	10.983
	B513810H	0.70	-35.90	-25.66	10.566
	B513811H	0.72	-35.90	-30.53	3.447
	B513812H	0.63	-35.90	-37.15	0.750
	B513813H	0.67	-35.90	-37.15	0.750
Sch03_moh	M513800H	0.38	-35.90	-40.86	0.319
	M513801H	0.41	-35.90	-32.82	2.032
	M513802H	0.38	-35.90	-27.42	7.059
Sch04_moh	M513803H	0.28	-35.90	-32.44	2.219
	M513804H	0.32	-35.90	-63.72	0.002
	M513805H	0.41	-35.90	-32.73	2.077
	M513806H	0.3	-35.9	-39.766	0.410781

Table A21. Eastern Shore acoustic survey (#3) on October 4, 2013, using sample TS from commercial fishery samples on October 11.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Moh_sch01	-35.96	0.78	-42.016	0.2479	193.4	44	23
Tbs_sch01_pass01	-35.96	0.37	-30.993	3.1375	1,160.9	775	67
Esfpa_2013_10_04	-35.96	1.15	-35.249	1.1776	**1,354**	776.2	57%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Moh_sch01	M513800H	0.50	-35.96	-51.47	0.028
	M513801H	0.70	-35.96	-42.22	0.236
	M513802H	0.79	-35.96	-39.56	0.437
	M513803H	0.98	-35.96	-40.10	0.385
	M513804H	1.01	-35.96	-42.01	0.248
	M513805H	0.87	-35.96	-43.58	0.173
	M513806H	0.60	-35.96	-47.06	0.078
Tbs_sch01_pass01	T513800H	0.70	-35.96	-80.94	0.000
	T513801H	0.75	-35.96	-26.45	8.926
	T513802H	0.69	-35.96	-31.00	3.136
	T513803H	0.70	-35.96	-46.52	0.088

Table A22. Eastern Shore acoustic survey (#4) on October 14, 2013, using sample TS from commercial fishery samples on October 11.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Esfpa_2013_10_14	-35.96	0.78	-42	0.248801	**194**	121	62%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Esfpa_2013_10_14	B513800H	1.19	-35.96	-43.62	0.172
	B513801H	1.14	-35.96	-36.66	0.851
	B513802H	1.13	-35.96	-51.97	0.025
	B513803H	1.17	-35.96	-43.19	0.189
	B513804H	1.12	-35.96	-58.25	0.006

Table A23. Stratum/school summary results for Glace Bay acoustic survey (#1) on September 11, 2013, using standard TS (no samples were collected).

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Sch_01	-35.96	0.74	-48.014	0.062	46	15	33
Sch_02	-35.96	0.44	-56.626	0.009	4	1	18
GlaceBay_2013_09_11	-35.96	1.18	-49.699	0.042	**50**	15	30%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Sch_01	N513800H	0.89	-35.96	-43.883	0.161289
	N513801H	0.592	-35.96	-50.702	0.033551
	N513802H	0.903	-35.96	-51.296	0.029265
	N513803H	1.173	-35.96	-47.708	0.066854
	N513804H	1.219	-35.96	-50.586	0.034458
	N513805H	0.809	-35.96	-49.269	0.046668
Sch_02	N513806H	0.791	-35.96	-56.787	0.008264
	N513807H	0.713	-35.96	-56.997	0.007873
	N513808H	0.813	-35.96	-54.347	0.014495
	N513809H	0.843	-35.96	-58.461	0.005621
	N513810H	0.675	-35.96	-58.002	0.006247

Table A24. Scots Bay acoustic survey (#1) on June 21, 2014, using sample TS from fishery samples on June 23, 2014.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Scotsbay_2014_06_21	-35.34	666	-46.081	0.0844	56,210.8	11,131	20
Western_edge_2014_06_21	-35.35	45	-52.253	0.02041	918	354	39
North	-35.57	84	-58.556	0.00503	423	55	13
Total	-35.42	795	-46.749	0.07240	**57,552**	11,137	19%
Out_Box	-35.46	129	-55.251	0.01040	**1341**	358	27%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Main_box	C213800H_2_In	41.828	-35.42	-61.816	0.00229
	C213801H_2_In	34.386	-35.42	-75.326	0.0001
	I413800H_2_In	46.17	-35.42	-62.386	0.00201
	I413801H_2_In	39.27	-35.42	-53.072	0.01715
	K413800H_2_In	45.152	-35.42	-63.133	0.00169
	K413801H_2_In	37.905	-35.42	-51.349	0.02551
	M423800H_2_In	43.033	-35.15	-56.062	0.0081
	M423801H_2_In	35.936	-35.15	-61.238	0.00246
	P413800H_2_In	44.149	-35.42	-48.091	0.054
	P413801H_2_In	36.732	-35.42	-45.476	0.0986
Western_edge_of_box	C213800H_1_Out	2.776	-35.42	-1024.43	0
	C213801H_1_Out	3.096	-35.42	-1024.91	0
	I413800H_1_Out	2.452	-35.42	-69.538	0.00039
	I413801H_1_Out	2.614	-35.42	-53.744	0.01469
	K413800H_1_Out	2.575	-35.42	-72.046	0.00022
	K413801H_1_Out	2.808	-35.42	-1024.49	0
	M423800H_1_Out	2.444	-35.15	-54.077	0.0128
	M423801H_1_Out	3.504	-35.15	-60.398	0.00299
	P413800H_1_Out	2.626	-35.42	-63.938	0.00141
	P413801H_1_Out	2.964	-35.42	-69.554	0.00039
North_box	M413800H	17.94	-35.15	-57.300	0.0061
	M413801H	17.19	-35.15	-65.065	0.00102
	M413802H	15.76	-35.15	-66.610	0.001
	M413803H	9.47	-35.15	-64.120	0.001

Table A25. Scots Bay acoustic survey (#2) on July 8, 2014, using sample TS from fishery samples on July 9.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Scotsbay_2014_07_08	-34.950	657	-42.878	0.16103	105,793.3	50,817	48
Westernedge2014_07_08	-34.950	48	-52.104	0.01925	924.2	393	43
North	-35.210	83	-61.190	0.00252	209.5	57	27
Scots_2014_07_08	-35.037	788	-43.622	0.13570	**106,927**	50,819	48%
Out_box only	-35.080	131	-55.624	0.00870	**1,134**	397	35%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Scotsbay_2014_07_08	B414800H_02_In	39.926	-34.95	-46.006	0.078345
	B414801H_01_In	35.777	-34.95	-39.970	0.31451
	D414800H_02_In	42.569	-35.05	-52.878	0.016503
	D414801H_01_In	33.419	-35.05	-58.807	0.004214
	K414800H_02_In	45.291	-34.95	-54.830	0.010271
	K414801H_01_In	38.15	-34.95	-39.739	0.33164
	L414800H_02_In	45.963	-34.95	-50.343	0.028862
	L414801H_01_In	39.193	-34.95	-44.451	0.112077
	M414800H_02_In	43.702	-34.95	-50.682	0.026694
	M414801H_01_In	36.295	-34.95	-35.233	0.93596
	S414800H_02_In	42.079	-34.95	-42.466	0.176997
	S414801H_01_In	34.54	-34.95	-57.482	0.005577
Westernedge201_07_08	B414800H_01_Out	3.582	-34.95	-58.22	0.004706
	B414801H_02_Out	2.175	-34.95	-53.53	0.013854
	D414800H_01_Out	2.773	-35.05	-63.509	0.001427
	D414801H_02_Out	3.034	-35.05	-58.128	0.004927
North	K414800H_01_Out	2.356	-34.95	-61.927	0.002004
	K414801H_02_Out	2.846	-34.95	-44.974	0.099353
	L414800H_01_Out	2.588	-34.95	-59.901	0.003195
	L414801H_02_Out	2.836	-34.95	-52.505	0.017541
	M414800H_01_Out	3.042	-34.95	-58.212	0.004714
	M414801H_02_Out	2.734	-34.95	-48.200	0.047276
	S414800H_01_Out	3.024	-34.95	-55.263	0.009297
	S414801H_02_Out	3.787	-34.95	-51.361	0.022828
	C214800H	18.688	-35.21	-65.615	0.000911
	C214801H	17.407	-35.21	-59.852	0.003435
	C214802H	16.143	-35.21	-59.264	0.003934
	C214803H	15.174	-35.21	-62.275	0.001966

Table A26. Scots Bay acoustic survey (#3) on July 19, 2014, using sample TS from fishery samples on July 20 and 22.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Scotsbay_2014_07_19	-35.34	654	-49.594	0.03753	24,542.8	6933	28
Westernedge_2014_07_19	-35.31	42	-58.428	0.00488	205	113	55
Total	-35.33	696	-49.828	0.03560	**24,748**	6,934	28%
Out_Box	-35.31	42	-58.428	0.00488	**205**	113	5500%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Scotsbay_2014_07_19	B414800H_02_In	39.973	-35.31	-47.784	0.0565
	B414801H_01_In	34.73	-35.31	-46.562	0.07487
	C214800H_02_In	43.048	-35.57	-51.110	0.02792
	C214801H_01_In	35.667	-35.57	-55.547	0.01005
	M414800H_02_In	43.681	-35.31	-60.101	0.00331
	M414801H_01_In	36.547	-35.31	-46.032	0.08459
	M424800H_02_In	46.095	-35.31	-57.995	0.00538
	M424801H_01_In	39.198	-35.31	-48.671	0.04607
	P414800H_02_In	44.592	-35.57	-66.745	0.00076
	P414801H_01_In	37.698	-35.57	-52.975	0.01818
	S414800H_02_In	41.274	-35.31	-49.739	0.03603
	S414801H_01_In	34.491	-35.31	-44.678	0.11553
Westernedge_2014_07_19	B414800H_01_Out	2.932	-35.31	-64.847	0.00111
	B414801H_02_Out	3.006	-35.31	-52.005	0.02138
	C214800H_01_Out	3.193	-35.57	-1025.04	0
	C214801H_02_Out	3.099	-35.57	-67.533	0.00064
	M414800H_01_Out	2.673	-35.31	-65.270	0.00101
	M414801H_02_Out	1.187	-35.31	-68.173	0.00052
	M424800H_01_Out	2.864	-35.31	-68.575	0.00047
	M424801H_02_Out	2.95	-35.31	-66.058	0.00084
	P414800H_01_Out	1.192	-35.57	-77.066	7.1E-05
	P414801H_02_Out	1.698	-35.57	-72.166	0.00022
	S414800H_01_Out	3.120	-35.31	-1024.95	0.000
	S414801H_02_Out	2.660	-35.31	-50.970	0.027

Table A27. Scots Bay acoustic survey (#4) on August 2, 2014, using sample TS from fishery samples on August 4 and 5, 2014.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Scotsbay_2014_08_02	-35.59	657	-50.696	0.03083	20,253.7	8,125	40
Westernedge_2014_08_02	-35.63	54	-60.705	0.00311	168	41	24
North	-35.84	77	-63.156	0.00186	143	117	82
Total	-35.69	788	-51.422	0.02610	**20,565**	8,126	40%
Out_Box	-35.74	131	-61.974	0.00240	**311**	124	40%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Scotsbay_2014_08_02	B414800H_02_In	40.29	-35.57	-54.227	0.01363
	B414801H_01_In	34.216	-35.57	-50.35	0.03329
	D414800H_02_In	46.178	-35.68	-1036.64	0
	D414801H_01_In	39.375	-35.68	-57.173	0.00709
	K414800H_02_In	44.258	-35.57	-43.06	0.17835
	K414801H_01_In	37.315	-35.57	-47.721	0.06099
	L414800H_02_In	45.496	-35.57	-63.628	0.00157
	L414801H_01_In	38.265	-35.57	-52.011	0.02271
	M414800H_02_In	43.053	-35.57	-50.555	0.03176
	M414801H_01_In	36.039	-35.57	-49.101	0.04439
	P414800H_02_In	41.378	-35.84	-61.348	0.00281
	P414801H_01_In	34.094	-35.84	-56.487	0.00861
	S514800H_02_In	42.446	-35.68	-61.437	0.00266
	S514801H_01_In	35.163	-35.68	-53.204	0.01769
Westernedge_2014_08_02	B414800H_01_Out	2.653	-35.57	-58.787	0.00477
	B414801H_02_Out	3.002	-35.57	-63.423	0.00164
	D414800H_01_Out	2.702	-35.68	-1024.32	0
	D414801H_02_Out	3.005	-35.68	-61.064	0.0029
	K414800H_01_Out	2.956	-35.57	-60.157	0.00348
	K414801H_02_Out	3.019	-35.57	-64.271	0.00135
	L414800H_01_Out	2.549	-35.57	-57.564	0.00632
	L414801H_02_Out	3.347	-35.57	-62.942	0.00183
	M414800H_01_Out	2.897	-35.57	-65.746	0.00096
	M414801H_02_Out	2.902	-35.57	-55.723	0.00966
	P414800H_01_Out	4.148	-35.84	-67.998	0.00061
	P414801H_02_Out	4.100	-35.84	-60.517	0.00341
	S514800H_01_Out	4.275	-35.68	-64.763	0.00124
	S514801H_02_Out	3.359	-35.68	-57.101	0.00721
North	C214800H	18.668	-35.84	-70.595	0.00034
	C214801H	17.45	-35.84	-57.89	0.00624
	C214802H	16.241	-35.84	-76.551	8.5E-05
	C214804H	11.201	-35.84	-74.722	0.00013

Table A28. Scots Bay acoustic survey (#5) on August 16, 2014, using sample TS from fishery samples on August 17 and 18, 2014.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Scotsbay_2014_08_16	-35.63	640	-55.327	0.01073	6869.2	1914	28
Westernedge_2014_08_16	-35.68	50	-57.603	0.00642	321	138	43
Total	-35.66	690	-55.457	0.01040	**7,190**	1,919	27%
Out_Box	-35.68	50	-57.603	0.00642	**321**	138	43%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Scotsbay_2014_08_16	B414800H_02_In	39.476	-35.62	-58.59	0.00505
	B414801H_01_In	33.67	-35.62	-52.007	0.02299
	C214800H_02_In	40.958	-35.89	-64.582	0.00135
	C214801H_01_In	34.511	-35.89	-60.132	0.00376
	M414800H_02_In	42.569	-35.62	-56.542	0.00809
	M414801H_01_In	35.984	-35.62	-51.153	0.02799
	M424800H_02_In	44.083	-35.62	-55.574	0.01011
	M424801H_01_In	37.47	-35.62	-53.18	0.01755
	S414800H_02_In	45.654	-35.62	-80.818	0.00003
	S414801H_01_In	39.572	-35.62	-53.722	0.01549
Westernedge_2014_08_16	B414800H_01_Out	3.366	-35.62	-66.252	0.00087
	B414801H_02_Out	2.699	-35.62	-51.718	0.02458
	C214800H_01_Out	3.024	-35.89	-74.334	0.00014
	C214801H_02_Out	5.135	-35.89	-56.621	0.00845
	M414800H_01_Out	3.202	-35.62	-57.2	0.00696
	M414801H_02_Out	2.373	-35.62	-52.643	0.01986
	M424800H_01_Out	3.134	-35.62	-68.275	0.00054
	M424801H_02_Out	2.876	-35.62	-60.134	0.00354
	S414800H_01_Out	3.123	-35.62	-61.308	0.0027
	S414801H_02_Out	2.647	-35.62	-1024.23	0

Table A29. Scots Bay acoustic survey (#6) on August 30, 2014, using sample TS from fishery samples on August 31 and September 1, 2014.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Scotsbay_2014_08_30	-35.36	656	-54.692	0.01165	7644.8	3002	39
Westernedge_2012_08_30	-35.38	44	-50.062	0.03402	1,497	1,148	77
Total	-35.37	700	-54.201	0.01310	**9,142**	3,214	35%
Out_Box	-35.38	44	-50.062	0.03402	**1,497**	1,148	77%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Scotsbay_2014_08_30	B414800H_02_In	39.031	-35.34	-52.533	0.0191
	B414801H_01_In	33.206	-35.34	-55.878	0.00884
	C214800H_02_In	43.038	-35.61	-92.757	2E-06
	C214801H_01_In	34.751	-35.61	-59.458	0.00412
	M414800H_02_In	45.73	-35.34	-56.191	0.00823
	M414801H_01_In	38.04	-35.34	-50.478	0.03065
Westernedge_2014_08_30	B414800H_01_Out	3.03	-35.34	-67.668	0.00059
	B414801H_02_Out	2.851	-35.34	-57.576	0.00598
	C214800H_01_Out	1.991	-35.61	-1022.99	0
	C214801H_02_Out	3.382	-35.61	-51.928	0.02334
	M414800H_01_Out	2.663	-35.34	-58.623	0.0047
	M414801H_02_Out	2.835	-35.34	-43.246	0.16208

Table A30. German Bank acoustic survey (#1) on August 12, 2014, using sample TS from fishery samples on August 12.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Germanbank_2014_08_12	-35.76	646	-46.820	0.078	50,644	26,520	52
Germanbank_outbox	-35.66	196	-59.277	0.004345	851.6	602	71
Total_German_2014_08_12	-35.71	842	-47.897	0.0642	**51,496**	26,527	52%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Germanbank_2014_08_12	D414800H	37.07	-35.75	-46.63	0.082
	K414800H	37.13	-35.64	-51.71	0.025
	K414801H	37.09	-35.64	-46.79	0.077
	L414800H	37.20	-35.64	-53.59	0.016
	L414801H	36.78	-35.64	-71.29	0.000
	M424800H	36.93	-35.64	-55.29	0.011
	P414800H	37.27	-35.91	-58.90	0.005
	P414801H	36.92	-35.91	-42.92	0.199
	S414800H	36.90	-35.64	-48.71	0.049
	S514800H	36.90	-35.75	-53.96	0.015
	S514801H	36.62	-35.75	-61.36	0.003
	T414800H	37.15	-35.75	-38.46	0.535
	T414801H	36.97	-35.75	-1035.68	0.000
Germanbank_outbox	D414801H	36.87	-35.75	-63.64	0.002
	S414801H	36.74	-35.64	-55.43	0.010
	M424801H	37.216	-35.64	-65.799	0.000965

Table A31. German Bank acoustic survey (#2) on August 25, 2014, using sample TS from fishery samples on August 25, 2014.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
German_2014_08_25	-35.65	646	-45.285	0.1088	70,290.3	43471	62
German_outbox	-35.59	194	-68.696	0.0005	94.8	59	62
Total_2014_08_25	-35.62	840	-46.420	0.0838	**70,385**	43,471	62%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
German_2014_08_25	D414800H	37.04	-35.66	-53.81	0.015
	K414800H	36.54	-35.56	-44.02	0.143
	K414801H	37.01	-35.56	-59.87	0.004
	L414800H	37.00	-35.56	-57.15	0.007
	L414801H	36.62	-35.56	-82.36	0.000
	M424800H	36.95	-35.56	-64.27	0.001
	P414800H	37.04	-35.82	-55.10	0.012
	P414801H	37.02	-35.82	-59.20	0.005
	S414800H	37.10	-35.56	-74.51	0.000
	S414801H	36.88	-35.56	-1035.67	0.000
	S514800H	37.19	-35.66	-39.48	0.416
	T414800H	36.50	-35.66	-36.54	0.817
	T414801H	36.05	-35.66	-1035.57	0.000
German_outbox	D414801H	37.12	-35.66	-1035.70	0.000
	S514801H	37.23	-35.66	-69.36	0.000
	M424801H	37.089	-35.56	-65.386	0.00104

Table A32. German Bank acoustic survey (#3) on September 8, 2014, using sample TS from fishery samples on September 8.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Germanbank_2014_09_08	-35.49	646	-44.645	0.1216	78,540.3	55689	71
Germanbank_outbox	-35.58	194	-59.385	0.0042	808.2	701	87
Total_2014_09_08	-35.54	840	-45.742	0.0945	**79,349**	55,693	70%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Germanbank_2014_09_08	D414800H	37.166	-35.58	-49.44	0.041141
	K414800H	37.140	-35.47	-34.62	1.217676
	K414801H	16.463	-35.47	-52.23	0.021125
	K414802H	15.186	-35.47	-52.52	0.019762
	L414800H	37.370	-35.47	-54.92	0.011370
	L414801H	36.720	-35.47	-58.84	0.004603
	M424800H	37.099	-35.47	-53.70	0.015034
	M424801H	36.735	-35.47	-58.50	0.004979
	P414800H	37.049	-35.74	-57.41	0.006814
	P414801H	36.784	-35.74	-61.18	0.002857
	S414800H	37.065	-35.47	-54.82	0.011626
	S414801H	36.241	-35.47	-76.63	0.000077
	S514800H	37.146	-35.58	-42.33	0.211239
	T414800H	36.924	-35.58	-55.38	0.010474
Germanbank_outbox	T414801H	36.253	-35.58	-66.01	0.000906
	D414801H	36.939	-35.58	-74.425	0.000131
	S514801H	37.271	-35.58	-55.038	0.011336

Table A33. German Bank acoustic survey (#4a) on September 26, 2014, using sample TS from fishery samples on September 26 and 27.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Germanbank_2014_09_26	-35.170	110	-45.642	0.0897	9,870	3509	36
German_outbox_2014_09_26	-35.110	18	-49.604	0.0356	640.2	0	0
Total_2014_09_26	-35.140	128	-46.024	0.0821	**10,510**	3,509	33%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Germanbank_2014_09_26	K414800H	18.75	-35.470	-49.869	0.036
	K414801H	18.75	-35.470	-40.244	0.333
	L414801H	18.15	-35.470	-44.745	0.118
	M424800H	16.93	-35.470	-55.034	0.011
	M424801H	18.36	-35.470	-49.088	0.043
	P414800H	18.64	35.000	-55.696	0.000
	P414801H	18.67	35.000	-43.211	0.000
	S414800H	17.48	-35.470	-47.573	0.062
	S414801H	17.63	-35.470	-46.964	0.071
German_outbox_2014_09_26	L414800H	17.85	-35.470	-49.604	0.039

Table A34. German Bank acoustic survey (#5) on October 6, 2014, using sample TS from fishery samples on September 29. Note: No detailed samples were collected; only LF samples available.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Germanbank_2014_10_06	-35.52	524	-49.506	0.0399	20,906.4	8,510	41
German_outbox_2014_10_06	-35.51	21	-52.849	0.0185	387.5	0	0
Total_2014_10_06	-35.52	545	-49.597	0.0391	**21,294**	8,510	40%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Germanbank_2014_10_06	K414800H	36.96	-35.51	-46.08	0.088
	K414801H	36.14	-35.51	-50.35	0.033
	L414800H	37.04	-35.51	-49.76	0.038
	P514800H_WITHOUT_WHALE	37.20	-35.51	-43.83	0.147
	P514801H	37.07	-35.51	-50.20	0.034
	S414800H	36.89	-35.51	-73.39	0.000
	S414801H	36.87	-35.51	-83.92	0.000
	T414800H	37.22	-35.62	-54.54	0.013
	T414801H	37.08	-35.62	-57.88	0.006
German_outbox_2014_10_06	L414801H	14.73	-35.51	-52.85	0.018

Table A35. Trinity Ledge acoustic survey (#1) on August 26, 2014, using standard TS (no samples were collected).

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Trinity_2014_08_26	-35.96	0.14	-26.446	8.939111	**1,252**	1,395	111

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Trinity_2014_08_26	W414800H	0.219	-35.96	-19.953	39.86706
	W414801H	0.236	-35.96	-56.606	0.008616
	W414802H	0.263	-35.96	-50.452	0.035535
	W414803H	0.259	-35.96	-58.575	0.005475

Table A36. Trinity Ledge acoustic survey (#2) on September 10, 2014, using standard TS (no samples were collected).

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Trinity_2014_09_10	-35.959	0.25	11.48603	14.08	**3520**	1013	29%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Trinity_2014_09_10	W414800H	0.582	-35.96	-23.9851	15.75758
	W414801H	0.564	-35.96	-67.5292	0.000697
	W414802H	0.389	-35.96	-25.1584	12.02717
	W414803H	0.452	-35.96	-22.6296	21.52992
	W414804H	0.452	-35.96	-26.3143	9.21651
	W414805H	0.456	-35.96	-21.4054	28.54024

NOTE: Raw files were processed in Echoview rather than in HDPS because of difficulties with determining the bottom. A look at the files will show that the bottom appears to spike up in several areas into the school making it difficult to tell whether the spikes were fish or just the presence of rough bottom.

Table A37 (continued below). Little Hope acoustic survey (#1) on September 20, 2014, using sample TS from multi-panel gillnet sample on September 13 and 25 and commercial fishery samples on September 18 and 24.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
As01	-35.97	1.6	-29.561	4.37377	6998	3322	47
As02	-35.97	23.76	-39.977	0.3975	9444.5	573	6
E801	-35.97	4.3	-39.442	0.4495	1,933	311	16
E802	-35.97	2.35	-34.998	1.2508	2,940	687	23
E803	-35.97	0.24	-27.679	6.7472	1,619	640	40
E804	-35.97	1.56	-33.338	1.8331	2,860	1,484	52
LittleHope_2014_09_20	-35.97	33.81	-37.145	0.7629	25,794	1,783	7%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
As01	A514800H	0.732	-35.97	-55.352	0.011528
	A514801H	0.98	-35.97	-40.134	0.383329
	A514802H	1.031	-35.97	-31.347	2.899399
	A514803H	1.143	-35.97	-25.616	10.849685
	A514804H	1.133	-35.97	-25.956	10.032111
	A514805H	1.193	-35.97	-53.005	0.019791
As02	A514807H	2.699	-35.97	-38.393	0.572455
	A514808H	3.038	-35.97	-40.734	0.333866
	A514809H	3.919	-35.97	-39.097	0.486742
	A514810H	4.278	-35.97	-41.345	0.290044
	A514811H	6.11	-35.97	-40.018	0.393695
	A514812H	6.42	-35.97	-40.72	0.335
	A514813H	7.58	-35.97	-39.99	0.396
	A514814H	7.74	-35.97	-41.47	0.282
	A514815H	8.10	-35.97	-40.63	0.342
	A514816H	7.78	-35.97	-41.62	0.272
	A514817H	7.88	-35.97	-39.52	0.442
	A514818H	7.81	-35.97	-39.19	0.476
	A514819H	5.61	-35.97	-38.79	0.523
	A514820H	5.60	-35.97	-39.71	0.423
	A514821H	3.51	-35.97	-38.81	0.520
	A514822H	2.99	-35.97	-38.85	0.515
E801	E414800H	1.74	-35.97	-43.53	0.175
	E414801H	1.95	-35.97	-44.10	0.154
	E414802H	2.80	-35.97	-40.87	0.324
	E414803H	3.03	-35.97	-37.88	0.644
	E414804H	2.90	-35.97	-39.38	0.456
	E414805H	2.60	-35.97	-37.09	0.773
	E414806H	2.63	-35.97	-38.82	0.519
	E414807H	2.60	-35.97	-38.61	0.545
	E414808H	2.19	-35.97	-42.31	0.232

Table A37 (continued from above). Little Hope acoustic survey (#1) on September 20, 2014, using sample TS from multi-panel gillnet sample on September 13 and 25 and commercial fishery samples on September 18 and 24.

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
E802	E414810H	1.71	-35.97	-41.60	0.273
	E414811H	2.06	-35.97	-36.69	0.847
	E414812H	1.97	-35.97	-29.94	4.009
	E414813H	1.58	-35.97	-34.21	1.499
	E414814H	1.42	-35.97	-35.86	1.027
	E414815H	1.17	-35.97	-35.98	0.998
	E414816H	1.28	-35.97	-38.30	0.585
	E414817H	1.12	-35.97	-38.82	0.519
	E414818H	0.70	-35.97	-36.42	0.901
	E414819H	0.85	-35.97	-38.00	0.627
	E414820H	0.80	-35.97	-34.59	1.374
	E414821H	0.32	-35.97	-45.30	0.117
E803	E414823H	0.50	-35.97	-27.81	6.548
	E414824H	0.50	-35.97	-26.53	8.792
	E414825H	0.39	-35.97	-24.92	12.745
	E414826H	0.48	-35.97	-68.07	0.001
E804	E414828H	0.55	-35.97	-30.54	3.494
	E414829H	0.70	-35.97	-27.07	7.768
	E414830H	0.88	-35.97	-30.61	3.436
	E414831H	1.23	-35.97	-30.76	3.322
	E414832H	1.22	-35.97	-35.31	1.164
	E414833H	1.24	-35.97	-75.23	0.000
	E414834H	1.21	-35.97	-72.07	0.000
	E414835H	1.641	-35.97	-56.966	0.007951

Table A38 (continued below). Little Hope acoustic survey (#2) on September 30, 2014, using sample TS from multi-panel gillnet sample on September 25 and commercial fishery samples on September 29.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
As01	-36.00	0.77	-36.192	0.95739	737.2	602	82
As02	-36.00	0.45	-37.725	0.67268	302.7	196	65
As03	-36.00	0.29	-30.183	3.81931	1107.6	963	87
As04	-36.00	0.54	-33.205	1.90461	1028.5	491	48
As05	-36.00	1.19	-30.571	3.49273	4156.4	2391	58
As06	-36.00	3.93	-35.969	1.00777	3960.5	565	14
E801	-36.00	0.56	-34.298	1.48084	829.3	331	40
E802	-36.00	1.82	-38.503	0.56232	1023.4	243	24
LH_2014_09_30	-36.00	9.55	-34.615	1.3765	**13146**	2788	21%
Excludes As01,02 & 06	-36.00	4.40	-33.329	1.8512	**8145.2**	2656	33%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
As01	A514800H	0.706	-36	-47.72	0.067344
	A514801H	1.137	-36	-32.231	2.383313
	A514802H	1.052	-36	-55.011	0.012566
	A514804H	0.374	-36	-70.89	0.000325
	A514805H	0.591	-36	-37.119	0.773337
	A514806H	0.712	-36	-32.476	2.25291
	A514807H	0.752	-36	-48.915	0.051146
	A514808H	0.692	-36	-75.638	0.000109
	A514810H	0.495	-36	-60.067	0.003923
As02	A514811H	0.671	-36	-26.019	9.963342
	A514812H	0.586	-36	-57.312	0.007398
	A514814H	0.562	-36	-37.605	0.691459
	A514815H	0.675	-36	-28.907	5.123437
	A514816H	0.589	-36	-36.158	0.964924
As03	A514817H	0.823	-36	-32.299	2.346319
	A514818H	0.683	-36	-79.391	0.000046
	A514820H	1.393	-36	-25.222	11.97058
As04	A514821H	1.518	-36	-28.841	5.202002
	A514822H	1.696	-36	-62.087	0.002464
	A514823H	0.906	-36	-71.333	0.000293
	A514824H	1.075	-36	-56.425	0.009074
	A514825H	0.45	-36	-78.185	0.000061
As05	A514800H	0.706	-36	-47.72	0.067344
	A514801H	1.137	-36	-32.231	2.383313
	A514802H	1.052	-36	-55.011	0.012566
	A514804H	0.374	-36	-70.89	0.000325
	A514805H	0.591	-36	-37.119	0.773337
	A514806H	0.712	-36	-32.476	2.25291

Table A38 (continued from above). Little Hope acoustic survey (#2) on September 30, 2014, using sample TS from multi-panel gillnet sample on September 25 and commercial fishery samples on September 29.

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
As06	A514827H	0.644	-36	-38.647	0.543941
	A514828H	0.721	-36	-42.939	0.202508
	A514829H	0.782	-36	-39.334	0.464449
	A514830H	1.34	-36	-37.665	0.681956
	A514831H	1.22	-36	-34.536	1.40198
	A514832H	1.031	-36	-34	1.585995
	A514833H	1.154	-36	-33.32	1.854864
	A514834H	1.435	-36	-35.392	1.151151
	A514835H	1.599	-36	-33.793	1.663402
	A514836H	1.497	-36	-36.168	0.962742
	A514837H	1.321	-36	-38.927	0.510092
	A514838H	1.337	-36	-35.021	1.253821
	A514839H	1.248	-36	-37.229	0.754031
	A514840H	1.193	-36	-41.375	0.290279
E801	E414800H	0.486	-36	-66.09	0.00098
	E414801H	0.607	-36	-51.653	0.027228
	E414802H	0.628	-36	-34.139	1.535883
	E414803H	0.81	-36	-36.678	0.855966
	E414804H	0.723	-36	-29.751	4.218807
	E414805H	0.916	-36	-32.465	2.258298
	E414806H	0.419	-36	-61.845	0.002605
E802	E414808H	0.702	-36	-53.613	0.017336
	E414809H	1.683	-36	-44.212	0.151056
	E414810H	1.793	-36	-39.538	0.443081
	E414811H	1.595	-36	-36.071	0.984434
	E414812H	1.555	-36	-37.885	0.648395
	E414813H	1.417	-36	-36.043	0.990942
	E414814H	1.361	-36	-40.119	0.387657
	E414815H	0.77	-36	-35.814	1.044479
	E414816H	0.614	-36	-44.543	0.139956

Table A39. Little Hope acoustic survey (#3) on October 11, 2014, using sample TS from multi-panel gillnet sample on October 6 and commercial fishery samples on October 7.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
As01	-36.13	0.82	-37.445	0.7389	605.9	50	8
As02	-36.13	2.37	-33.525	1.82205	4318.3	469	11
As03	-36.13	2.55	-35.743	1.09349	2788.4	350	13
E801	-36.13	3.27	-42.286	0.24236	792.5	147	19
LH_2014_10_11	-36.13	9.01	-36.381	0.9440	**8505**	605	7%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
As01	A514800H	1.391	-36.13	-36.835	0.850442
	A514801H	1.214	-36.13	-38.028	0.646078
	A514802H	1.182	-36.13	-37.661	0.702994
As02	A514804H	1.75	-36.13	-34.982	1.302884
	A514805H	1.557	-36.13	-34.52	1.448987
	A514806H	1.584	-36.13	-33.11	2.005161
	A514807H	1.566	-36.13	-33.578	1.800084
	A514808H	1.605	-36.13	-31.858	2.674885
	A514809H	1.59	-36.13	-33.733	1.73695
As03	A514811H	1.016	-36.13	-39.829	0.426802
	A514812H	0.982	-36.13	-37.68	0.700055
	A514813H	0.842	-36.13	-35.673	1.111284
	A514814H	1.131	-36.13	-34.725	1.382283
	A514815H	1.165	-36.13	-34.669	1.400211
	A514816H	1.572	-36.13	-34.047	1.615714
	A514817H	1.509	-36.13	-35.07	1.276606
	A514818H	1.834	-36.13	-35.586	1.133594
	A514819H	1.534	-36.13	-38.584	0.568466
E801	E414800H	0.443	-36.13	-47.281	0.07673
	E414801H	0.847	-36.13	-48.711	0.055209
	E414802H	0.964	-36.13	-48.126	0.063175
	E414803H	1.469	-36.13	-45.046	0.128366
	E414804H	1.521	-36.13	-41.382	0.29844
	E414805H	2.28	-36.13	-41.125	0.316654
	E414806H	2.116	-36.13	-39.065	0.508848
	E414807H	1.991	-36.13	-40.97	0.328142
	E414808H	1.653	-36.13	-42.899	0.210463
	E414809H	1.6	-36.13	-43.663	0.176503
	E414810H	1.263	-36.13	-50.434	0.037127

Table A40. Little Hope acoustic survey (#4) on October 25, 2014, using sample TS from multi-panel gillnet sample on October 25 and commercial fishery samples on September 14.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
As01	-35.96	0.67	-45.324	0.11576	77.6	25	32
As02	-35.96	1.49	-43.58	0.17295	257.7	53	21
E801	-35.96	0.41	-37.613	0.68335	280.2	229	82
E802	-35.96	2.66	-38.227	0.59317	1577.8	542	34
E803	-35.96	0.57	-31.936	2.52495	1439.2	820	57
LH_2014_10_25	-35.96	5.80	-37.991	0.6263	**3633**	1011	28%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
As01	A514800H	0.392	-35.96	-45.172	0.119866
	A514801H	0.976	-35.96	-42.617	0.215891
	A514802H	0.837	-35.96	-48.879	0.051052
	A514803H	0.985	-35.96	-47.513	0.069922
As02	A514805H	1.388	-35.96	-44.64	0.135483
	A514806H	1.156	-35.96	-41.342	0.289555
	A514807H	1.091	-35.96	-42.549	0.219294
	A514808H	1.076	-35.96	-45.784	0.104113
	A514809H	1.027	-35.96	-45.345	0.11518
E801	E414800H	0.631	-35.96	-32.469	2.23348
	E414801H	0.588	-35.96	-59.298	0.004636
	E414802H	0.563	-35.96	-60.804	0.003277
	E414803H	0.287	-35.96	-59.78	0.004149
E802	E414808H	1.148	-35.96	-43.973	0.157986
	E414809H	1.328	-35.96	-45.006	0.124536
	E414810H	1.403	-35.96	-41.452	0.282307
	E414811H	2.187	-35.96	-39.11	0.484059
	E414812H	2.351	-35.96	-37.576	0.689176
	E414813H	2.627	-35.96	-33.894	1.608967
	E414814H	2.145	-35.96	-46.834	0.081754
E803	E414818H	0.194	-35.96	-27.614	6.831795
	E414819H	0.726	-35.96	-33.006	1.973793
	E414820H	0.918	-35.96	-26.833	8.177531
	E414821H	0.917	-35.96	-33.639	1.706025
	E414822H	0.974	-35.96	-65.034	0.001237
	E414823H	0.956	-35.96	-65.146	0.001206

Table A41. Eastern Shore acoustic survey (#1) on September 16, 2014, using sample TS from multi-panel gillnet sample on September 17 and 20, 2014.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Esfpa_2014_09_17	-36.22	0.41	-28.568	5.823	**2,387**	653	27

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Esfpa_2014_09_17	B514800H	0.66	-36.22	-27.78	6.976
	B514801H	0.41	-36.22	-27.55	7.355
	B514802H	0.47	-36.22	-49.34	0.049
	B514803H	0.59	-36.22	-25.93	10.701
	B514804H	0.61	-36.22	-28.34	6.142
	B514805H	0.43	-36.22	-33.57	1.842

Table A42. Eastern Shore acoustic survey (#2) on September 19, 2014, using sample TS from multi-panel gillnet sample on September 17 and 20, 2014. Note: The two schools of herring surveyed by the Miss Owl Head were likely a repeat of the school surveyed by the Bradley K in acoustic survey #1 on September 16, 2014; Data from Moh01 and Moh02 (grey cells) were excluded.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Bk01	-36.22	0.19	-45.191	0.12671	24.1	3	12
Bk02	-36.22	0.1	-29.131	5.11426	511.4	218	43
Bk03	-36.22	0.06	-1013.33	0	0	0	16
Bk04	-36.22	0.27	-29.585	4.60636	1,243.7	435	35
Moh01	-36.22	0.2	-38.996	0.52764	105.5	51	49
Moh02	-36.22	0.24	-31.592	2.90217	696.5	335	48
Esfpa_2014_09_19	-35.96	0.62	-31.620	2.8837	**1,779**	486.578	27%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Bk01	B514800H	0.406	-36.22	-44.489	0.148943
	B514801H	0.346	-36.22	-44.75	0.14026
	B514802H	0.334	-36.22	-44.416	0.151465
	B514803H	0.35	-36.22	-44.331	0.154454
	B514804H	0.344	-36.22	-46.203	0.10037
	B514805H	0.199	-36.22	-49.218	0.050125
	B514806H	0.163	-36.22	-47.106	0.081525
Bk02	B514808H	0.328	-36.22	-26.075	10.33826
	B514809H	0.288	-36.22	-28.718	5.624252
	B514810H	0.341	-36.22	-1015.33	0
	B514811H	0.321	-36.22	-40.713	0.355282
	B514812H	0.327	-36.22	-26.467	9.444179
Bk03	B514814H	0.171	-36.22	-1012.34	0
	B514815H	0.228	-36.22	-1013.57	0
	B514816H	0.266	-36.22	-1014.25	0
	B514817H	0.278	-36.22	-1014.45	0
	B514818H	0.132	-36.22	-1011.22	0
Bk04	B514820H	0.49	-36.22	-40.354	0.385882
	B514821H	0.516	-36.22	-25.916	10.72221
	B514822H	0.408	-36.22	-29.792	4.392139
	B514823H	0.39	-36.22	-29.334	4.880357
	B514824H	0.49	-36.22	-28.138	6.428888
	B514825H	0.455	-36.22	-43.091	0.205492
Moh01	M514800H	0.79	-36.22	-36.24	0.995
	M514801H	0.81	-36.22	-39.62	0.457
	M514802H	0.75	-36.22	-45.75	0.112
Moh02	M514803H	0.83	-36.22	-28.96	5.315
	M514804H	0.86	-36.22	-59.19	0.005
	M514805H	0.84	-36.22	-28.92	5.366
	M514806H	0.90	-36.22	-35.60	1.154

Table A43. Eastern Shore acoustic survey (#3) on October 1, 2014, using sample TS from multi-panel gillnet sample on October 2 and 7, 2014.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Bk01	-36.44	0.27	-35.913	1.1287	305	104	34

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Bk01	B514800H	0.35	-36.44	-41.40	0.319
	B514801H	0.59	-36.44	-38.28	0.655
	B514802H	0.45	-36.44	-34.17	1.688
	B514803H	0.42	-36.44	-35.93	1.125
	B514804H	0.52	-36.44	-32.36	2.558
	B514805H	0.38	-36.44	-68.38	0.001

Table A44. Eastern Shore acoustic survey (#4) on October 7, 2014, using sample TS from multi-panel gillnet sample on October 7, 2014. Note: Both vessels surveyed the same school of fish; Moh01 pass (grey cells) dropped as lower biomass estimate.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Bk01	-36.33	0.53	-27.574	7.5156	3983.2	1086	27
Moh01	-36.33	0.54	-30.01	4.2895	2316.4	578	25
Esfpa_2014_10_07	-36.33	0.53	-27.574	7.5156	**3983**	1086.0	2700%

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Bk01	B514800H	0.70	-36.33	-25.25	12.848
	B514801H	0.83	-36.33	-26.03	10.720
	B514802H	0.73	-36.33	-26.42	9.810
	B514803H	0.69	-36.33	-32.55	2.390
	B514804H	0.63	-36.33	-50.64	0.037
	B514806H	0.61	-36.33	-27.42	7.787
Moh01	M514800H	0.72	-36.33	-33.66	1.851
	M514801H	0.74	-36.33	-34.40	1.562
	M514802H	0.73	-36.33	-29.10	5.292
	M514803H	0.71	-36.33	-28.30	6.363
	M514804H	0.68	-36.33	-27.17	8.255
	M514805H	0.676	-36.33	-29.238	5.123988
	M514806H	0.461	-36.33	-38.099	0.666087

Table A45. Eastern Shore acoustic survey (#5) on October 9, 2014, using sample TS from multi-panel gillnet sample on October 9, 2014.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
ESPA_2014_10_09	-36.23	0.51	-36.403	0.9610	490.1	151	31

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Bk01	B514800H	0.89	-36.23	-34.28	1.568
	B514801H	0.94	-36.23	-33.40	1.919
	B514802H	0.82	-36.23	-38.75	0.560
	B514803H	0.74	-36.23	-40.60	0.366
	B514804H	0.91	-36.23	-36.10	1.030
	B514805H	0.80	-36.23	-49.17	0.051

Table A46. Eastern Shore acoustic survey (#6) on October 10, 2014, using sample TS from multi-panel gillnet sample on October 10, 2014.

Stratum Layer 1	Average TS (dB/kg)	Stratum Area (km^2)	Weighted Mean Sa ($/m^2$)	Biomass Density (kg/m^2)	Strata Biomass (t)	SE (t)	SE (%)
Esfpa_2014_10_10	-36.22	0.13	-29.279	4.9414	642.4	270	42

Stratum Layer 1	Transect Number	Transect Length (km)	TS (dB/kg)	Average Sa ($/m^2$)	Biomass Density (kg/m^2)
Esfpa_2014_10_10	M514800H	0.32	-36.22	-26.53	9.308
	M514801H	0.31	-36.22	-36.61	0.914
	M514802H	0.39	-36.22	-26.30	9.808
	M514803H	0.33	-36.22	-31.43	3.012
	M514804H	0.29	-36.22	-1014.57	0.000