



Results from the Spring 2013 Maine Sea Scallop Survey

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Executive Summary

A sea scallop survey was carried out in April 2013 between Cutler shore and Vinalhaven Is., including intensive sampling of the seven (7) limited access areas (LAAs) within survey strata 2-7 along with all adjacent open areas. A total of 179 tows were completed with 114 tows allocated to LAAs.

- Machias Bay LAA realized an increase in harvestable (≥ 4 in. shell height) scallop biomass of 33% between fall 2011 and fall 2013 (projected). Density of harvestable scallops within the Machias Bay LAA was over 2X higher than the adjacent open area.
- Chandler Bay LAA harvestable scallop abundance declined 58% since 2011.
- Moosabec Reach LAA realized an over 2X increase in harvestable abundance since 2011. Seed were also observed in this area.
- Harvestable biomass within Gouldsboro Bay declined over 40% from the 2011 estimate and over 60% from the 2012 estimate.
- Only 37 scallops were caught in 20 tows in Mt. Desert LAA.
- E. Penobscot Bay LAA harvestable scallop abundance declined 76% since 2011.
- Blue Hill LAA had a 96% decline in harvestable density between fall 2011 and fall 2013 (projected) and appeared to suffer a significant loss in biomass prior to opening to fishing in December 2012.

Seed were observed near Cutler at the highest level of the survey time series (2002-13) and were also noted in Stratum 6 on the W side of Vinalhaven. Sublegals were predominant in Chandler Bay (open portion). Union River Bay, which had been fished heavily in 2012-13, produced only 102 scallops in 13 tows.

Introduction

The sea scallop (*Placopecten magellanicus*) currently supports a 70 day commercial fishery along coastal Maine during December-March each year. Maine 2013 landings of scallop meats were approximately 0.42 million lbs. with an ex-vessel value of \$5.19 million (Fig. 1). The primary gear type is the dredge, although Maine also permits commercial and non-commercial harvest of scallops by diving.

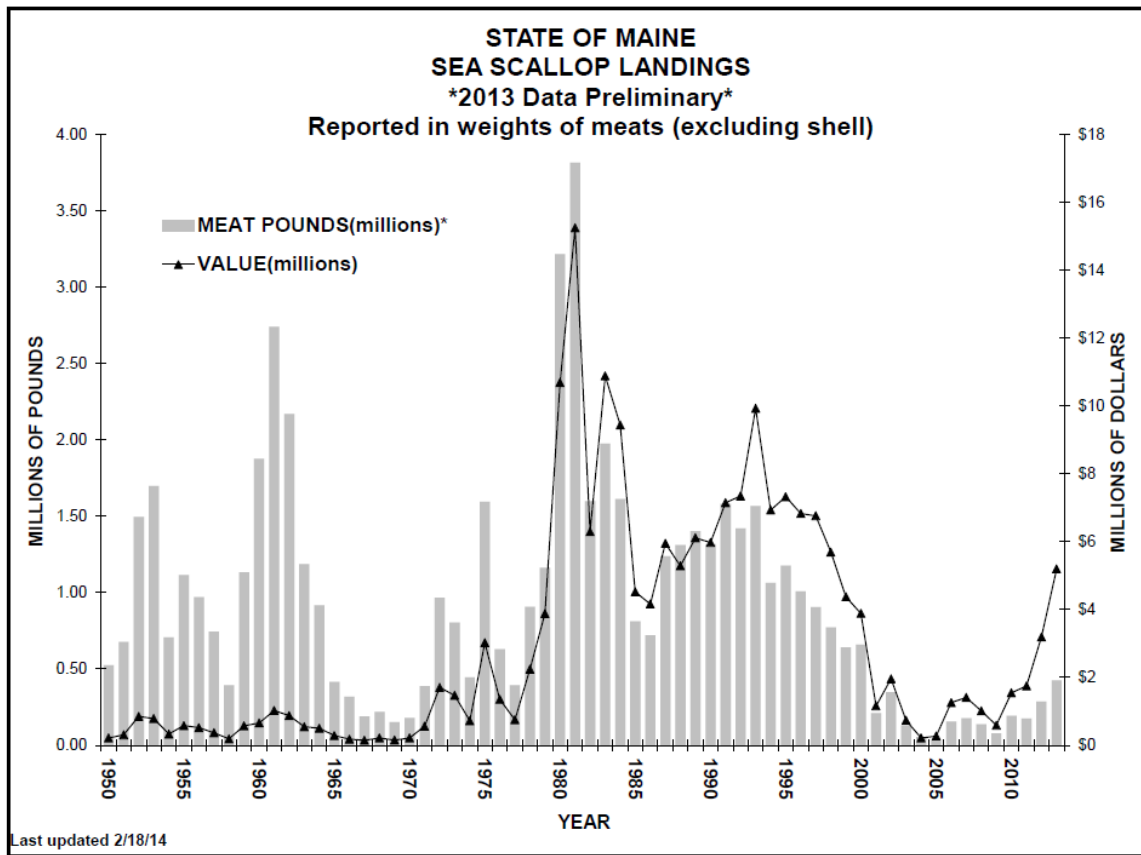


Figure 1. Maine scallop landings 1950-2013 (source: Maine Department of Marine Resources (DMR)).

Thirteen (13) areas along the Maine coast were closed by DMR to scallop fishing in 2009. These closures were re-opened in 2012-13 as limited access areas (LAAs). The policy of DMR since 2012 has been to ensure that not more than 30-40% of the harvestable biomass will be removed from the LAAs during the fishing season.

Purpose and extent of survey

An annual dredge-based fishery-independent survey by DMR of the scallop resource within Maine state waters has been conducted since 2002 (with the exception of 2004). A spring (as opposed to fall) survey was conducted for the first time in 2013.

The purpose of the survey is to characterize and monitor the sea scallop resource within Maine's coastal waters, and to compare results to previous years' surveys in light of regulatory and environmental changes. It is necessary to monitor changes in abundance and stock size from year to year to evaluate effects of the fishery, document recruitment events and determine what is available for harvest. The survey provides information needed to evaluate management strategies such as harvest limits and rotational closures. The survey provides information on geographic distribution, relative abundance, population size structure, meat yield and occurrence of seed and sublegal scallops as well as estimates of harvestable biomass.

For the first two years (2002-03) the entire coast was surveyed. During 2005-12 one of three major sections of the coast (1. Western Penobscot Bay to New Hampshire border, 2. Quoddy Head to eastern Penobscot Bay, and 3. Cobscook Bay/St. Croix River) was surveyed each year on a rotating basis (Table 1). All 2002-12 surveys were conducted in the fall, prior to the opening of the fishing season. In 2013, a spring survey of the 2012-13 and 2013-14 limited access and open sections of the eastern Maine coast (management Zone 2) was completed. The change to the spring allowed for time to enact management actions for the upcoming season based on survey results.

	Year												
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Area	Cobscook Bay/St. Croix R.	S	S	NS	NS	S (begin higher intensity survey)	S	NS	S	S	NS	S	S (fall)
	Eastern Maine	S	S	NS	NS	S (begin higher intensity survey)	NS	S	S (Machias Seal Is. and Mt. Desert Rock only)	NS	S (incl. closures 4A-8C)	S (Machias Seal Is. and Mt. Desert Rock only)	S (spring - all open areas in mgt. Zone 2)
	Western Maine	S	S	NS	S	NS	NS	NS	S	NS	S (closures 1-3 only)	NS	NS

S = surveyed
NS = not surveyed

Table 1 . Chronology of Maine DMR scallop survey, 2002-13.

Methods

Survey design

A subset of the coastal zones (or “strata”) defined for the 2002-03 surveys (Fig. 2) were used in subsequent surveys, including 2013, with some modification.

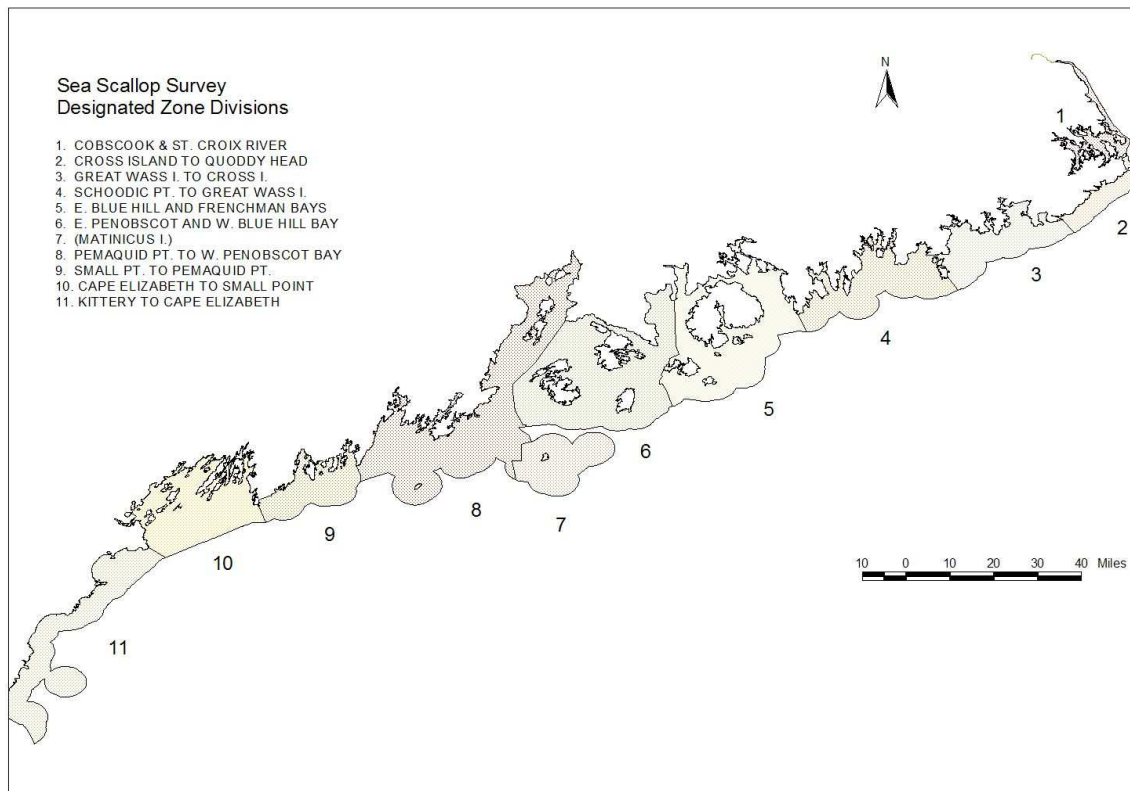


Figure 2. Designated strata for Maine DMR scallop survey.

Strata were sized to provide a manageable balance between area and sampling intensity. Scallop grounds within the strata were mapped based on fisher information (including a summary of industry input relative to limited access areas provided by Penobscot Bay Resource Center in 2011), prior survey data, surficial sediment maps (<http://megisims.state.me.us/metadata/surf.htm>) and coastal wildlife inventory maps (<http://megisims.state.me.us/metadata/shell.htm>) (Schick and Feindel 2005).

Station locations were based on random selection from a 500 m grid overlaying the known and potential scallop grounds of each stratum. Depth criteria were 6-43 m. The

500 m grid accommodated an average tow length of approximately 300 m. There were 179 tows completed on the 2013 survey.

A priority of the 2013 survey was to provide assessments of seven (7) of the LAAs located in eastern Maine (management Zone 2) (Machias Bay, Chandler Bay, Moosabec Reach, Gouldsboro Bay, Mt. Desert, E. Penobscot Bay, Blue Hill) (Fig. 3). The other open portions of management Zone 2 were also surveyed in 2013 and these areas were within survey strata 2-6 (Figs. 2,4).

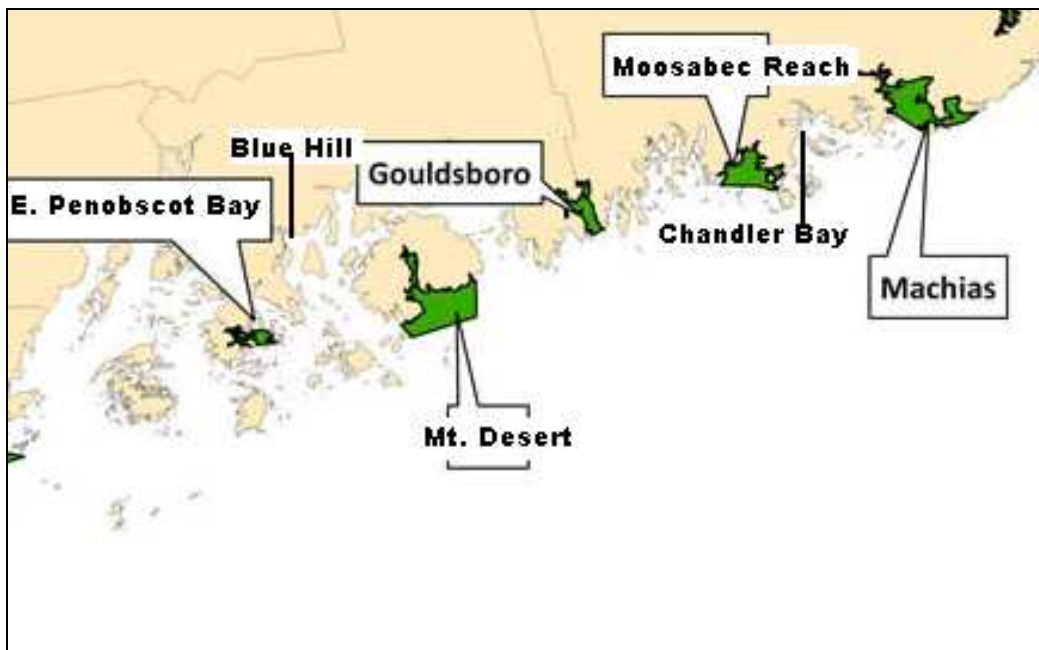


Figure 3. Maine scallop limited access areas (LAAs) surveyed in spring 2013.

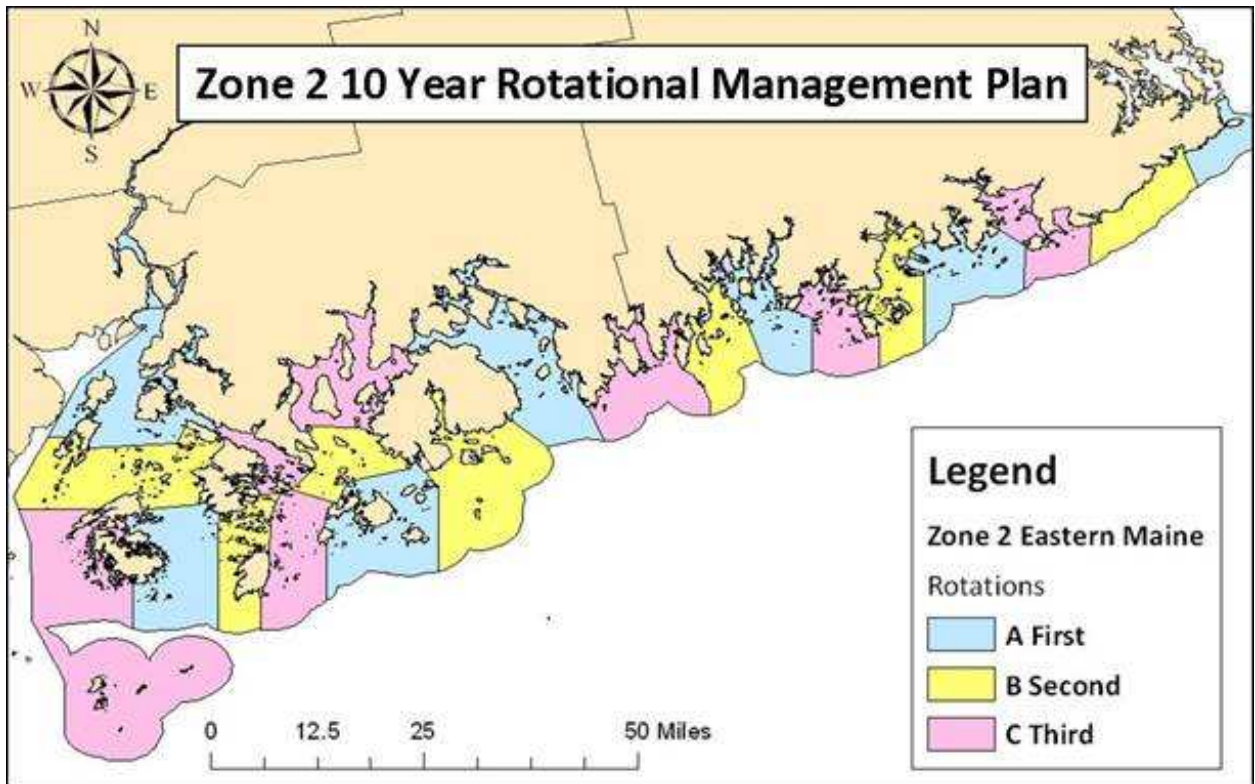


Figure 4. Areal rotation plan for eastern Maine (management Zone 2) scallop fishery. Areas in yellow and pink were open to fishing in 2012-13 and 2013-14 and surveyed in spring 2013.

The survey was conducted during 16-26 April aboard the 40 ft. *F/V Bad Company* from Cutler and the 39 ft. *F/V Kristin Lee* from Eastport. The survey gear was a 7 ft. wide New Bedford-style chain sweep dredge with 2 inch rings, 1¾ inch head bale, 3 inch twine top (double hung) and 10 inch pressure plate. The dredge was equipped with rock chains and was not lined. The survey dredge was constructed in 2009 (Fig. 5; also see Kelly 2010).



Figure 5. View of survey drag constructed in 2009.

Sampling procedure

Stations to be sampled were plotted using Capn Voyager™ navigational software. A Garmin™ Map 76 GPS unit with Garmin™ GA 29 GPS antenna interfaced with a laptop computer displaying station location was used to position the vessel on station. Location and time were recorded at three points (dredge in, tow start and haulback) for each tow. A Juniper Allegro™ ruggedized handheld computer was also interfaced with a GPS unit to record time/date/location information. Stations were sampled by a straight line tow at an average speed of 3.5 knots for 2½ minutes.

A ruggedized handheld computer with an RS232 serial port input for digital calipers was used to facilitate rapid entry of shell measurements and other information while sampling. Data entry screens for the sampling programs and survey were configured

using Data Plus Professional™ software, which aided in standardizing data entry, providing error checks and minimizing subsequent data auditing and keying (Schick and Feindel 2005).

The following sampling protocol was employed for each tow:

- 1.) Station information (location, time, depth) was entered from the wheelhouse.
- 2.) Bottom type was recorded as combinations of mud, sand, rock, and gravel based on sounder information and dredge contents. For example “Sg” designated a primarily sand substratum with some gravel (after Kelley et. al.1998).
- 3.) Once the drag was emptied, a digital picture of the haul was taken.
- 4.) Scallops, sea cucumbers (*Cucumaria frondosa*) and ocean quahogs (*Arctica islandica*) were culled from the drag contents for subsequent measurement. Catches of the latter species were quantified because of their importance in other drag fisheries. While the survey gear is not suitable for formally sampling ocean quahogs their presence in the catch does suggest the existence of a bed below the sediment.
- 5.) Bycatch was enumerated using a 0-5 qualitative abundance scale corresponding to “absent”, “present”, “rare”, “common”, “abundant”, and “very abundant”.
- 6.) Total number of scallops was recorded. The total weight and volume of the scallop, sea cucumber, and ocean quahog catch was recorded.
- 7.) The shell height (SH; distance from the umbo to the outer edge, perpendicular to the hinge line) of individual scallops was measured. All scallops from catches of 100 animals or less were measured for SH. If >100 scallops were present at least 100 were measured. Where $n > 1,000$ a subsample of 10% was measured.
- 8.) On selected tows (normally every third or fourth tow) a subsample of 24 scallops, chosen to represent the catch of scallops $\geq 3\frac{1}{2}$ in. shell height, were measured (shell length, width and height) and shucked for meat weight determination. Meats were placed in a compartmentalized box in the order that the animals were measured and later individually weighed on shore (using an Ohaus Navigator™ balance interfaced with the ruggedized handheld computer) and matched to the corresponding shell measurements.

Data analysis

Area swept per tow was determined from tow distance (tow start to haulback) and drag width (7 ft., or 2.1 m). Tow distance was determined using Capn Voyager™ software. The scallop catch for each tow was standardized to density (number of scallops per square meter). Total scallop catch was divided into the following size categories:

- “seed”: < 2½ in. (<63.5 mm) SH
- “sublegal”: 2½ in. to < 4 in. (63.5 – <101.6 mm) SH
- “harvestable”: ≥ 4 in. (≥101.6 mm) SH

Estimates of total abundance for each of the three size classes were calculated using the classic Cochran (1977) approach. For each of the six survey substrata identified above, the overall average abundance by area swept was estimated as:

$$\bar{X} = \sum_{h=1}^H W_h \bar{X}_h$$

where \bar{X}_h is the average abundance of swept area for substratum h, H is the total number of substrata, and W_h is proportion of the area of substratum h with respect to the survey area. The associated standard error can be calculated as

$$std\ error(\bar{X}) = \sqrt{\sum_{h=1}^H W_h^2 \frac{1-f_h}{n_h} S_h^2}$$

where S_h^2 is the variance estimated for substratum h, $f_h = \frac{n_h}{N_h}$ is the finite population correction for substratum h, and n_h and N are the number of stations sampled and the

total number of stations available for sampling, respectively, in substratum h. The finite population correction factor was ignored since the proportion of area sampled was small compared to the total area of each substratum.

RESULTS:

Stratum 2 (Great Head to W. Quoddy Head)

Thirteen stations were sampled in the open part of this area in 2013 (Fig. 6). One (1) tow contained no scallops. The highest density of seed yet observed for this stratum occurred in 2013.

Harvestable scallop density decreased from 0.021 per m² in 2011 to 0.011 in 2013 (Figs. 7-8). Sublegal density also decreased between 2011 (0.030 per m²) and 2013 (0.023 per m²). Seed density increased from 0.002 per m² in 2011 to 0.018 per m² in 2011 (0.010 per m²).

Highest overall catch rate and highest seed, sublegal and harvestable density was NE of Western Head.

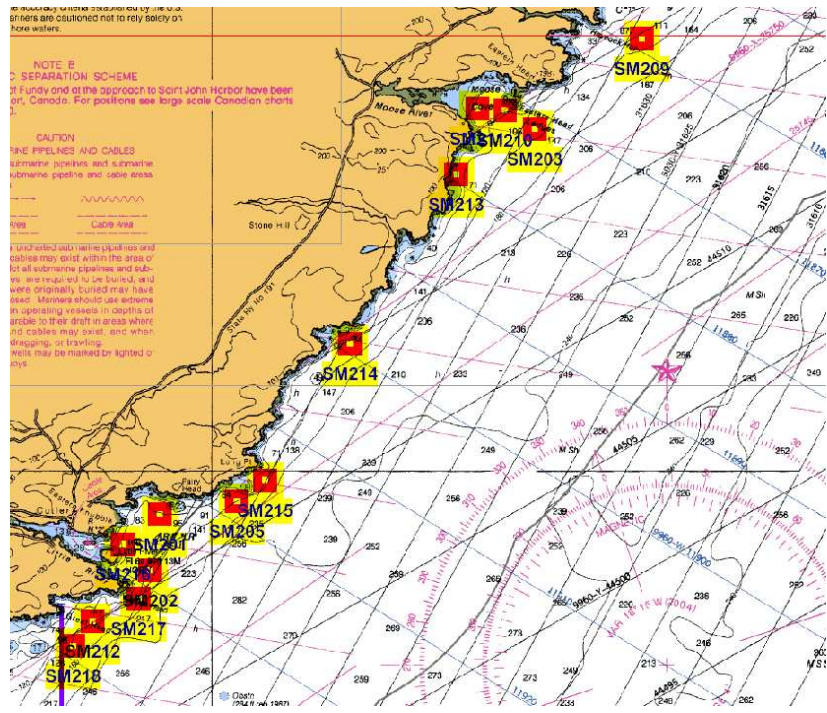


Figure 6. Location of 2013 survey stations (open portion Stratum 2).

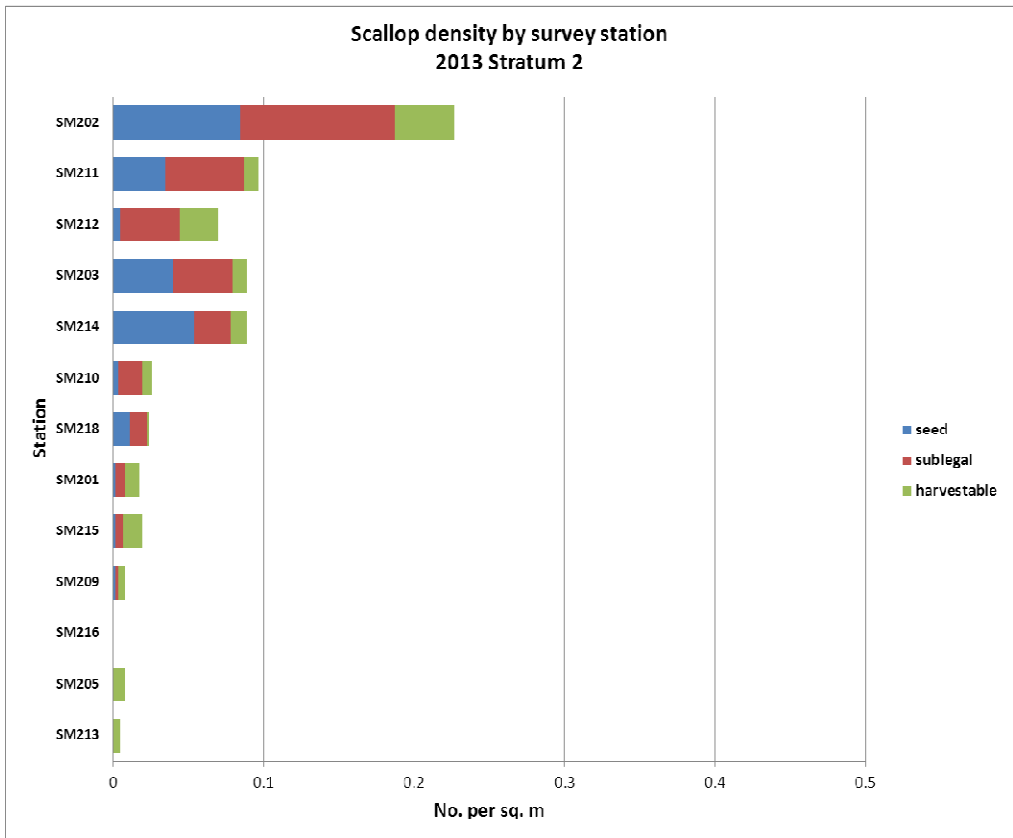


Figure 7. Density of scallops and size class composition by tow (open portion Stratum 2), 2013 survey.

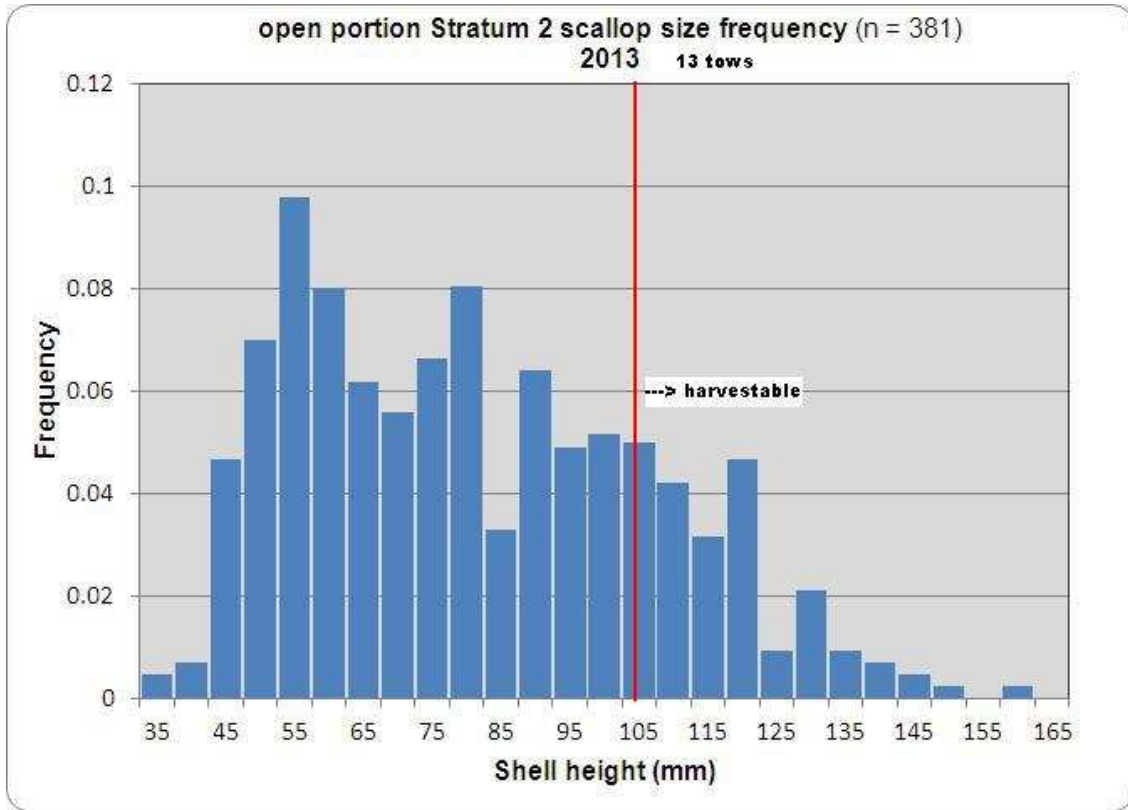


Figure 8. Size frequency (5 mm increments) of scallops in Stratum 2 (2013).

Stratum 3 (Great Wass Is. to Great Head)

Machias Bay LAA

A total of 19 tows were done within the Machias Bay LAA (Fig. 9). One (1) tow contained no scallops. The estimated harvestable biomass was higher in 2013 than it was prior to re-opening to fishing in 2012.

Harvestable density was greater in the LAA (0.047 per m²) than the adjacent open area (0.022 per m²) (Figs. 10-11). The density of harvestables increased from the previous survey of 2011 (0.027 per m²). Sublegal density was 0.037 per m² in the LAA and 0.045 per m² in the open portion of Stratum 3. There was only a small presence of seed (0.005 per m²) in the LAA.

Highest overall catch rate was at the western end of Cross Is. Narrows and the highest catch rate of harvestables was S of Cape Wash.

Scallop harvestable (≥ 4 inch SH) biomass (by meat weight) was calculated by applying the shell height-meat weight relationship for combined Strata 2-3 from fall 2011 (Kelly 2012). Spring 2013 size frequencies were projected to December 1 using von Bertalanffy parameters (Serchuk et al. 1982) on a tow-by-tow basis to determine mean harvestable biomass (g) per m². That value (adjusted with a dredge efficiency factor of 0.429 (Kelly 2013)) was then expanded to the total survey area within the Machias LAA to obtain a total harvestable biomass estimate of 120,100 \pm 8,200 lbs., an increase of 6% from the 2012 estimate projected from the 2011 survey (Figure 12).

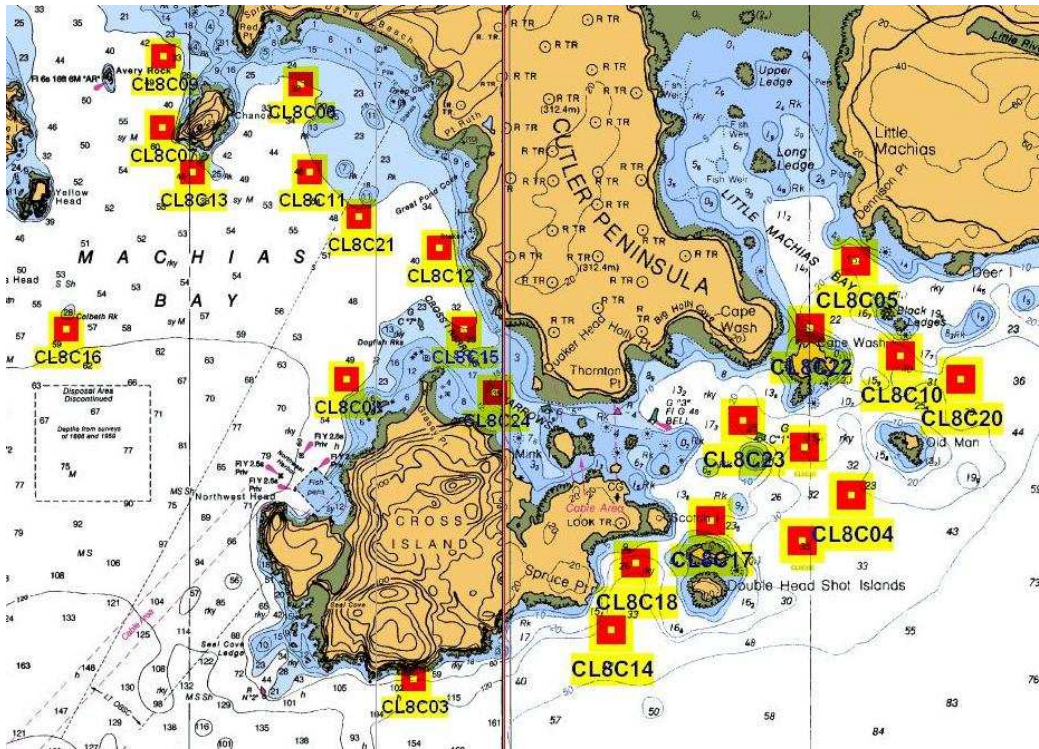


Figure 9. Location of 2013 survey stations (Machias Bay LAA).

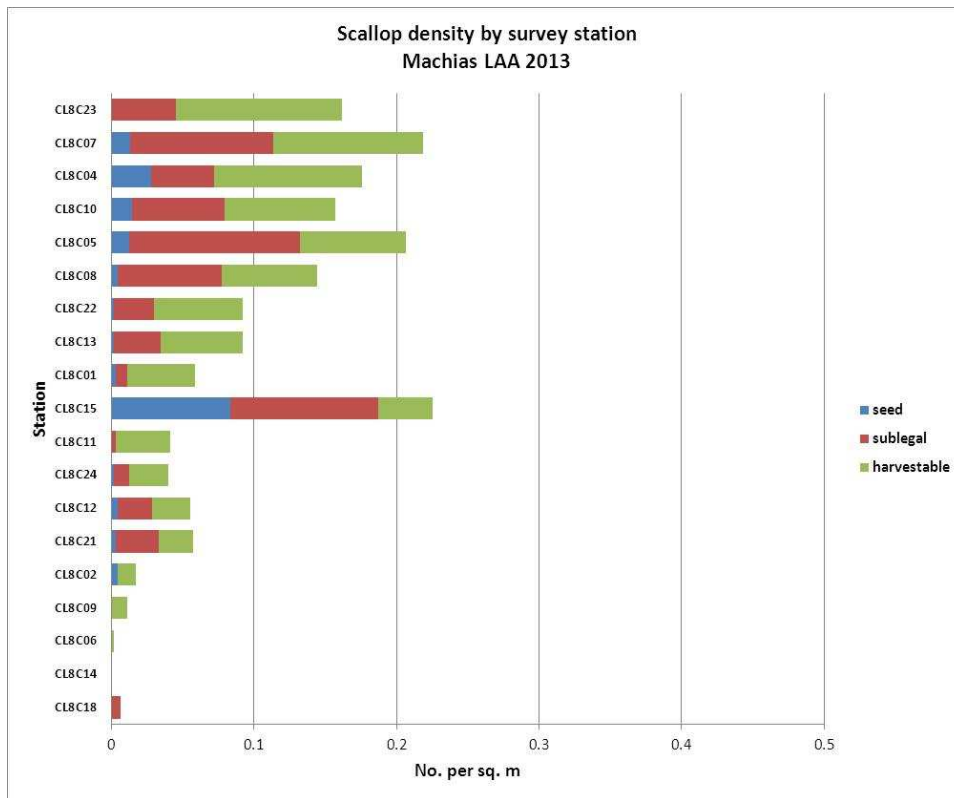


Figure 10. Density of scallops and size class composition by tow (Machias Bay LAA), 2013 survey.

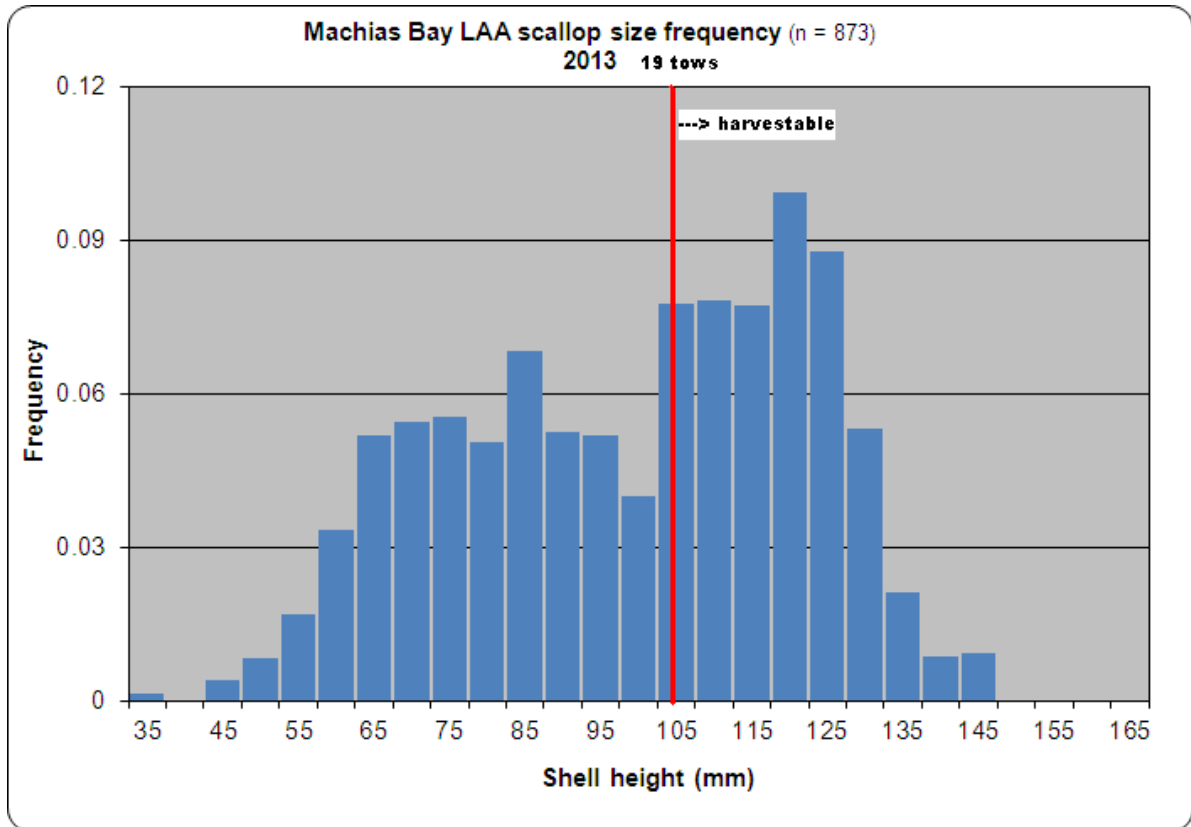


Figure 11. Size frequency (5 mm increments) of scallops in Machias Bay LAA, 2013.

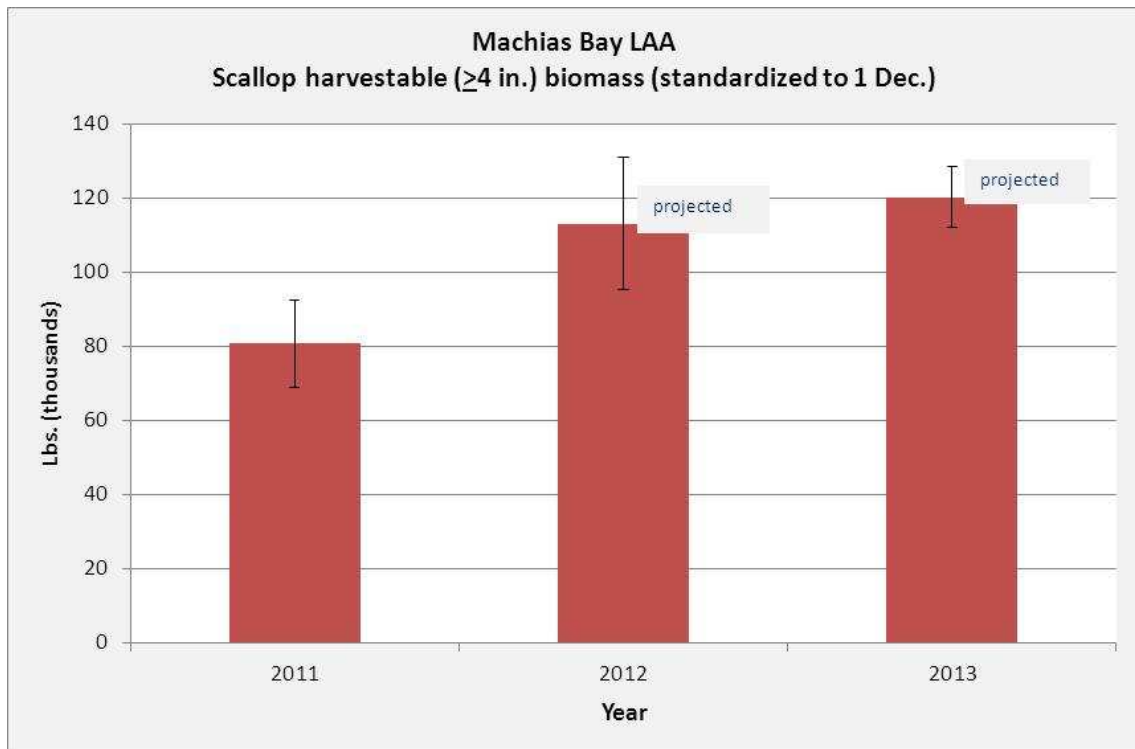


Figure 12. Estimated mean harvestable scallop biomass (meat lbs.), Machias Bay LAA, 2011-13.

Chandler Bay LAA

Nine (9) tows were completed in this LAA (Fig. 13). Three (3) tows contained no scallops.

Harvestable density (0.014 per m²) was 58% less than 2011 (0.033 per m²) (Figs. 14-15). Seed density remained low (0.004 per m²), comparable to 2011 (0.009 per m²). Sublegal density (0.028 per m²) was the same as in 2011 in Chandler Bay LAA.

Highest overall catch rate and highest density of seed and sublegals was E of Great Bar. Highest density of harvestables was NE of Squire Pt.

This area was closed to fishing in 2013-14 to protect recruitment.

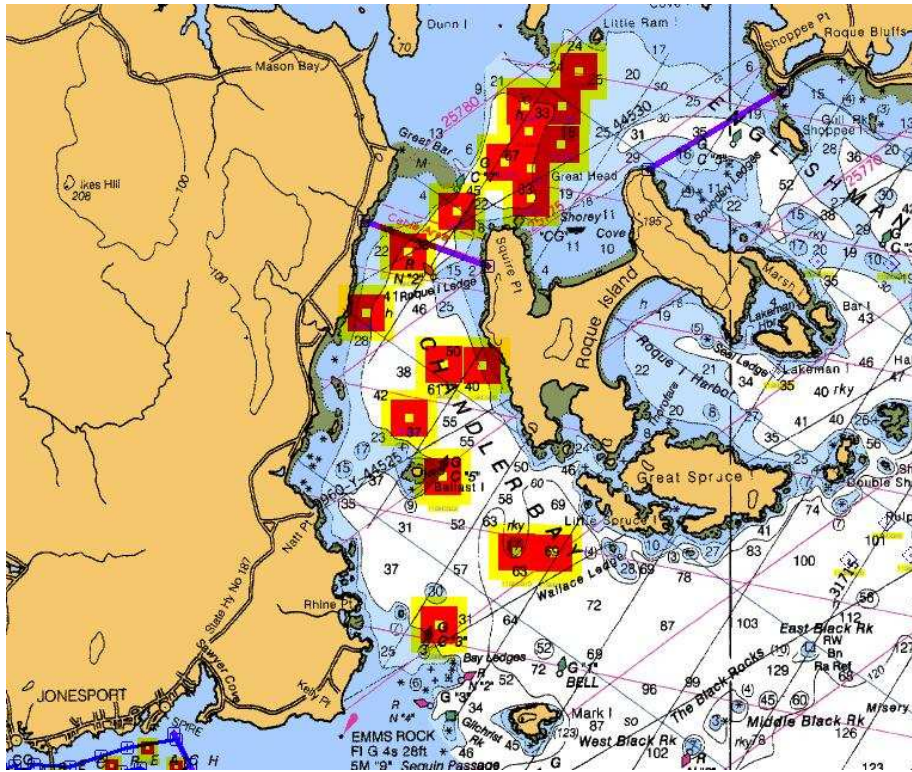


Figure 13. Location of 2013 survey stations (Chandler Bay LAA).

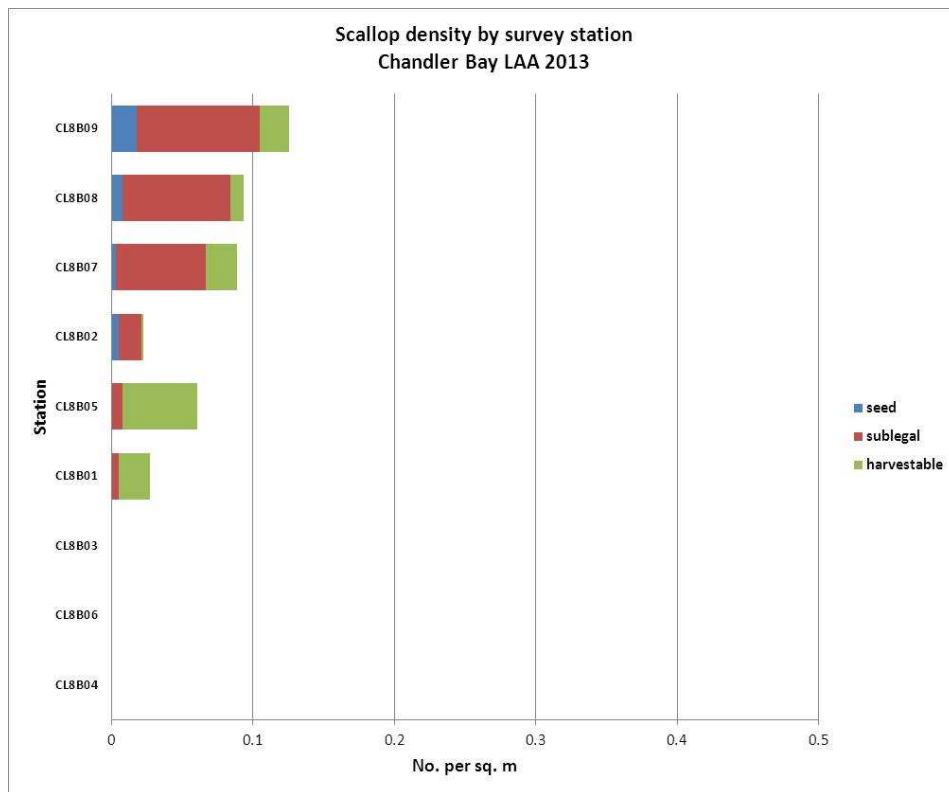


Figure 14. Density of scallops and size class composition by tow (Chandler Bay LAA), 2013 survey.

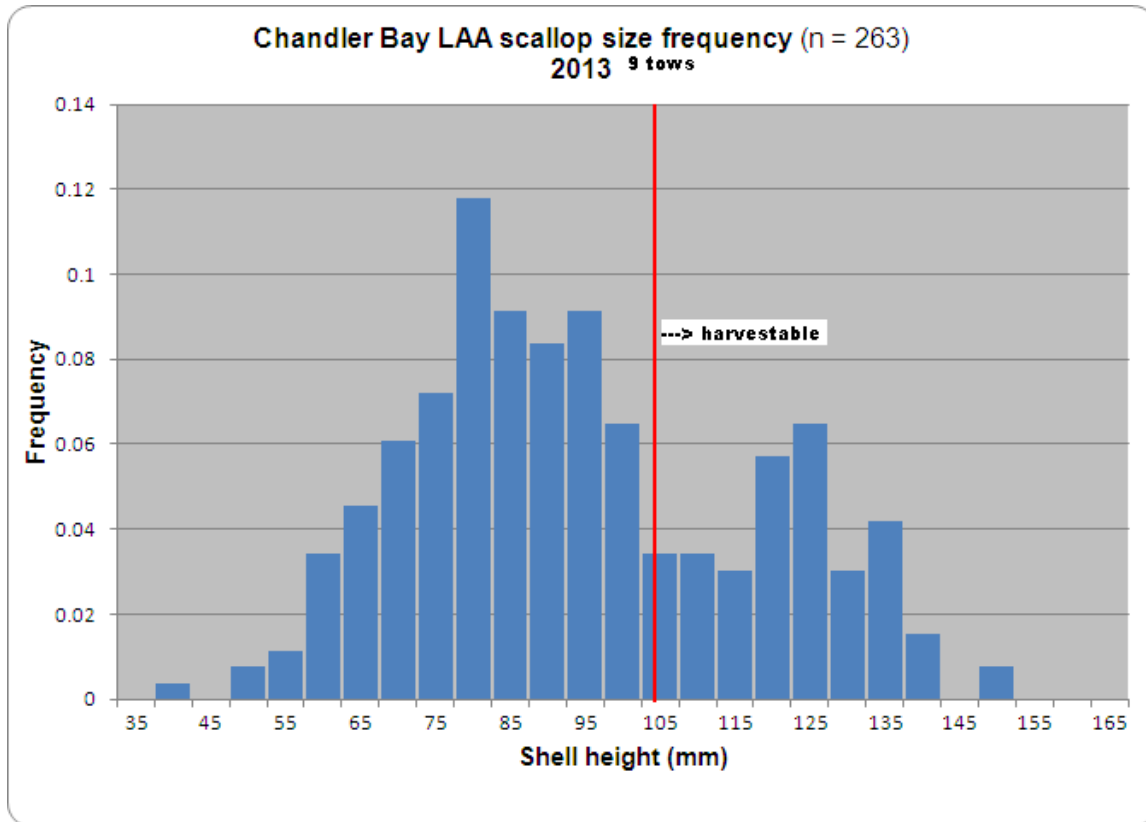


Figure 15. Size frequency (5 mm increments) of scallops in Chandler Bay LAA, 2013.

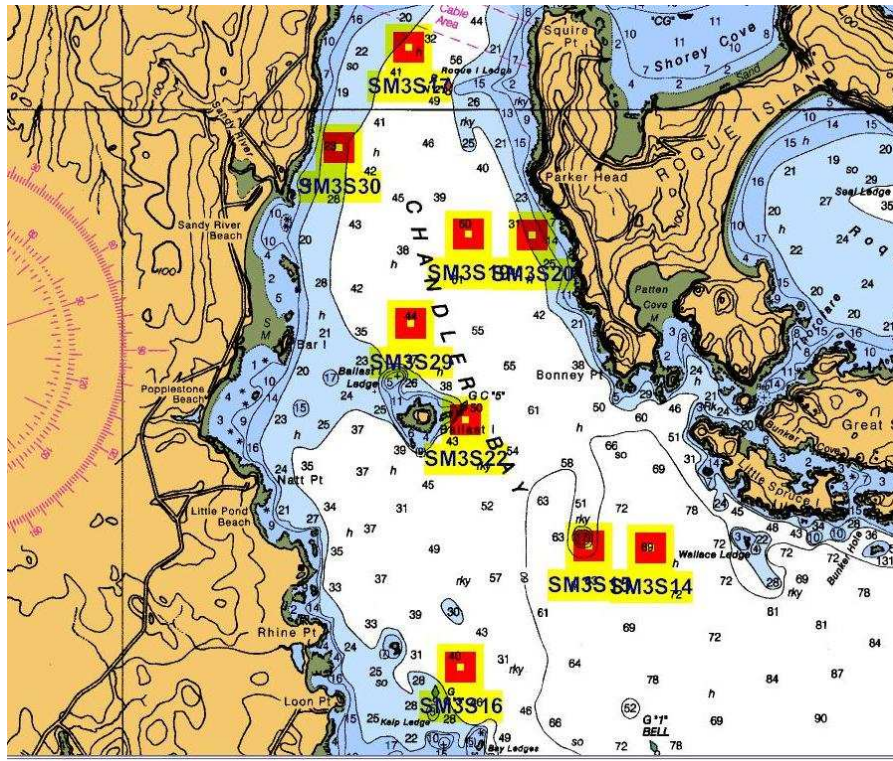
Open portion Stratum 3

There were 13 stations completed on the survey in the *open* portion of Stratum 3 (Figs. 16a-b). Four (4) tows contained no scallops.

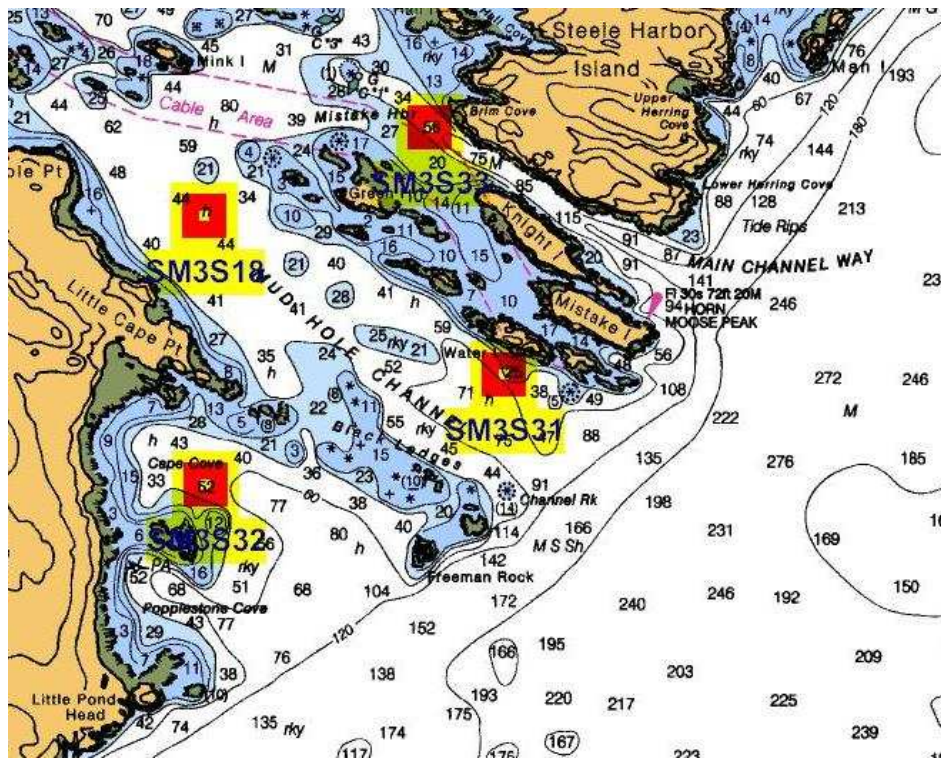
Chandler Bay LAA and Machias LAA are within the boundaries of Stratum 3 but this discussion represents results from portions of the stratum that were not considered LAAs. The predominant size group was sublegals (0.045 per m²) which increased 114% from 2011 (0.021 per m²) (Figs. 17-18). Harvestable density was 0.022 per m². Seed density remained low (0.005 per m²), comparable to 2011 (0.007 per m²).

Highest overall catch rate and highest harvestable, sublegal and seed densities were in the open portion of Chandler Bay.

Much of Chandler Bay was closed to fishing in 2013-14 to protect recruitment.



a.



b.

Figures 16a-b. Location of 2013 survey stations (open portion Stratum 3).

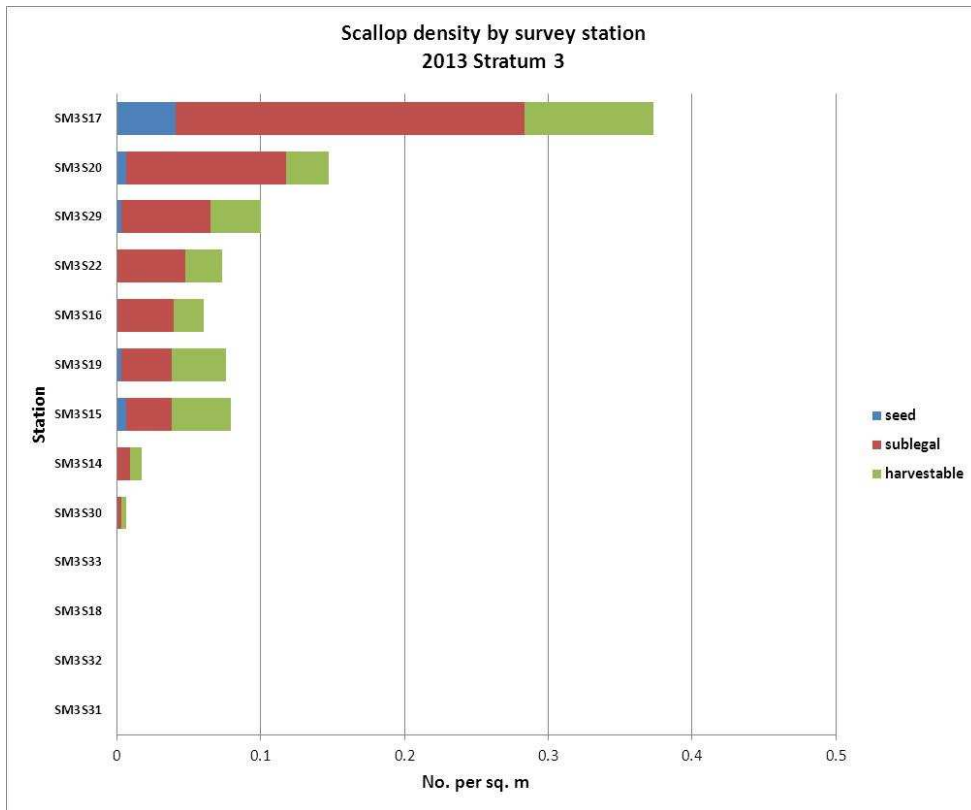


Figure 17. Density of scallops and size class composition by tow (open portion Stratum 3), 2013 survey.

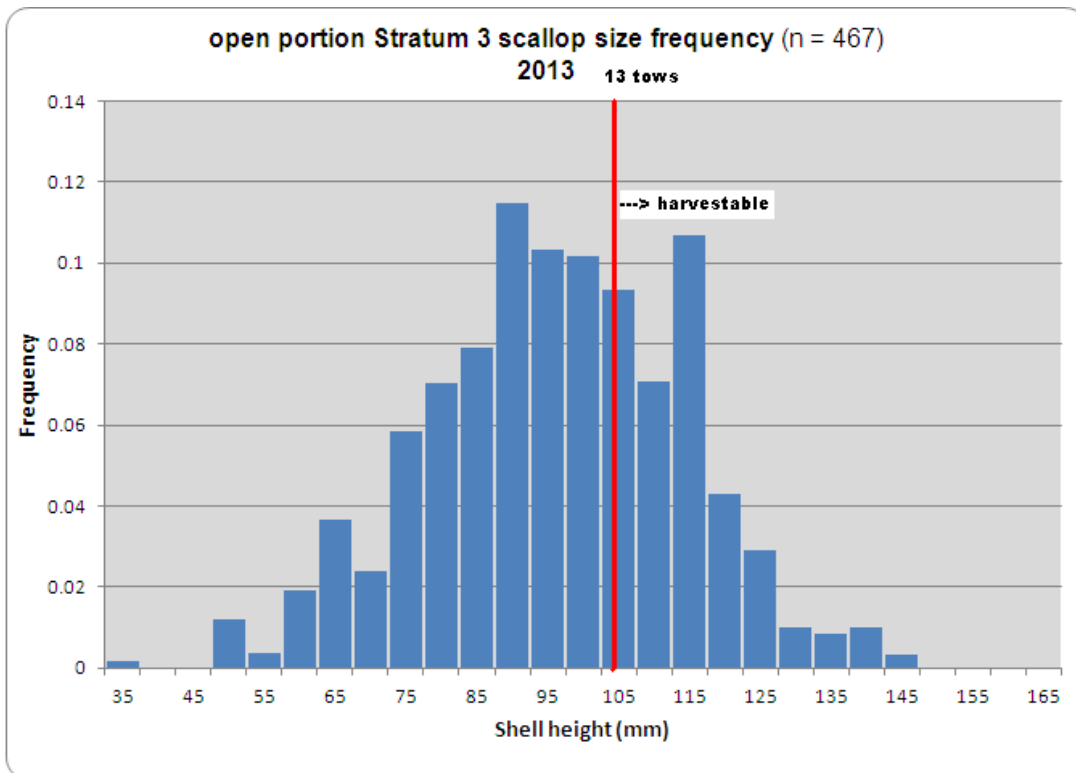


Figure 18 . Size frequency (5 mm increments) of scallops in Stratum 3 (2013).

Stratum 4 (Schoodic Pt. to Great Wass Is.)

Moosabec Reach LAA

There were 14 tows done in this LAA (Fig. 19). Seven (7) tows contained no scallops.

The predominant size class was sublegal (0.044 per m²) which was 209% higher than in 2011 (0.021 per m²) (Figs. 20-21). Harvestable density (0.027 per m²) was 225% higher than 2011 (0.012 per m²). Seed abundance (0.009 per m²) was comparable to 2011 (0.005 per m²).

Virtually all of the scallops in this closure were in the eastern part of Moosabec Reach although one station just W of the Jonesport-Beals bridge had the highest abundance of harvestables. Highest densities of seed and sublegals were just E of the bridge.

Tows in the portion of the LAA in or near Western Bay contained few or no scallops.

Part of this area was closed to fishing in 2013-14 to protect recruitment.

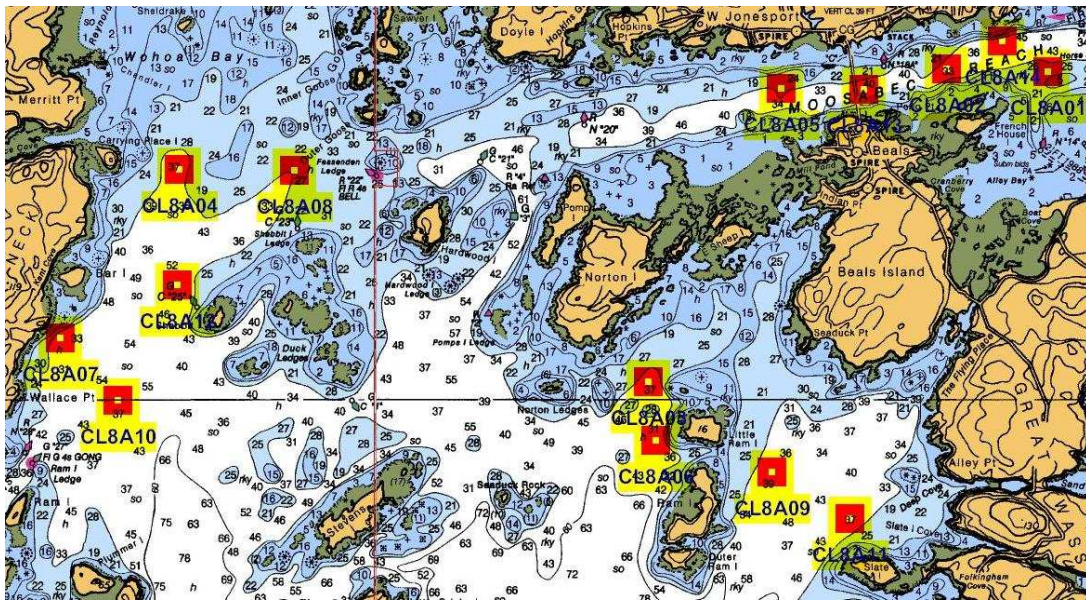


Figure 19. Location of 2013 survey stations (Moosabec Reach LAA).

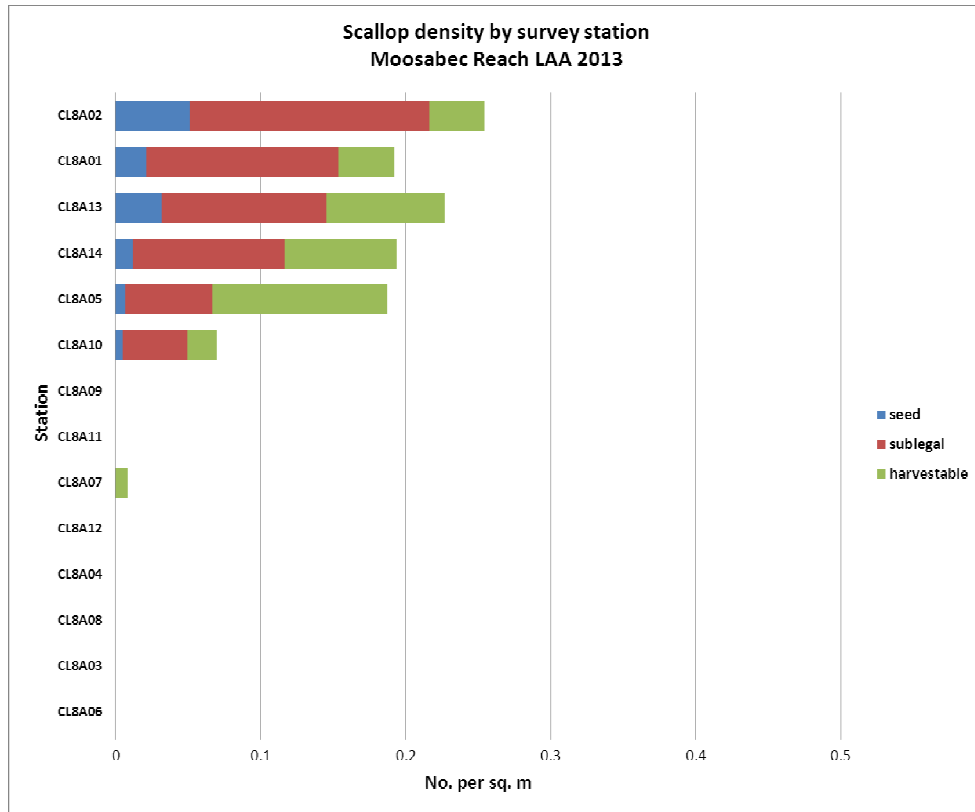


Figure 20. Density of scallops and size class composition by tow (Moosabec Reach LAA), 2013 survey.

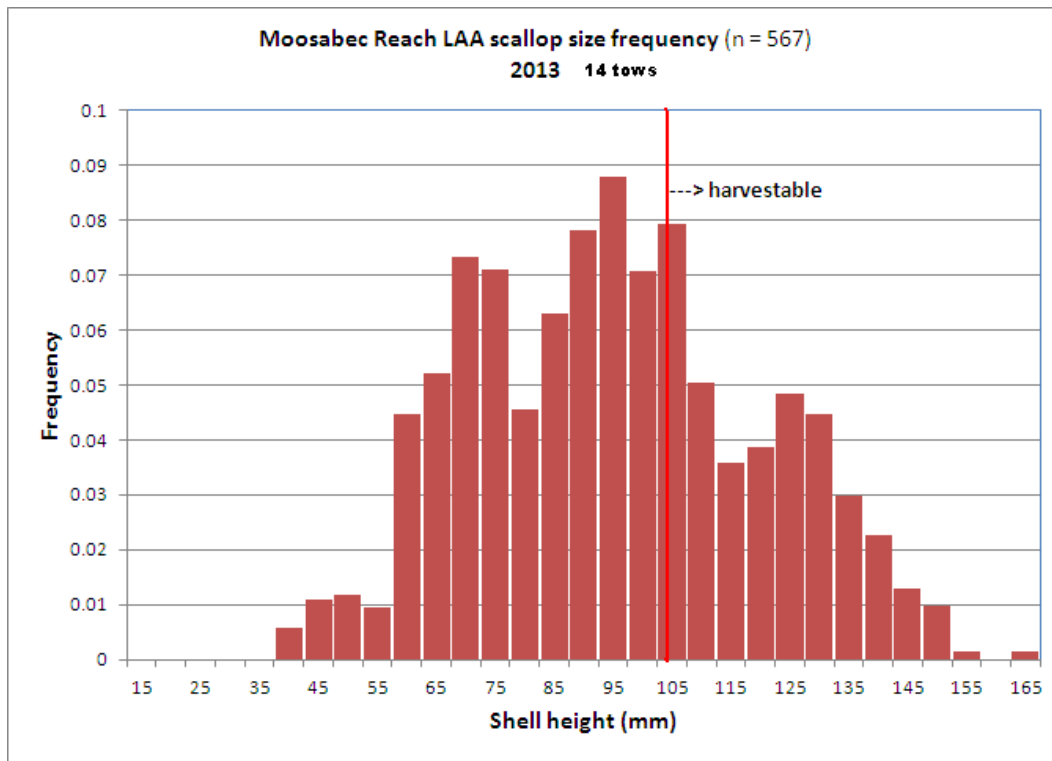


Figure 21. Size frequency (5 mm increments) of scallops in Moosabec Reach LAA, 2013.

Gouldsboro Bay LAA

There were 14 tows completed in Gouldsboro Bay (Fig. 22). One (1) tow contained no scallops. Scallop abundance was markedly lower than the previous survey.

The predominant size group was harvestables (0.034 per m²) although there was a 58% decrease from 2011 (0.080 per m²) (Figs. 23-24). There was a 77% decline in sublegal density (0.014 per m²) from 2011 (0.062 per m²). Seed abundance (0.003 per m²) remained low and unchanged since 2011.

Harvestable biomass was calculated by applying the fall 2011 shell height-meat weight relationship for Stratum 4 to spring 2013 survey size frequency data. Spring 2013 size frequencies were projected to December 1 using von Bertalanffy parameters (Schick et al. 1987) on a tow-by-tow basis to determine mean harvestable biomass (g) per m².

Expansion of that value to the total survey area (7,300 km²) within the Gouldsboro Bay LAA resulted in an estimate of 47,800 ± 3,600 lbs. (Fig. 25).

Estimated harvestable biomass in Gouldsboro Bay increased nearly 13X between 2008 (pre-closure) and 2012 (end of closure; projected estimate from 2011 survey) (Fig. 25). There was a drop of over 60% however between 2012 and 2013. A large amount of fishing effort in this area on limited access days during 2012-13 as well as multiple reports of illegal harvesting both during the fishing season and in the years prior to re-opening likely contributed to the loss of biomass here.

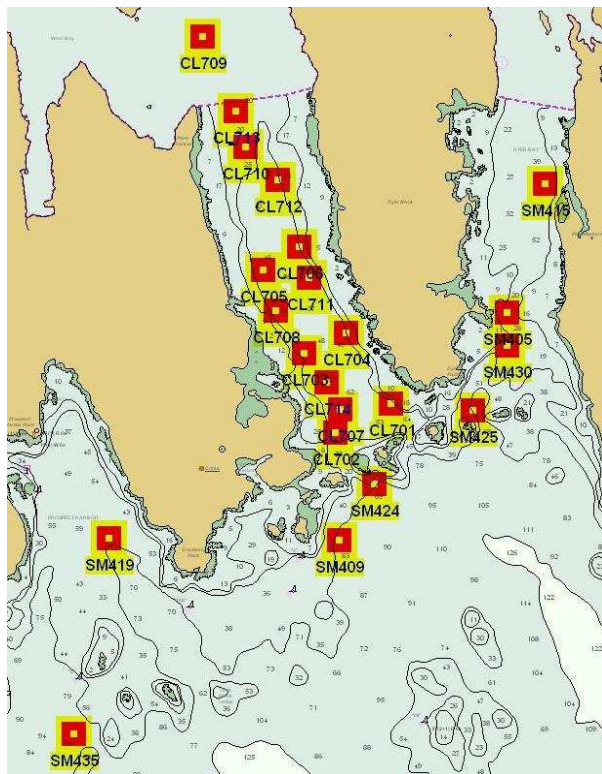


Figure 22. Location of 2013 survey stations (Gouldsboro Bay LAA).

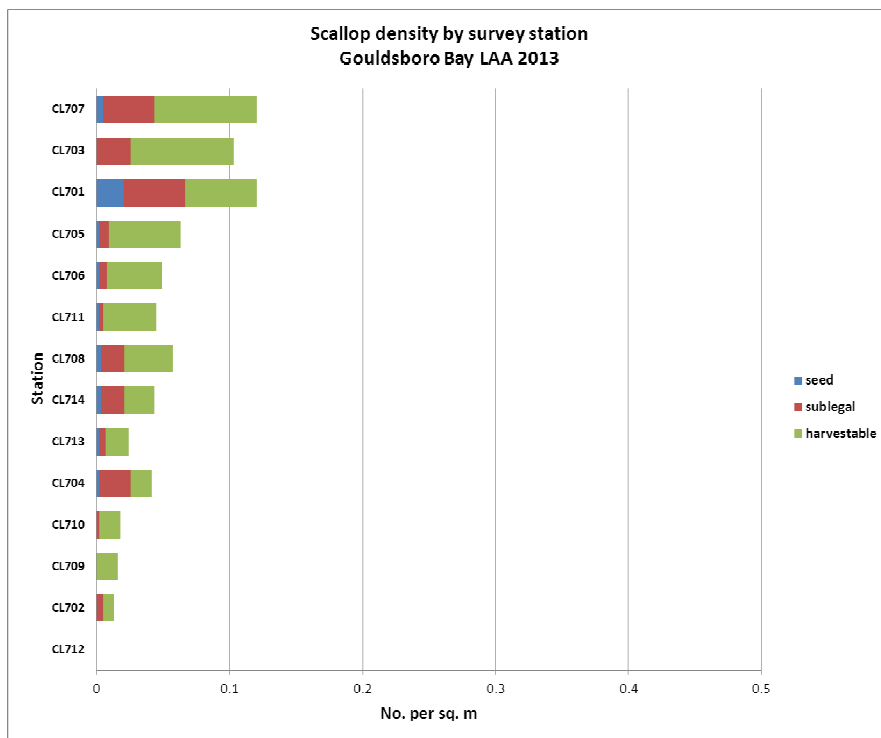


Figure 23 . Density of scallops and size class composition by tow (Gouldsboro Bay LAA), 2013 survey.

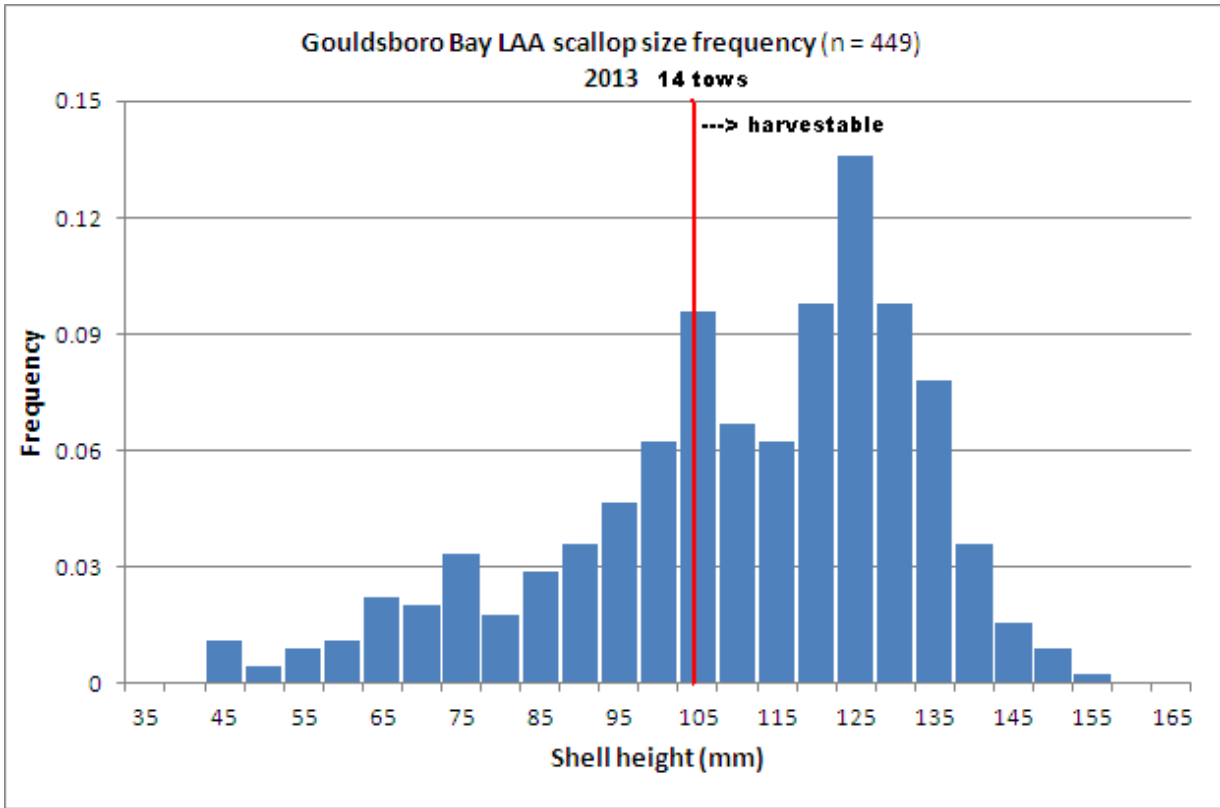


Figure 24 . Size frequency (5 mm increments) of scallops in Gouldsboro Bay LAA, 2013.

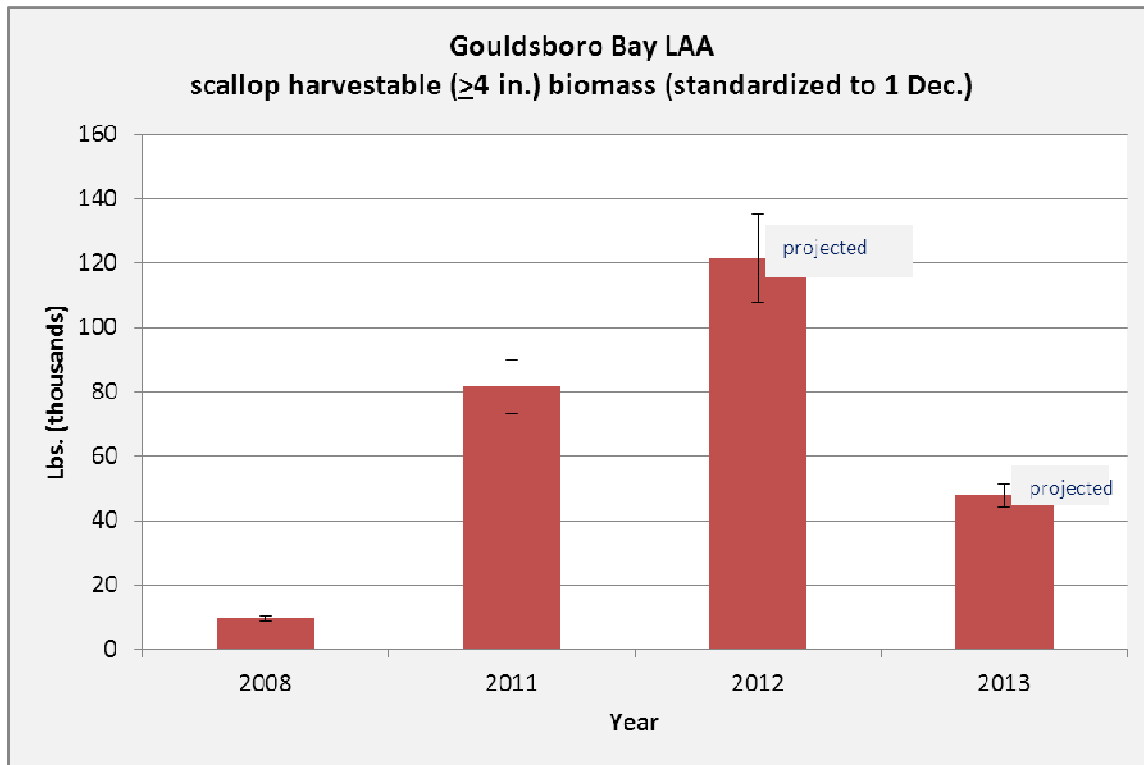


Figure 25 . Estimated mean harvestable scallop biomass (meat lbs.), Gouldsboro Bay LAA, 2008-13.

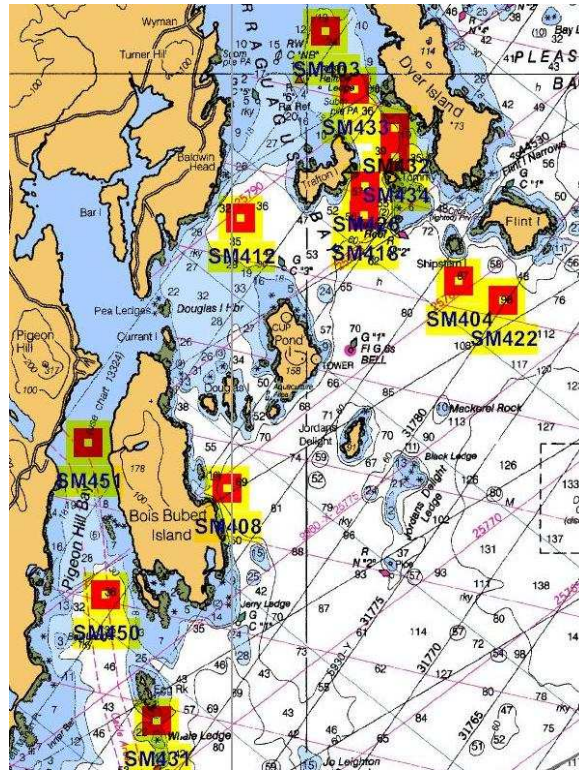
Open portion Stratum 4

There were 16 tows completed in the open portion of Stratum 4 (Fig. 26a-b). Six (6) tows had no scallops.

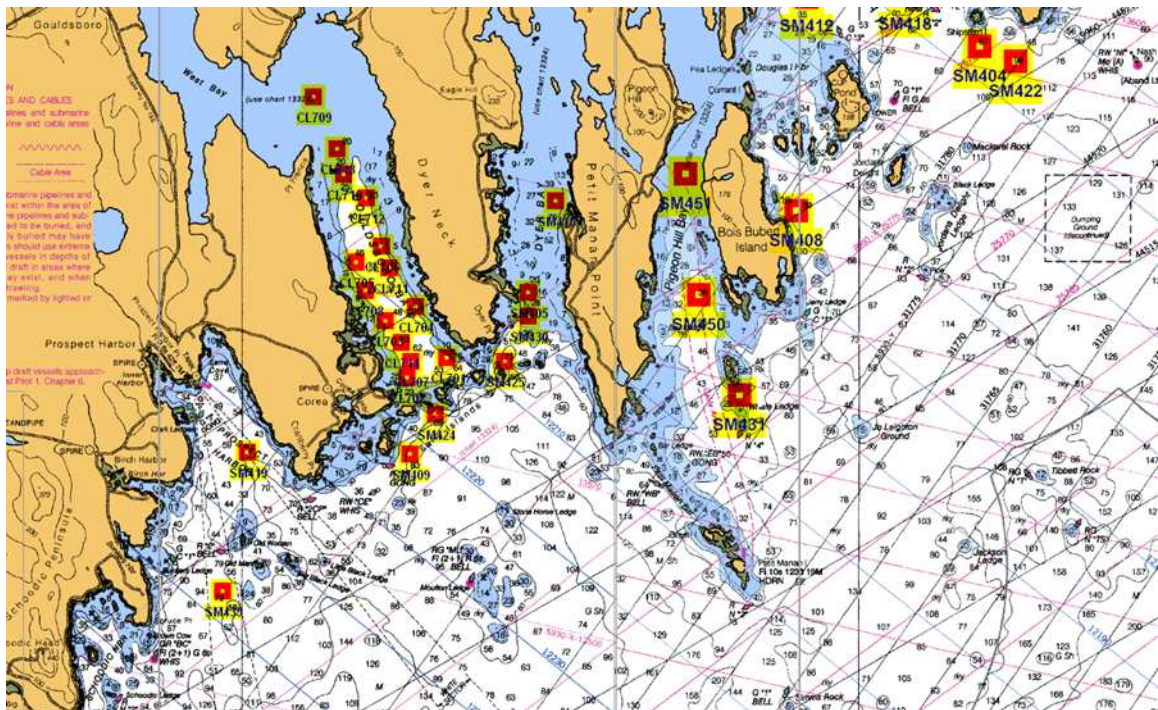
Sublegals (0.015 per m²) increased since 2011 (0.009 per m²) and were the prominent size group in this area (Figs. 27-28). Seed density (0.007 per m²) increased slightly from 2011 (0.001 per m²) as did harvestable abundance (0.010 per m² in 2013 vs. 0.005 per m² in 2011).

Highest seed, sublegal and harvestable densities were at the mouth of Dyers Bay. Scattered occurrences of scallops were observed in the vicinity of the Sally Islands and Narraguagus Bay.

Part of this area (Dyers Bay) was closed to fishing in 2013-14 to protect recruitment.



a.



b.

Figures 26a-b. Location of 2013 survey stations (open portion Stratum 4).

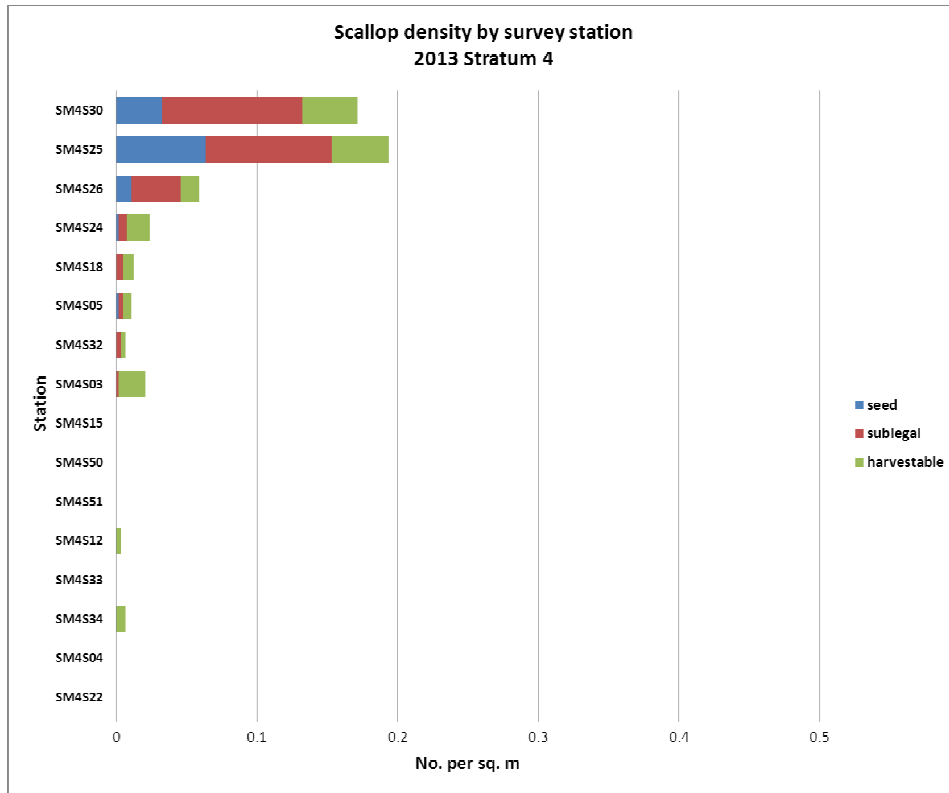


Figure 27. Density of scallops and size class composition by tow (open portion Stratum 4), 2013 survey.

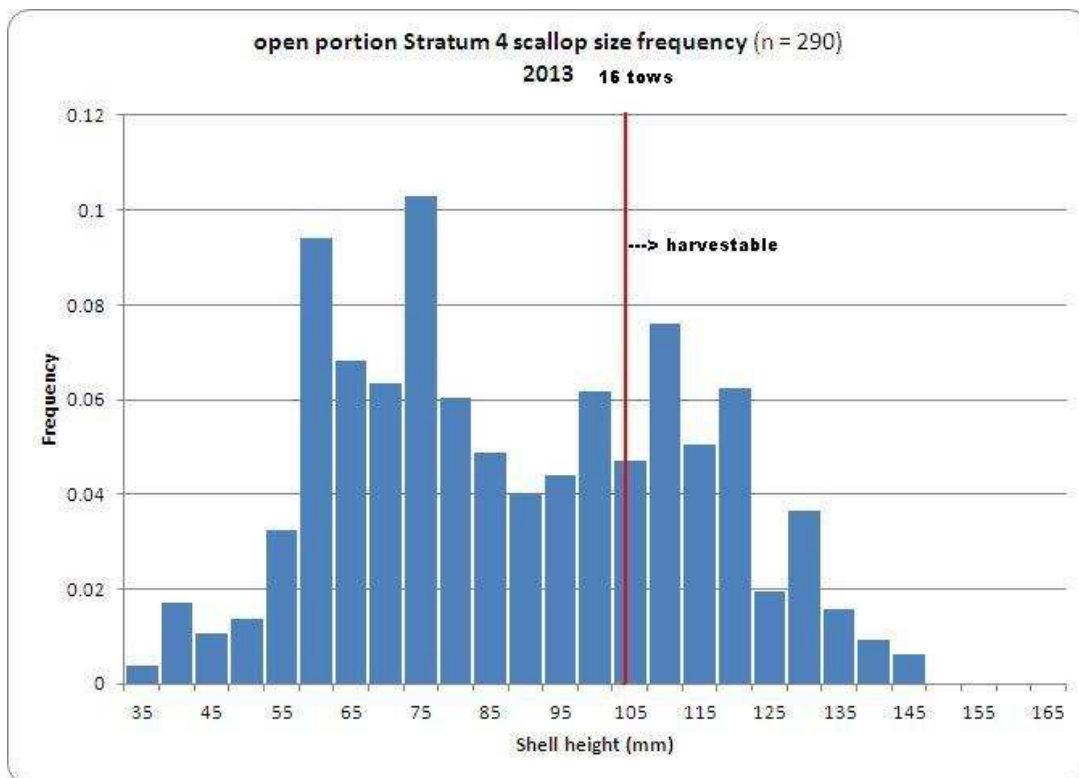


Figure 28. Size frequency (5 mm increments) of scallops in Stratum 4 (2013).

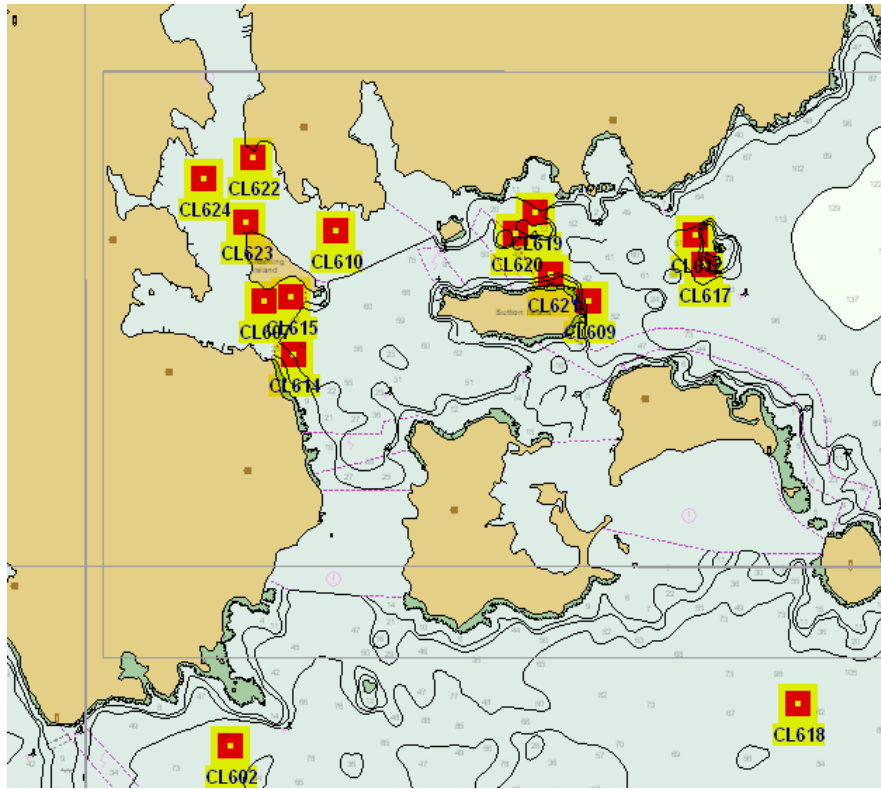
Stratum 5 (E. Blue Hill Bay to Frenchman Bay)

Mt. Desert LAA

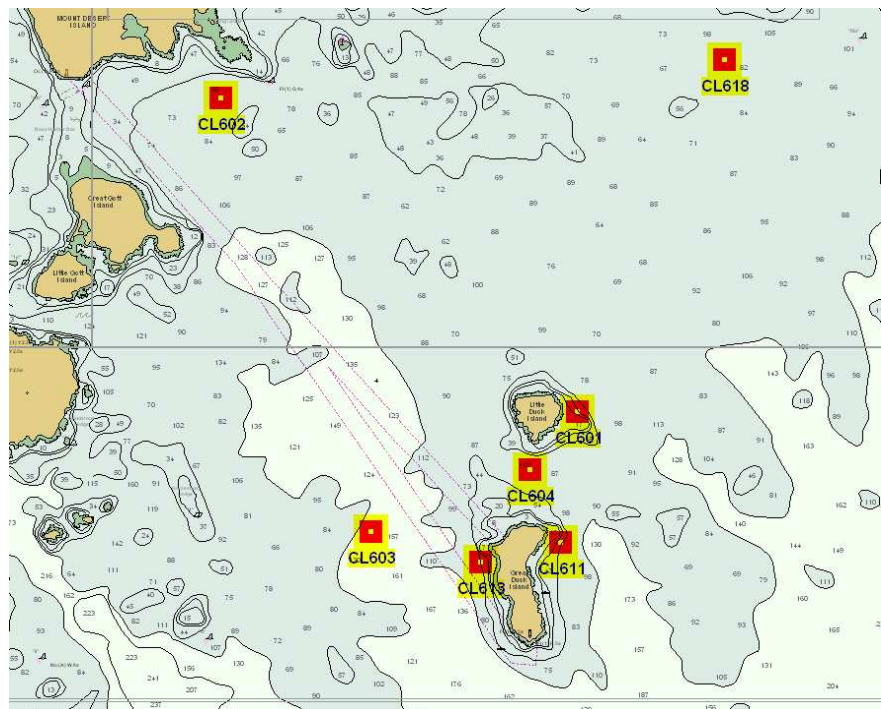
Twenty (20) tows were done in this LAA and 16 contained no scallops, similar to 2011 (Figs. 29a-b, 30).

Overall scallop density was very poor (Figs. 31-32). The outside (further offshore) portion of this closure had no scallops (Fig. 31). Virtually the only scallops seen in the entire LAA were NW of Greening Is. where there was a light presence of seed, sublegal and harvestables.

Part of this area (near Greening Is.) was closed to fishing in 2013-14 to protect sublegals.



a.



b.

Figure 30a-b . Location of 2013 survey stations (Mt. Desert LAA).

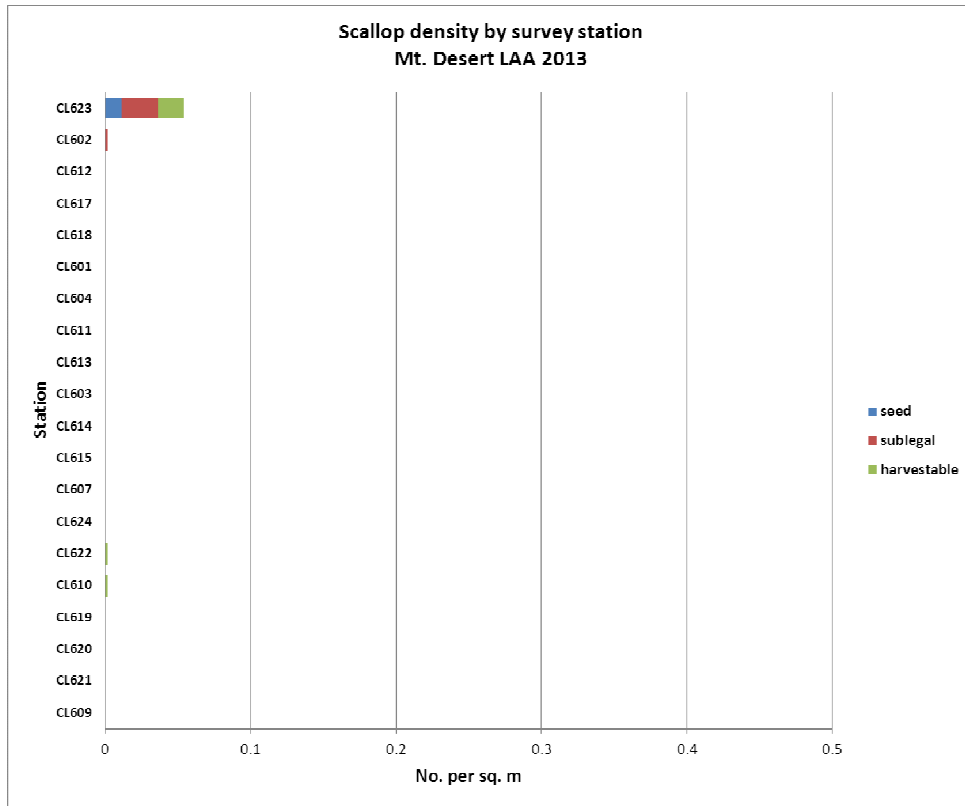


Figure 31. Density of scallops and size class composition by tow (Mt. Desert LAA), 2013 survey.

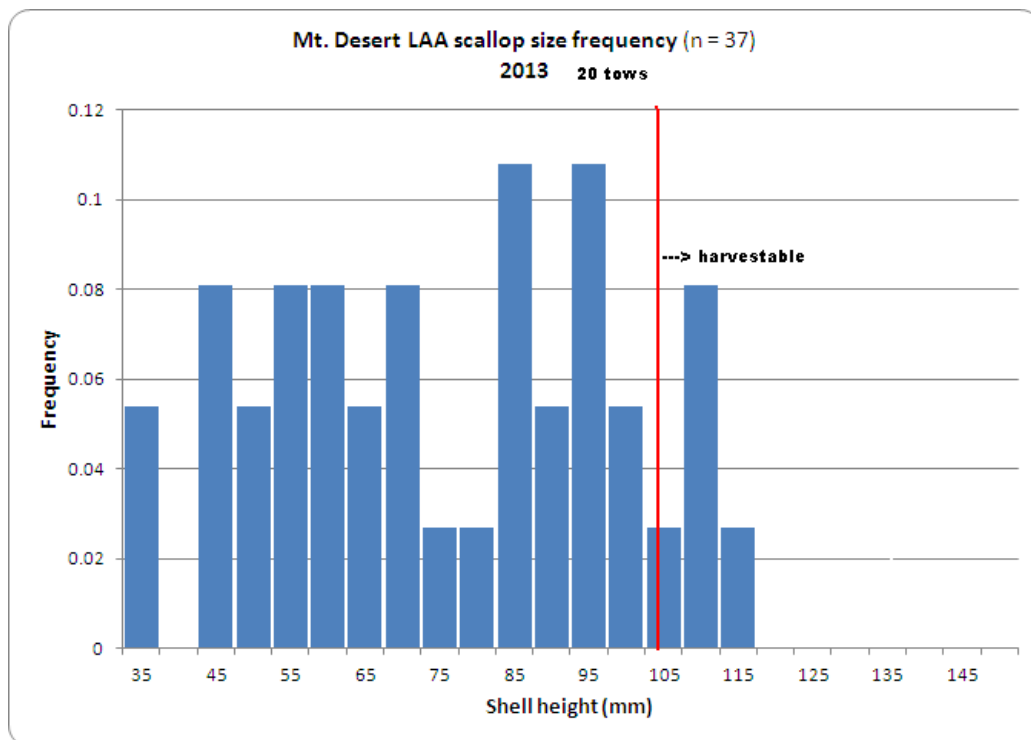


Figure 32. Size frequency (5 mm increments) of scallops in Mt. Desert LAA, 2013.

Open portion Stratum 5

There were 13 tows completed in the open portion of this stratum (Fig. 33). Two (2) tows had no scallops. Due to elevated landings and fishing activity in the Union River Bay area in the 2011-12 and 2012-13 seasons survey intensity was increased in this part of the stratum. Union River Bay scallop abundance appeared depleted in the 2013 survey.

Stratum 5 harvestable density remained about the same in 2013 (0.010 per m²) as 2011 (0.008 per m²) (Figs. 34-35). Sublegals declined from 0.013 per m² in 2011 to 0.005 per m² in 2013. There was barely a trace (<0.001 per m²) of seed in this stratum, same as in 2011.

Highest density of harvestable scallops was in Union River Bay and highest density of sublegals was in Bartlett Narrows but quantities of both were small.

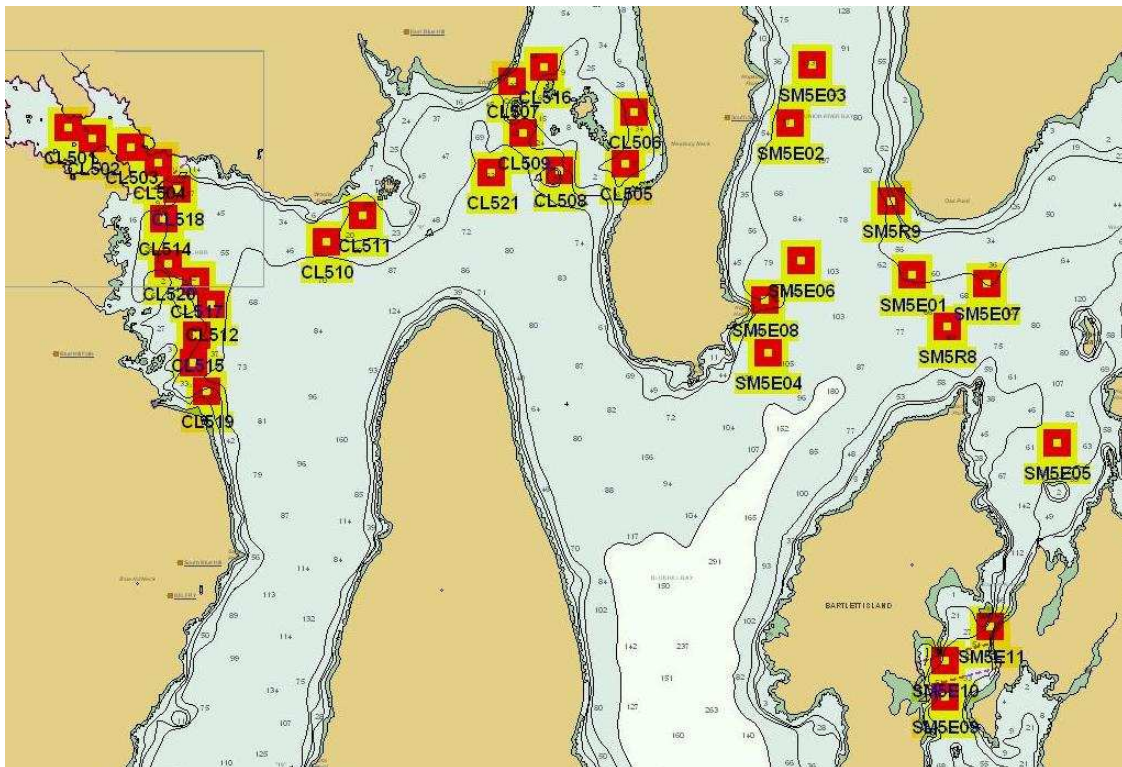


Figure 33. Location of 2013 survey stations (Blue Hill Bay to Union River Bay).

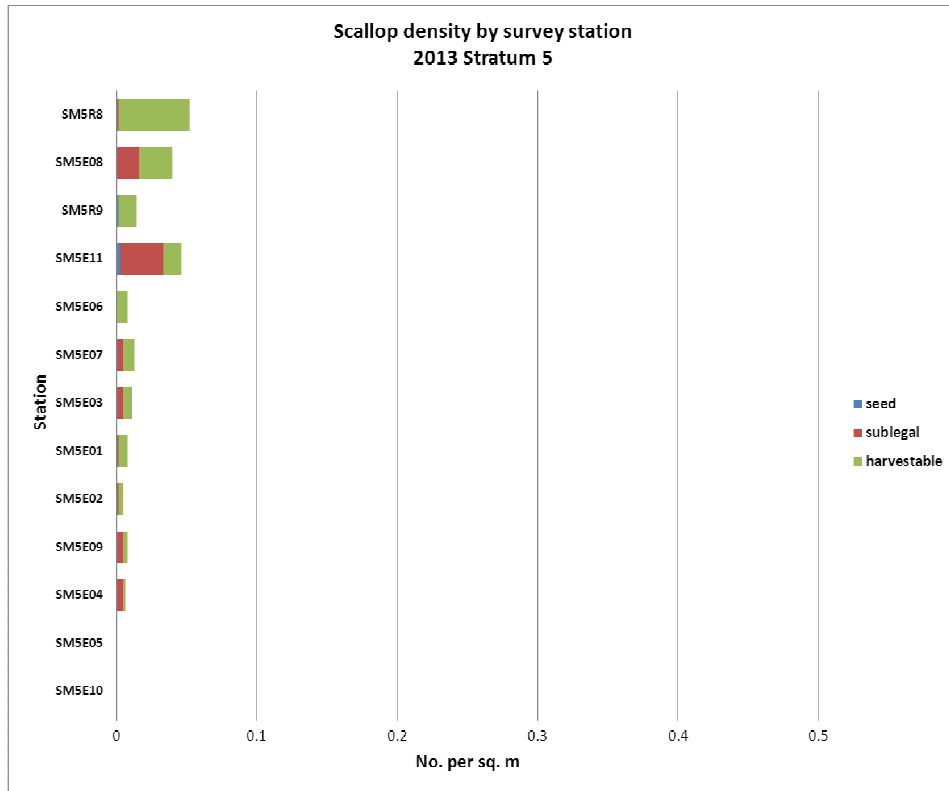


Figure 34. Density of scallops and size class composition by tow (open portion stratum 5), 2013 survey.

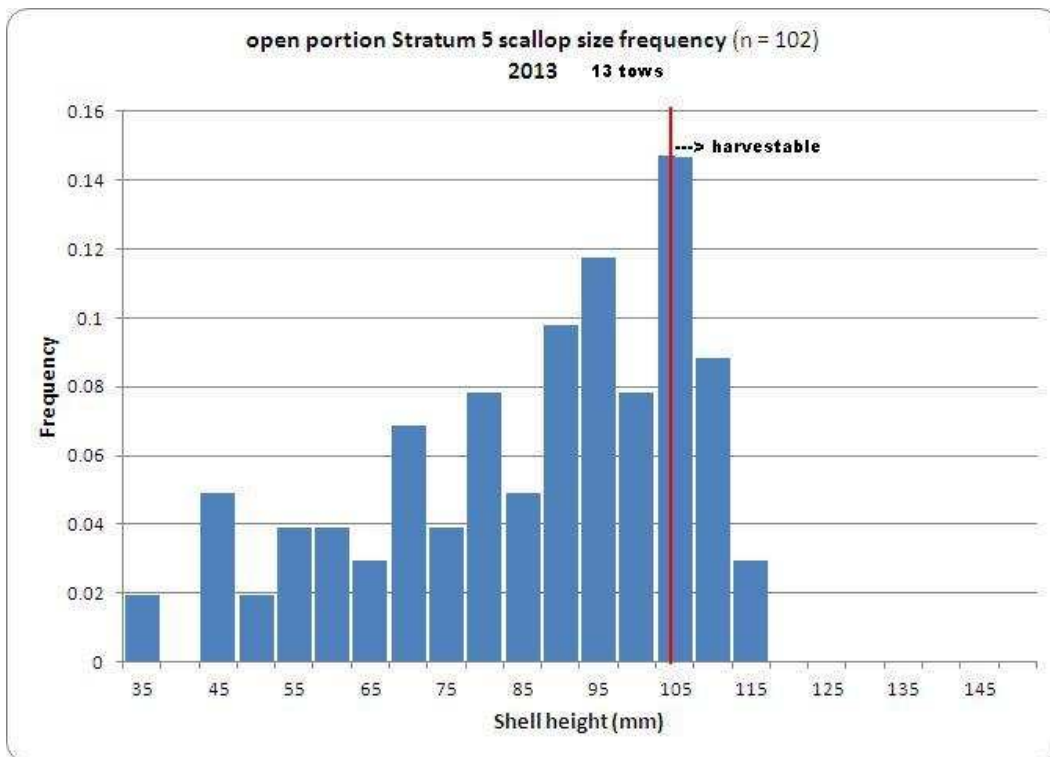


Figure 35 . Size frequency (5 mm increments) of scallops in Stratum 5 (2011).

Stratum 6 (E. Penobscot Bay to W. Blue Hill Bay)

E. Penobscot Bay LAA

There were 17 stations completed in the E. Penobscot Bay LAA (Fig. 36). Seven (7) had no scallops. This area showed a decline in scallop abundance and very little sign of recruitment.

Sublegals (0.002 per m²) declined 91% from 2011 (0.023 per m²) (Figs. 37-38). Seed abundance (0.004 per m²) remained low in this area. Seed abundance was very low (0.002 per m²). The only tow which contained seed was in Southeast Harbor.

Harvestables (0.006 per m²) declined 76% from 2011 (0.025 per m²). Small amounts of harvestable scallops were observed in Southeast Harbor, Eggemoggin Reach and Benjamin River.

Part of the Southeast Harbor area was closed to fishing in 2013-14 to encourage spat production.

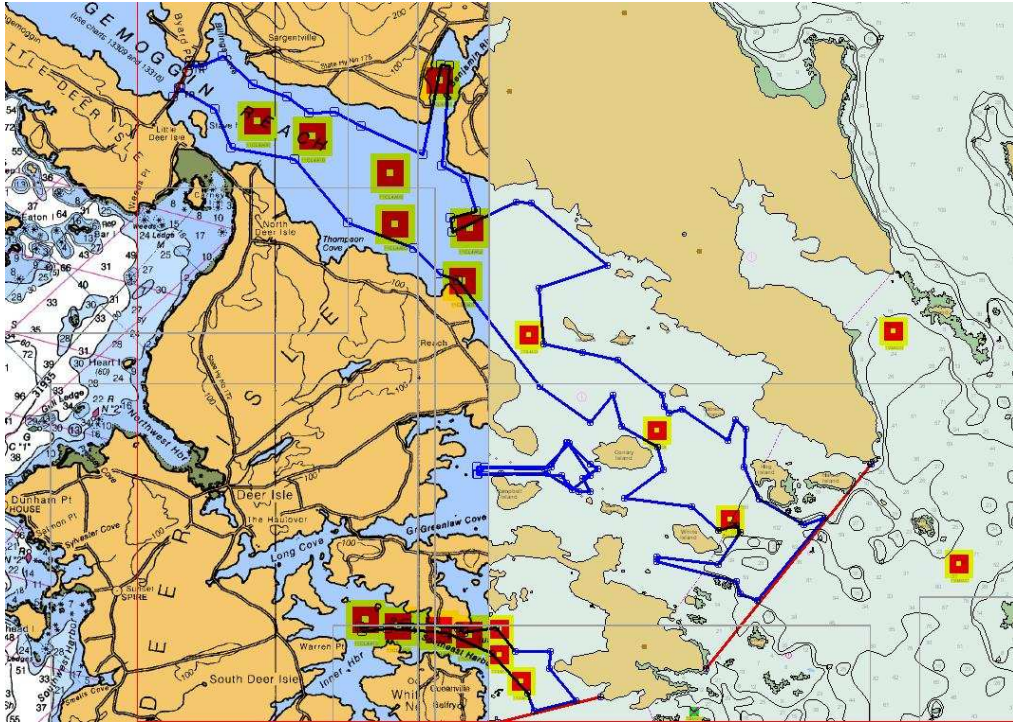


Figure 36. Location of 2013 survey stations (E. Penobscot Bay LAA).

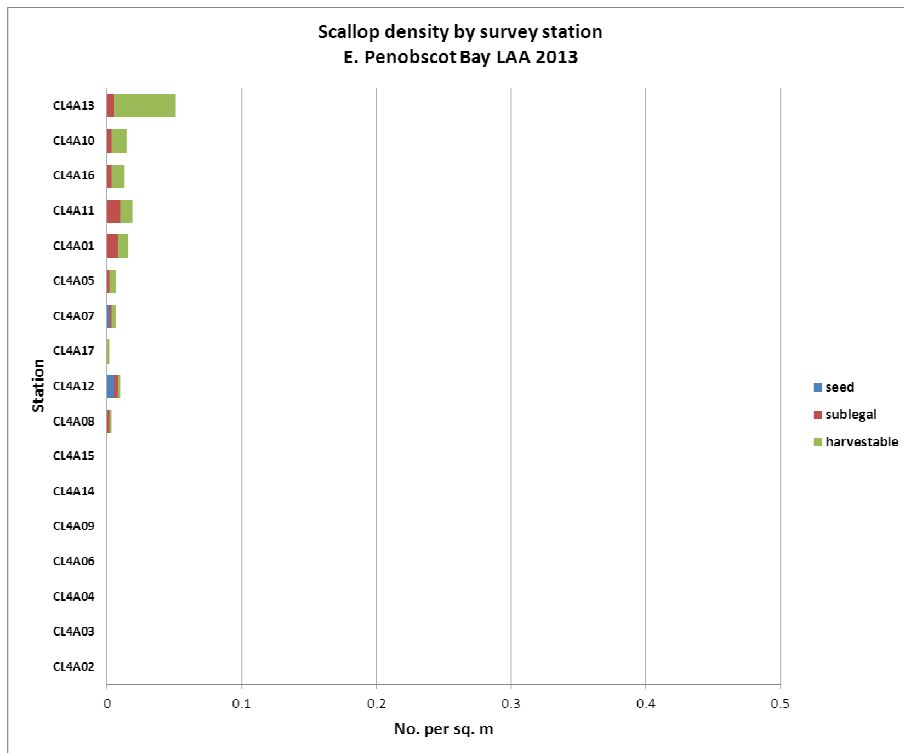


Figure 37. Density of scallops and size class composition by tow (E. Penobscot Bay LAA), 2013 survey.

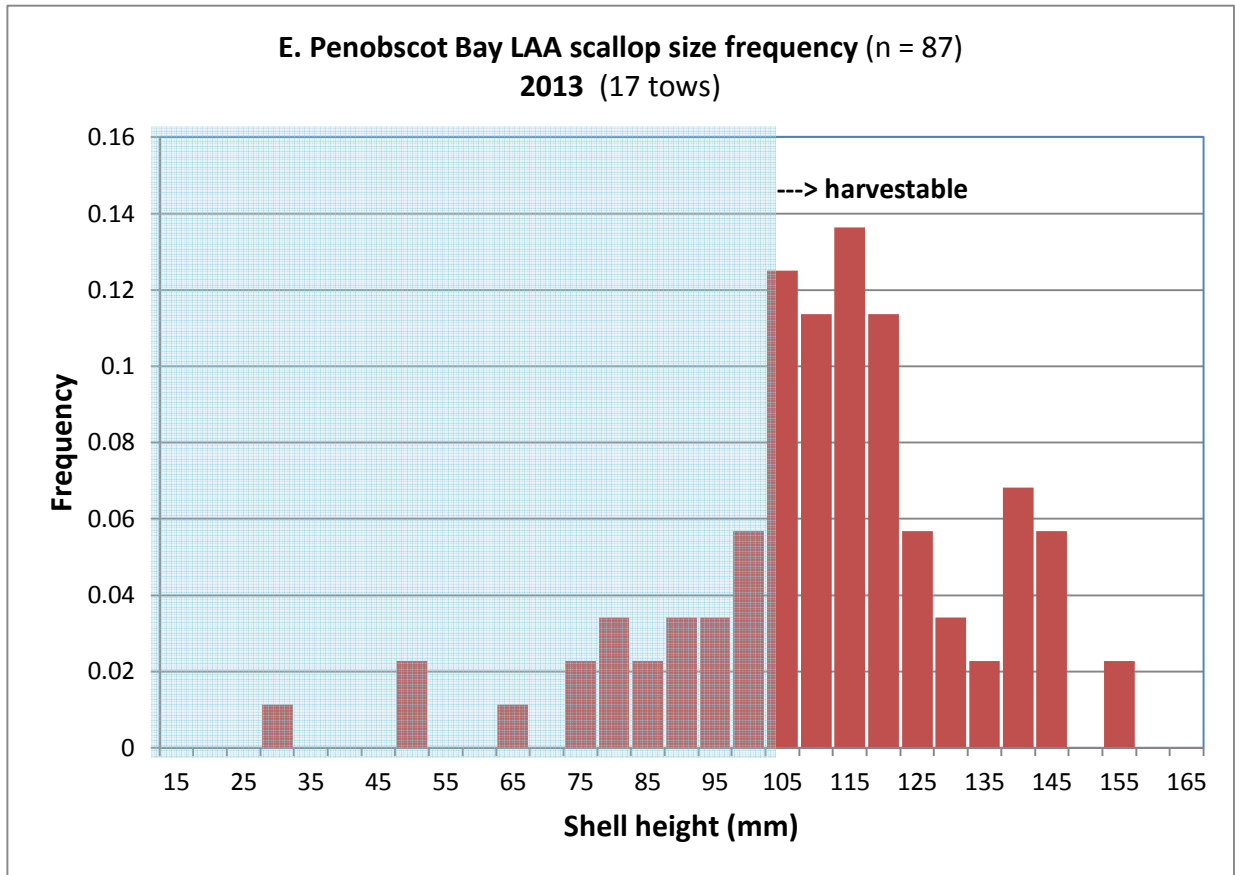


Figure 38. Size frequency (5 mm increments) of scallops in E. Penobscot Bay LAA, 2013.

Blue Hill LAA

Twenty-one (21) tows were completed in the Blue Hill LAA (Fig. 39). Nine (9) tows contained no scallops. This area experienced a very large decrease in scallop abundance since 2011.

The density of harvestable scallops was 96% less in 2013 (0.004 per m²) than 2011 (0.100 per m²) (Figs. 40-41). Harvestable density had increased nearly 5X between 2008 (0.021 per m²) and 2011 (0.100 per m²) (Kelly 2012). The estimated harvestable biomass in fall 2011 was 99.4 thsd. lbs.

Sublegal abundance (0.002 per m²) declined 98% from 2011 (0.091 per m²). Seed abundance was negligible in 2013, similar to 2011.

The highest densities of scallops in this LAA in fall 2011 were in Blue Hill Harbor. However when this area opened to fishing on 4 December 2012 it appeared from sea sampling and reports from fishermen that scallop abundance did not match with the survey estimates. A high concentration of fishing vessels (approx. 30) were in the harbor on opening day and catch rates fell within the span of a few hours. The crowding of boats, rumored destruction of vessel moorings and concern about rapid depletion of scallops led to an emergency closure of this part of the LAA after only a single day of fishing.

Causes for the apparent loss of scallops in the Blue Hill LAA are not clear. A large die-off in the area is possible but a few reports of clappers are about the only evidence that this may have occurred. Another possibility is movement from the area although there is little evidence of active, directed migration in *P. magellanicus* (Brand 2006). Net movements of scallops on Georges Bank were more related to direction and velocity of tidal currents (Melvin et. al 1985). A large bed of scallops that was not detected by the fall 2011 ME DMR survey was found by the fleet in the adjacent Union River Bay (approx. 27 km from Blue Hill Harbor) in late winter 2012. Whether there is a relation between the occurrence of scallops in Union River Bay and the loss in Blue Hill LAA is also difficult to substantiate however given the considerable distance between the two areas.

This area was closed to fishing in 2013-14 due to depletion of the resource.

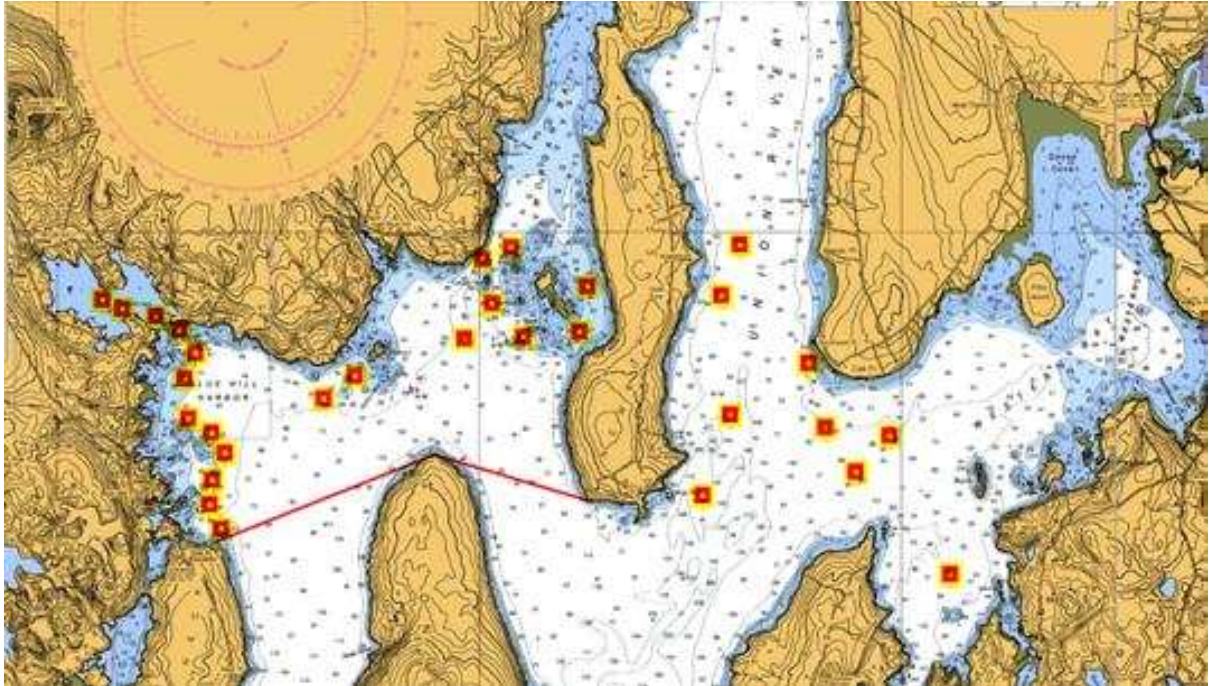


Figure 39. Location of 2013 survey stations (Blue Hill LAA).

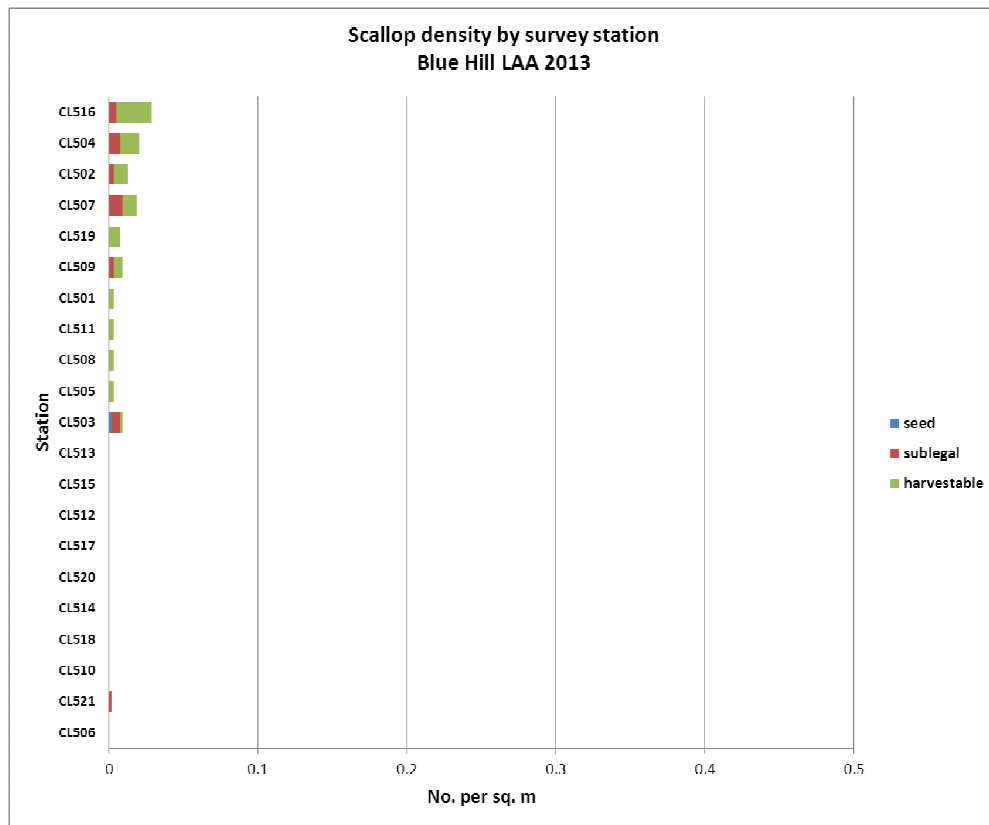


Figure 40 . Density of scallops and size class composition by tow (Blue Hill LAA), 2013 survey.

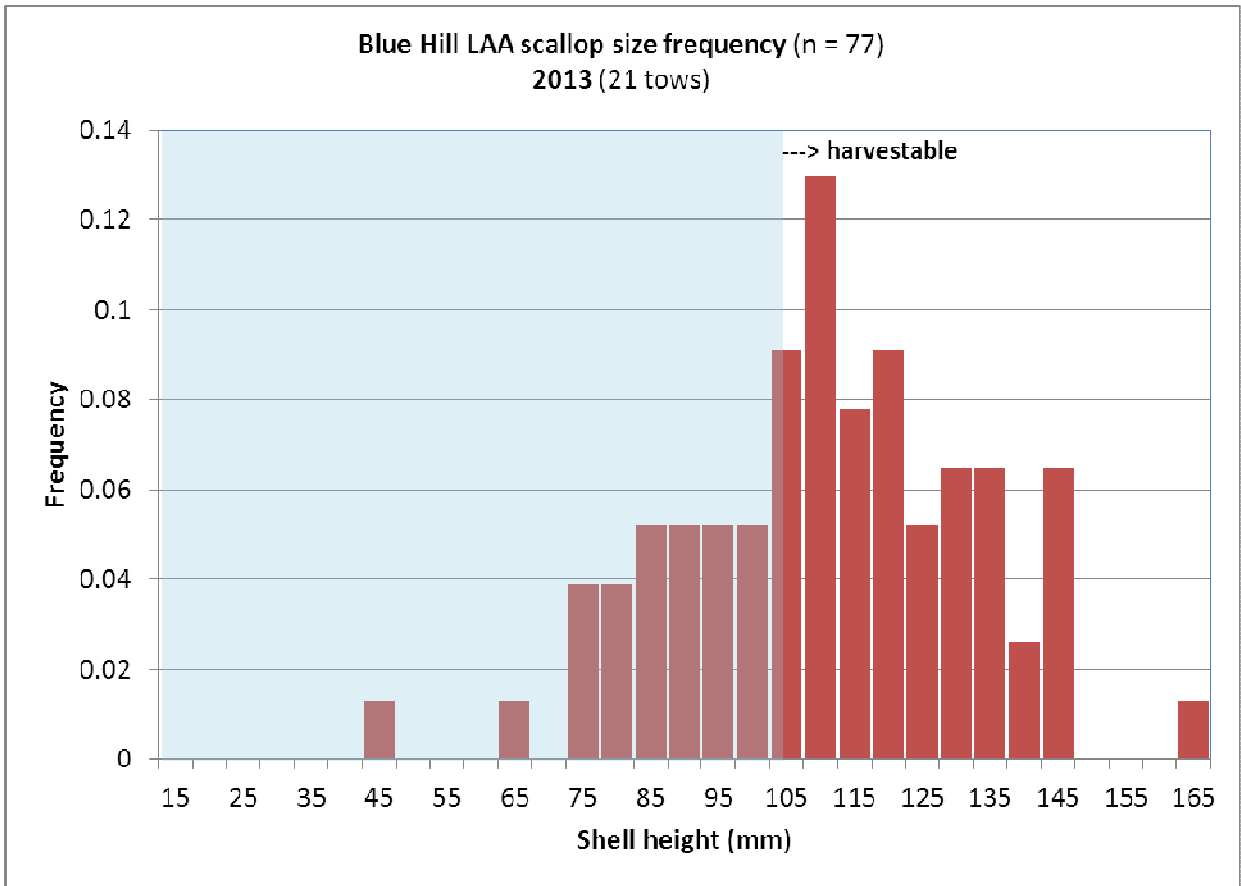


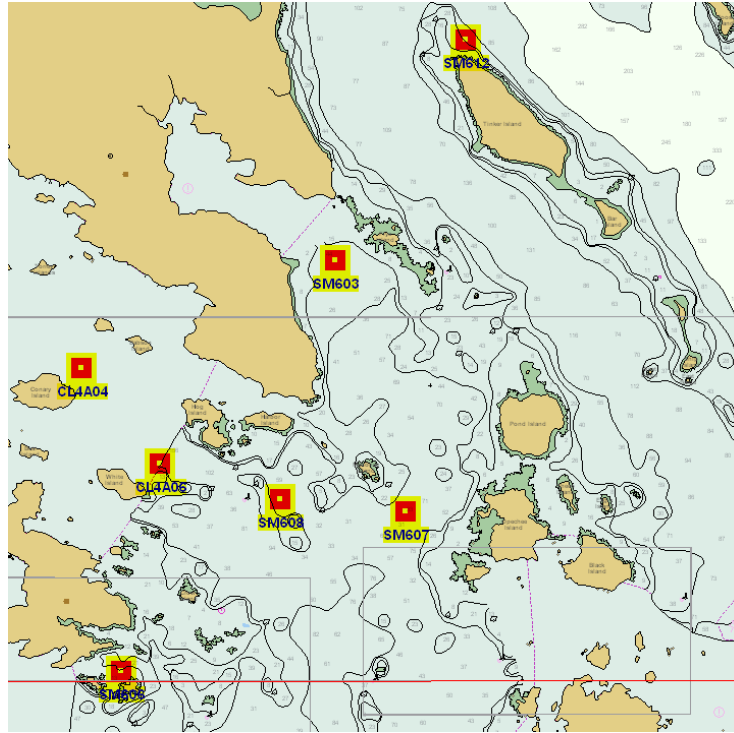
Figure 41. Size frequency (5 mm increments) of scallops in Blue Hill LAA, 2013.

Open portion Stratum 6

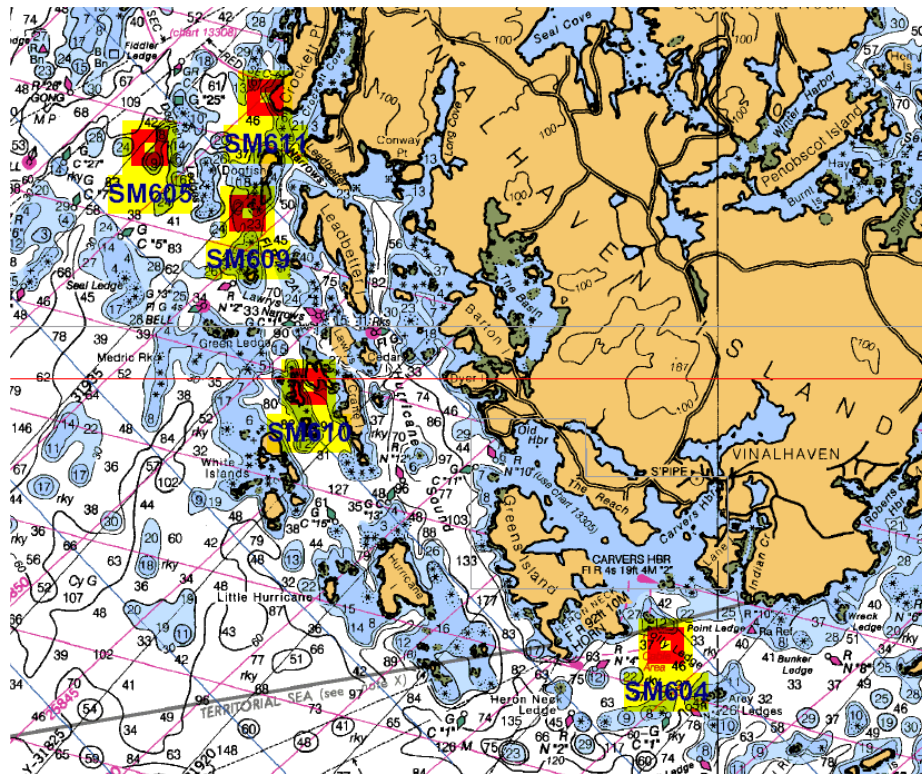
There were ten (10) tows completed in the open portion of this stratum (Fig. 42 a-b). Two (2) tows contained no scallops.

The predominant size group was sublegals (0.014 per m²) which were virtually unchanged from 2011 (0.013 per m²) (Figs. 43-44). Harvestable density (0.008 per m²) decreased slightly from 2011 (0.010 per m²). There was some increase in seed from 2011 (<0.001 per m²) to 2013 (0.004 per m²) in 2013. Seed were noted at three (3) stations off the western side of Vinalhaven Is.

Overall catch rates were very poor in the Jericho Bay tows. Stations off western Vinalhaven were more productive although harvestable densities were not robust in either area.



a.



b.

Figures 42 a-b. Location of 2013 survey stations (open portion Stratum 6).

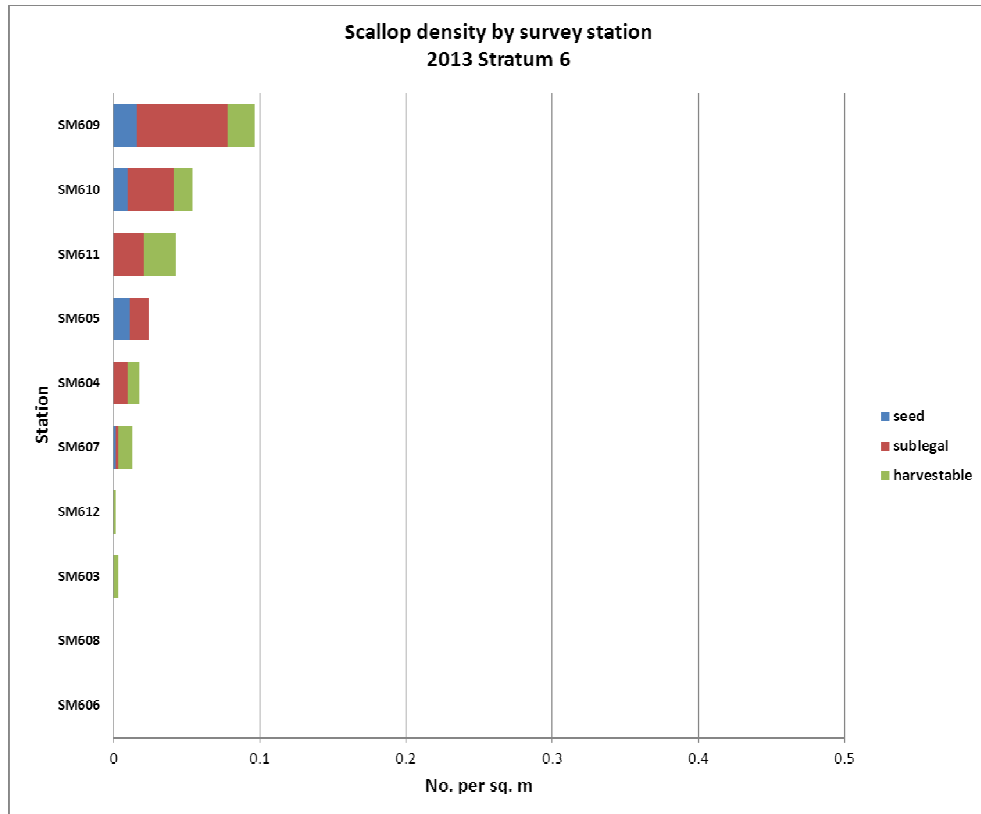


Figure 43. Density of scallops and size class composition by tow (open portion Stratum 6), 2013 survey.

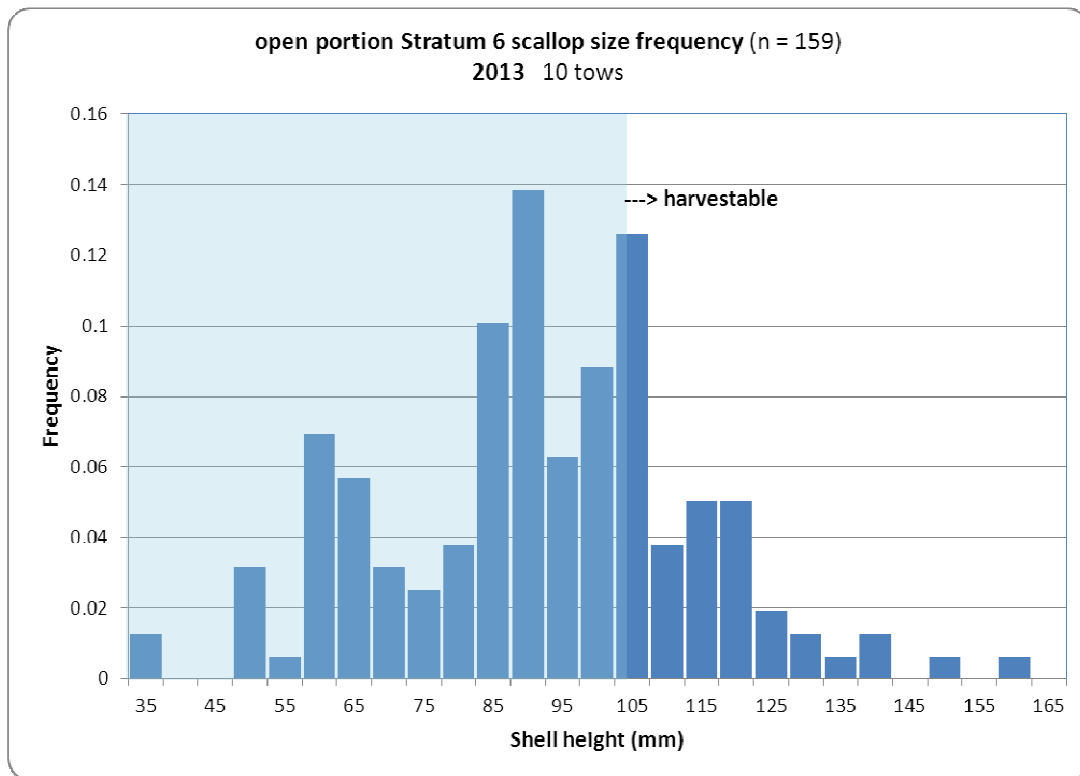


Figure 44. Size frequency (5 mm increments) of scallops in Stratum 6 (2013).

Stratum 7 (Matinicus Is.)

This area was not surveyed due to large presence of lobster gear.

Conclusions

There were seven (7) LAAs surveyed in spring 2013 following their first season of fishing since 2009. Of the larger (containing the most harvestable biomass) ones, only Machias Bay did not appear depleted. In fact there was a higher amount of harvestable biomass projected for this area for the 2013-14 season than for the 2012-13 season, reflecting strong growth and recruitment of scallops and less fishing pressure than some of the other areas.

Gouldsboro Bay harvestable biomass was largely depleted and Blue Hill did not produce the expected amount of scallops in the 2012-13 season. Only a limited amount of harvest was recommended to managers for Gouldsboro Bay for 2013-14.

The survey did not indicate strong recruitment in either Blue Hill or Gouldsboro Bay for future years. This was similar to the 2011 survey of these areas. The Union River Bay area also appeared depleted with no evidence of recruitment.

The survey did show signs of recruitment in some eastern ME areas, namely near Cutler, in the open portion of Chandler Bay, Moosabec Reach LAA and on the western side of Vinalhaven. The survey highlighted that over the large area of management Zone 2 the areas that are supporting much of the commercial fishing are limited.

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