Department of Marine Resources
Cobscook Bay Urchin Relocation Report

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Cobscook Bay Urchin Relocation Study

Introduction

Maine's green sea urchin stock, which supported a fishery worth $18 million to Maine harvesters in 2000, is depleted in some areas. However, there are still many extensive beds of slow-growing, poor quality sea urchins in areas with little feed. There is currently no market for these urchins, which lack the desirable yellow roe because they are underfed. Harvesters have experimented with moving these urchins to more productive feed (kelp) areas and harvesting them after they have had a chance to "bulk up", and report successes.

In October of 2000 the Cobscook Bay Fishermen's Association approached The Dept. of Marine Resources (DMR) and the Sea Urchin Zone Council (SUZC), about possibly conducting a study to track the survival and roe enhancement of sea urchins that were dragged from deep areas with high population density and low roe content and relocated to shallow, high feed areas that had low population densities.

In March 2000, on the last day of their open season, roughly seventeen members of the association had gone to a deep water region (100-110ft, 30.5-33.5m) within the Bay called Estes Head, just south of Eastport, and dragged up an estimated 800 to 1000 totes of poor-quality (underfed) urchins. No numbers were recorded. These urchins were then moved to a number of regions around the Bay that had been highly productive in the past. The majority of the urchins were relocated on the western side of Rogers Island. Other locations included Cooper Island Ledges and Goose Island. There was no special handling of the urchins. Urchins were brought on deck, placed in totes or in piles, and then shoveled off the vessels onto the new locations. The fishermen were assisted by Maine Sea Grant Marine Extension Service agent Chris Bartlett. The following fishing season, which opened in October 2000, these areas were dragged commercially. Reports on the number of urchins harvested vary greatly (from 200-600 totes), leading to the desire for a more controlled experiment. With the SUZC's support, DMR agreed to monitor another relocation project.

Study Objectives

After further discussions that involved the CBFA, DMR, SUZC, University of Maine graduate students, and Maine Sea Grant Marine Extension Service staff, a project was designed to:

1. Reestablish small populations of urchins in two areas that previously supported urchins but were fished out, by transplanting urchins dragged from a nearby deep-water, poor feed (barrens) source.
2. Determine the survival rate of transplanted urchins, and whether they stay on the site.
3. Determine whether the roe content of urchins that are moved from barrens to high feed areas is improved, and if so, how much. The urchins that were moved would have access to dense stands of kelp (*Laminaria*) to feed on and convert to roe. The urchins remaining in the deep areas would also have access to a greater volume of food per individual when overall numbers were reduced.
4. If possible, measure the impact of urchin removal on the source site (barren).

5. Measure the impact of urchin transplanting and grazing on the seaweed (algal community).
6. Monitor larval supply. By increasing total roe production, the reproductive potential of the Bay would increase, possibly generating more urchin larvae to settle and replace the stock that had been harvested.
7. Estimate the cost/benefit ratio for this project.
8. Minimize costs and maximize effectiveness by creating a collaborative project involving harvesters, scientists, students, and staff from several institutions.

There are however a number of barriers to successfully relocating urchins. Urchins have been shown to have a low tolerance for handling stress and dermal abrasion (Duggan and Miller 2001, Creaser and Weeks 1998, and Leland 2000 unpublished). Puncturing or cracking the test of the animal often leads to infections and mortality. Dragging for urchins in order to relocate them for later harvest may cause considerable damage to individuals. When population densities are high or tows are made for extended periods, urchins will fill a drag, becoming tightly packed against each other leading to punctures, spine breakage, and crushing (Creaser and Weeks, 1998). In addition the handling methods used on deck in the original trial - piling and shoveling - are added sources for injury to the urchins.

Once the urchins have been relocated to a new high feed area the next concern is whether they will stay on that site and survive. Those that remain long enough to feed and increase roe content then have the potential to contribute to larval production.

Cobscook Bay is close to the Bay of Fundy and its record tides. The tidal range in Cobscook Bay is 26 feet (7.9 m). Huge tidal flushing leads to very short retention times for particles and possibly larvae in the Bay. Modeling of the retention times and currents in the Bay have shown that in almost every region a free floating particle will be flushed out of Cobscook within twelve days, often within only three days (Fig 1,Brooks et al 1999). There are certainly eddies that would entrain larvae longer but the estimate of time spent in the water column for urchin larvae before they settle to the bottom is 8 weeks (Strathman 1978, Towers 1976), much longer than the retention times of the Bay. What would happen to any additional larval production from these relocated urchins?

Finally, the fate of the deep-water source population is important. Even when individual urchins have low gonad indices, when they are in high densities the overall fertilization success can be very high (Wahle 1998). In practice these low yield urchins may represent a significant portion of the larval supply for the area. Any over harvest of these urchins may negatively impact larval production as a whole.

Methods

Two test sites were chosen (Fig 2). The first, a location on the west side of Rogers Island, had been the primary release site the previous year and was considered by the local fishermen to be a very productive area. During initial dives in November 2000 to determine site locations, Rogers Island had been heavily dragged. There were no algal stands remaining and only a few urchins could be found. Fishermen said this was common and the algal growth would return completely during the spring bloom. The second site, south of Edgecomb Pt. in South Bay, was chosen because of its similar depth profile (sloping from 0 to 35feet (10.7m) from mean low water) and because it is one of the few areas in Cobscook Bay that has a tidal retention longer than 12 days (Brooks et al. 1999). Rogers Island happens to be in the main current path of the Bay and has retentions of only a few tide cycles (Fig. 1).

At each of the two sites one experimental and one control plot were chosen. More extensive replication was not possible because of limited resources for the project. The plots consisted of five 100m lines running parallel to shore with the first line along shore just below the low water mark. The next of the five lines started at the same point as the first but 5m offshore. The remaining three lines were laid in the same way each 5m further offshore (Fig.3). Each line was held in place at its ends by a five gallon pail of concrete attached with a rope eye. The lines were clipped on with snap hooks to enable us to remove the lines at the end of each round of sampling. The lines were then designated; -2, -1, 0, 1, 2 with 0 being the center line and 2 the closest to shore and –2 the furthest offshore (Fig 3). The buckets marking the center lines of each plot were marked with a surface buoy. Each line was marked every five meters along its length with a cable tie through the line.

Urchins were collected using five vessels and the same techniques as the previous year in order to replicate the first trial as closely as possible. We did this to determine the effectiveness of relocation using methods and gear that were already in use in the Cobscook fishery. All vessels used 5 ½ ft wide urchin drags. (See Creaser and Weeks (1998) for a description of Maine urchin drags.) A total of 205 totes or approximately 16,000 lbs of urchins were collected. Subsamples were collected for later gonad analysis. 102 totes were dropped along the center line of the Edgecomb experimental plot and 101 totes were dropped along the center line of the Rogers experimental plot. It should be noted that the actual number of totes placed on the Rogers Island plot was significantly reduced due to the loss of a buoy that identified the site and caused one of the vessels to drop the bulk of their urchins in the space between the control and experimental plots. The actual number of totes known to be correctly placed on site is 48. After the urchins had been placed on the plots one of the vessels conducted one more drag for urchins at a shallow water site on the west side of Treat Island. One tote of urchins was collected as a comparision for the deep water urchins.

The one tote of urchins from Treat Island plus two held out from the deep water tows were taken back to shore and held in protective troughs in Peacock Seafood’s flowing seawater system in Lubec to closely monitor mortality. Urchins were relocated to their final sites as quickly as possible. Urchins were on deck for no more than 2 and a half hours, while most were on deck for roughly one and a half hours.

Site surveys were conducted prior to the urchin relocation, the day after the relocation, then roughly one week, one month, two months, and six months after relocation. Due to a lack of divers and disruption of the Rogers Island experimental plot, only the Edgecomb experimental plot was surveyed every time. Other plots were surveyed when possible. Table 1. indicates the dates individual plots were surveyed and what took place on that date.

Surveys of the study sites were conducted along the lines divers reattached to the buckets (Fig. 3). The diver would then swim along placing a $1m^2$ quadrat (a pvc frame that marks off a fixed unit of area) at the first fixed cable tie location. They would record the number of urchins they saw alive in the quadrat, the number dead or moribund and would estimate the percent cover of three forms of algae - encrusting, understory and large canopy forming kelps. The diver would then proceed to the next cable tie and so on until the transect was complete.

Table 1.

	Date					
Site	3/17/01	3/27/01	4/5/01	4/25/01	5/24/01	9/18/01
Edgecomb Experimental	setup/survey	survey	survey	survey	survey	survey/pickup
Edgecomb Control	setup/survey	*	visual survey	visual survey	survey	survey/pickup
Rogers Experimental	setup/survey	survey	destroyed	repaired	survey	survey/pickup
Rogers Control	setup/survey	*	no survey	no survey	no survey	survey/pickup
* no expected change in one week						

The Rogers Island site happened to be located in a popular shortcut for large aquaculture barges. These barges would sometimes foul up on our marker buoys and moorings would be dragged. Evidence was also found of at least one incidence of a drag going through the site and moving some of the moorings. Using some of the undisturbed moorings as reference points the site was reestablished for later surveys.

The shortage of divers meant that only visual qualitative surveys of the control sites could be made on some of the sampling dates.

On the last day of the experiment (9/18/01) the sites were surveyed, and urchins were collected from the sites and the deep-water source to test for any change in roe content. The lines, buoys, and moorings were then removed from the sites, and regular commercial fishing commenced as usual when the season reopened on October 1.

Results

Size Distributions

Urchin size frequencies for deep water urchins ranged from 14mm to 69mm test diameter with average size 48.8mm (SE $\pm$0.88). 67% of the urchins collected were below the legal harvestable size of 2 1/16th inches (52.3mm) (Fig 4). Deep-water urchins were measured again in September and there had been no statistical change in size.

Gonad Indices

Gonad indices, which are the weights of the gonads expressed as a percent of the whole weight of the animal, were calculated by individual vessels and pooled. All urchins came from the deep-water channel off Estes Head, Eastport, except some of the urchins from the vessel Storm King, which came from shallower water (20ft, 6m) around Dog Island, a region just north of Eastport. Gonad indices (Fig. 5) for collected urchins averaged 3.2% (SE$\pm$0.53). Gonad indices for urchins collected during the Sept 19th sampling indicate highest roe contents were at Rogers Island. These urchins increased from 3.2% to 18.35% (Stdev$\pm$ 1.97) a 573% increase in gonad index from March to September of 2001. Urchins at Edgecomb Point increased from 3.2% to 7.2% (Stdev $\pm$ 3.4) or a 224% increase. Urchins from the source population at Estes Head decreased from 3.2% to 2.34% (Stdev $\pm$ 1.2). Urchins collected from the control site at Rogers Island on September 19th had gonad indices of 22.12% (Stdev $\pm$ 3.2). No urchins were collected at the Edgecomb Pt. Control site.

Survival

Mortality was calculated by combining the counts for each transect line at a site for a given sampling date then multiplying that value by the reciprocal of the total area sampled (we surveyed 1/20th of the area each time so we multiply by a factor of 20 for an estimate of the total urchin abundance) The total number of urchins remaining on each date was then expressed as a percent of the urchins accounted for on the first day of sampling. Initial frequent sampling and subsequent test surveys around the perimeter of the plots indicate that the bulk of the urchins either perished, or remained within the plot area and emigration should not be a significant influence on total survival. It cannot be determined if any of the surveyed urchins were immigrants to the site. There was a four month time frame between the final rounds of sampling in which urchins may have moved into the site, which may help explain the slightly elevated number of urchins found. Again, numbers from the Rogers Island site remain in question due to a number of disruptions at the site and the presence of an estimated 4700 urchins prior to the relocation. Overall mortality was highest in the first week following relocation (Fig. 6). Edgecomb Point experienced 53% mortality during this time. Mortality continued until it peaked at 74% two months later on the 24th of May. Rogers Island peaked at 53% mortality two months later as well. Both sites showed slight increases in numbers of urchins present during the final round of sampling on September 19th. Control sites had low numbers of urchins initially (33 for Rogers and 6 for Edgecomb). Numbers remained low but were slightly elevated by the time of the final sampling (77 for Rogers and 10 for Edgecomb).

Urchins that had been held in flowing seawater tanks at Peacock Seafoods in Lubec also showed rapid increases in mortality (Table 2). After one week 57% of the urchins held in captivity and closely monitored had died. By the end of three weeks mortality was at 75%. Urchins that had been collected by hand instead of dragging and held in the same flowing system showed only a 1% mortality rate after one week, and by three weeks 98% of these urchins remained alive (Devin 2000, unpublished).

Algal Cover

Average algal cover at Rogers Island increased considerably throughout the project. Experimental and control sites were similar. Algal cover was composed primarily of large Phaeophytes such as *Chorda filum* and *Laminaria longicruris.* Edgecomb Point also had an increase in algal cover but it was mostly confined to a narrow fringe in the shallow subtidal.

Movement

The fixed grid design of this experiment allowed us to track general movement of the urchins over time (Fig. 7). Urchins tended to move initially towards the shore and existing shallow patches of algae. Over the course of the experiment movement tended toward the ends of the transect lines and to forming aggregations. Urchins did not seem to return to deeper waters.

Conclusions

Successful relocation of low yield urchins into highly productive areas has the potential to substantially increase larval supply and to add value to urchins that were previously unmarketable. As has been shown before (Leland 2000, unpublished) the barriers to successful relocation can be great. The Cobscook Bay fishery is primarily a drag fishery and the potential source population for urchins is in deep water (over 100 feet, 30.5m) and in high currents, well beyond practical dive limits. For relocation in this area to be large enough and cost effective it would have to be conducted by dragging. Dragging however exposes urchins to numerous opportunities to be damaged.

This study was very small in scale and was an attempt to quantify the mortality of relocated urchins and any concomitant increase in roe production. Due to logistical and funding restrictions only two study sites could be chosen, and unfortunately the Rogers Island site encountered a number of disturbances, making it impossible to survey the site at each of the specified dates. The remaining Edgecomb site and the data that was gathered from Rogers Island still give a good picture of what might have occurred during the previous year's attempt and what might occur with any future large-scale relocation efforts in the area.

<u>Survival</u>

Mortality rates for urchins that were dragged for relocation were very high, ranging from 53% to 75%. Causes for these high mortalities cannot be determined from this study alone but handling stress and injuries sustained from the drag itself seem to play a significant role. The weather was cool (high temp of 46 degrees Fahrenheit) so heat stress should have been mitigated and the time on deck was relatively low. Stress from changes in depth has little effect on urchins because they have no internal air sacs or bladders. Evidence of disease or die offs was not seen during other urchin survey projects in the region conducted at the same time reducing the likelihood of infection as a direct cause. This leaves handling and its associated injuries as the primary cause of mortality. These conclusions suggest this technique should not be used to relocate urchins. The high end of the range (75%) comes from urchins that were held in a highly controlled environment and where individual urchins could be counted very accurately and frequently with no chance of numbers being influenced by emigration or immigration. The low end of the range (53%) comes from the Rogers Island site and may be an artifact of the problems with surveying or from the higher numbers of urchins occurring naturally at the site before the study began. The increase in numbers of urchins seen during the final round of sampling might be a result of the relocated urchins aggregating around the mooring buckets, or it might be from local urchins outside the plot immigrating and being counted.

<u>Gonad Indices</u>

Urchins were harvested for this experiment in March of 2001 at a time when gonad indices are expected to be low. The deep-water urchins from Estes Head had an average roe yield of 3.2% (SE $\pm$ 0.53). The market quality urchin begins at 8-10% so these urchins have little to no market value. They are however in dense aggregations and their fertilization success would be high (Wahle 1998). Even at depressed gonad indices of 1%-3% they still may be contributing significantly to the overall larval production for Cobscook Bay and possibly outer coastal areas. Sampling conducted on September 19th before the harvest season opened revealed across the board increases in roe production. We would expect to see an increase in gonad size over the course of the summer into fall as part of the natural reproductive cycle. What we were interested in seeing was if there was a large difference between urchins that had been moved and urchins that had remained in deep water. What we found was encouraging and expected. The urchins that were given access to better food sources increased roe production. Urchins moved to Rogers Island with its dense algal cover increased from 3% to 18% roe while urchins remaining in the source population stayed basically unchanged and well below the 10% market threshold. The Edgecomb site did not increase as much but this would be expected given the lower levels of algal cover over the entire site.

Movement

One of the main concerns for this relocation was that once urchins were placed in a productive area would they remain in place or would they return to deep water. Urchins are sensitive to UV radiation (Adams 2001) and urchins from our source population have been in very dark conditions presumably their entire lives. How would they respond to this brighter environment? What we saw was a general movement towards shore and existing fringes of kelp. Then as the season progressed and algal growth increased over all the sites urchins started to form small aggregations around kelp. Additional sampling and visual surveys conducted on the fringes of the plots showed that some of the urchins began to aggregate just outside the plots near the moorings and at the Edgecomb experimental plot they had moved a little closer inshore. In both cases the total number of urchins appearing outside the plots were low and should not greatly affect overall survival numbers.

Settlement

A question we hoped to address by this study is whether or not increases in roe production will translate into higher local settlement. For this portion of the study larval collection plates (Harris) were set out at each of the experimental sites. Through circumstances beyond our control only 5 of the plates at Rogers Island made it through the settlement season. These plates are being sorted and numbers from them were not available at the time this report was written and will be addended at a later date. (Since spawning had already happened before the urchins were moved, we would not be able to show any improvement in settlement as a result of the relocation this year; however this would give us some indication of what local settlement was and would established a baseline for future settlement surveys.)

Summary

Cost: benefit analysis: There are two questions that need to be answered in order to determine the economic potential of urchin relocations in Cobscook Bay. How much are they worth if moved and how much are they worth if they are left where they are? One of the results from this experiment has been the increase in gonad index from roughly 3% to 18% for urchins relocated to areas of high feed like the one behind Rogers Island. It must be assumed that any urchins relocated at the end of one season will be the first to be harvested the following season. Individual fishermen would not want to risk losing time and resources to other fishermen that did not participate in the move and these areas would be targeted first. Using an average price per pound from the 2000-2001 fishing season we can set a high price of $1.70 per pound for an 18% roe yield urchin, in October, the start of the season in Zone 2. Tracking the value of a single tote of urchins through a relocation such as this we would find that 80 pounds of urchins harvested from deep-water and relocated will only yield 20 pounds of product the following season, given a 75% mortality rate. 20 pounds at the market price estimated from the previous season would be worth approximately $34.00. From this $34.00 the expenses of relocating the urchins must be deducted. Using estimates of daily operating costs and a high end catch rate of 100 totes per day the operating expenses would average $2.50 to $3.00 per tote. The net value of the relocated 80 pound tote is $31.00. On the other hand if that same tote had been left on bottom it would not have had any commercial value with roe yields of only 3%. This would be the case if harvesters tried only to sell deep-water urchins. What often occurs is a cap on the price paid for urchins is set by dealers and buyers. This means that an increase in roe yield over a certain threshold no longer has an associated increase in the price paid to the harvester. Typically a price cap will be set at 18% or 20%. Unfortunately for the harvesters in Cobscook Bay roe yields at these times can be well over 24%. The added revenue from higher quality product is lost. In order to maximize profit under these price caps harvesters will mix lower quality product with product that is over the prescribed cap. When subsequent roe tests are done the overall roe yield appears to drop and the harvesters get a greater number of pounds at the capped price. If low quality urchins found in deep-water (at 3%) were left alone until market prices were high (generally around the Christmas holiday in the US) and roe yields for shallow water urchins were high (greater than 24%) then a mix ratio of 1:3 (one tote low quality 3%, 3 totes high quality 24%) would give a blended roe yield of 18%. Therefore the 80 pound tote that was not moved, when mixed with three totes of higher quality product, now becomes 80 pounds of product at 18%, which could sell during the holidays for over $2.00 per pound. The value of the tote increases from $31.00 to over $160.00 when left in deep-water. The difference between the two scenarios is that leaving the urchins where they are eliminates mortality associated with relocations conducted by dragging and the extra costs of moving the urchins. It seems that there is greater economic potential in leaving deep-water urchins where they are and using them as a dilution tool when market conditions are right.

Areas for further study

1. As with all studies the pursuit of one answer leads to many additional questions. Some questions that could be looked at as a continuation of this project might be:Are mortality rates equally high if urchins are hand harvested from deeper populations?
2. What is happening to the source population? We did not have the time nor resources to give this question the consideration that it deserves. The fate of the source population has great repercussions on the larval supply in general and the ability to continue any relocation plans in the future.
3. Many of the relocated urchins were sub-legal size. What has become of them after commercial fishing began again at the start of the season?
4. If dragging causes this kind of stress on urchins, how often are individuals subjected to it and what rates of mortality are associated with multiple drag encounters?

Acknowledgements

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Table 2. Mortality for urchins held in flowing tanks at Peacock Seafoods.

	Deep (dragged)		Shallow (hand collected)	
	tote1	tote 2	tankR	tankX
One Day	42%	30%	0%	0%
One Week	56%	58%	0%	2%
Two Weeks	64%	66%	0%	4%
Three Weeks	75%	76%		

Figure 1. Tidal retention times in days For Cobscook Bay, from Brooks et al 1999.

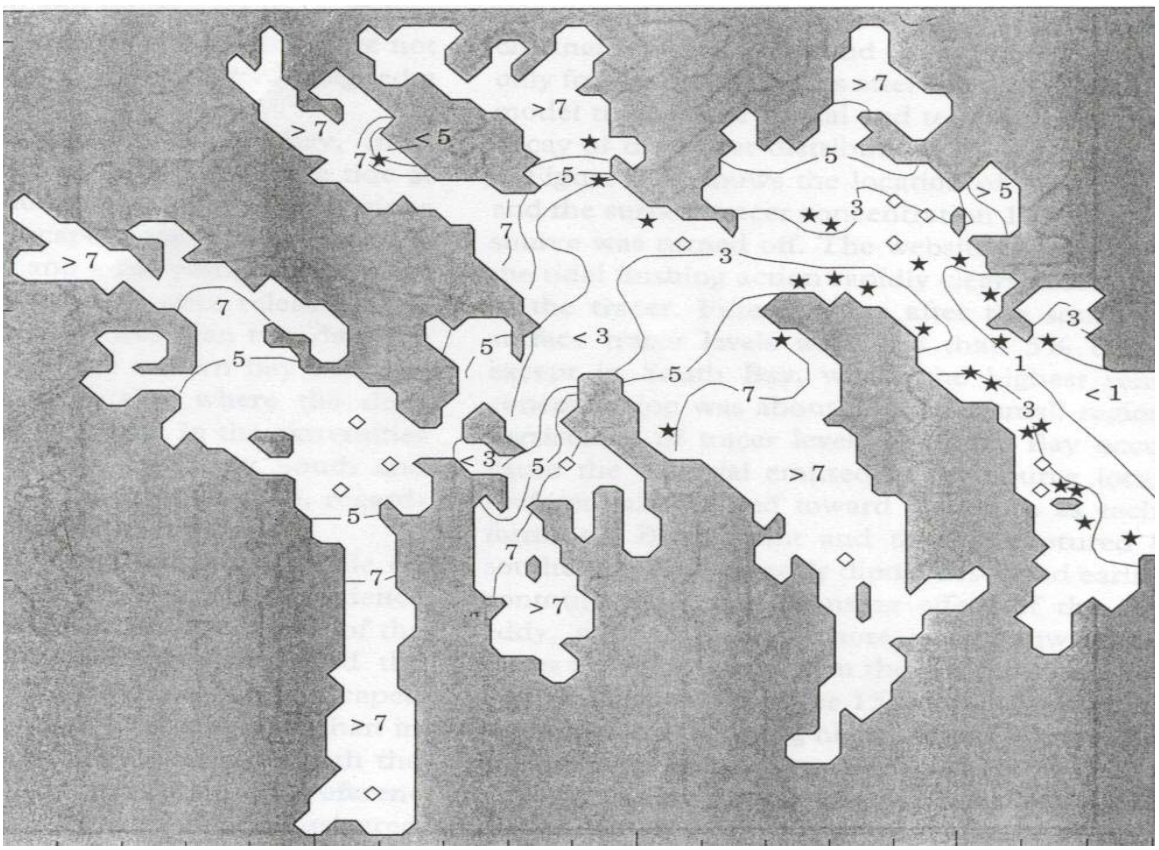


Figure 2. Experimental sites.

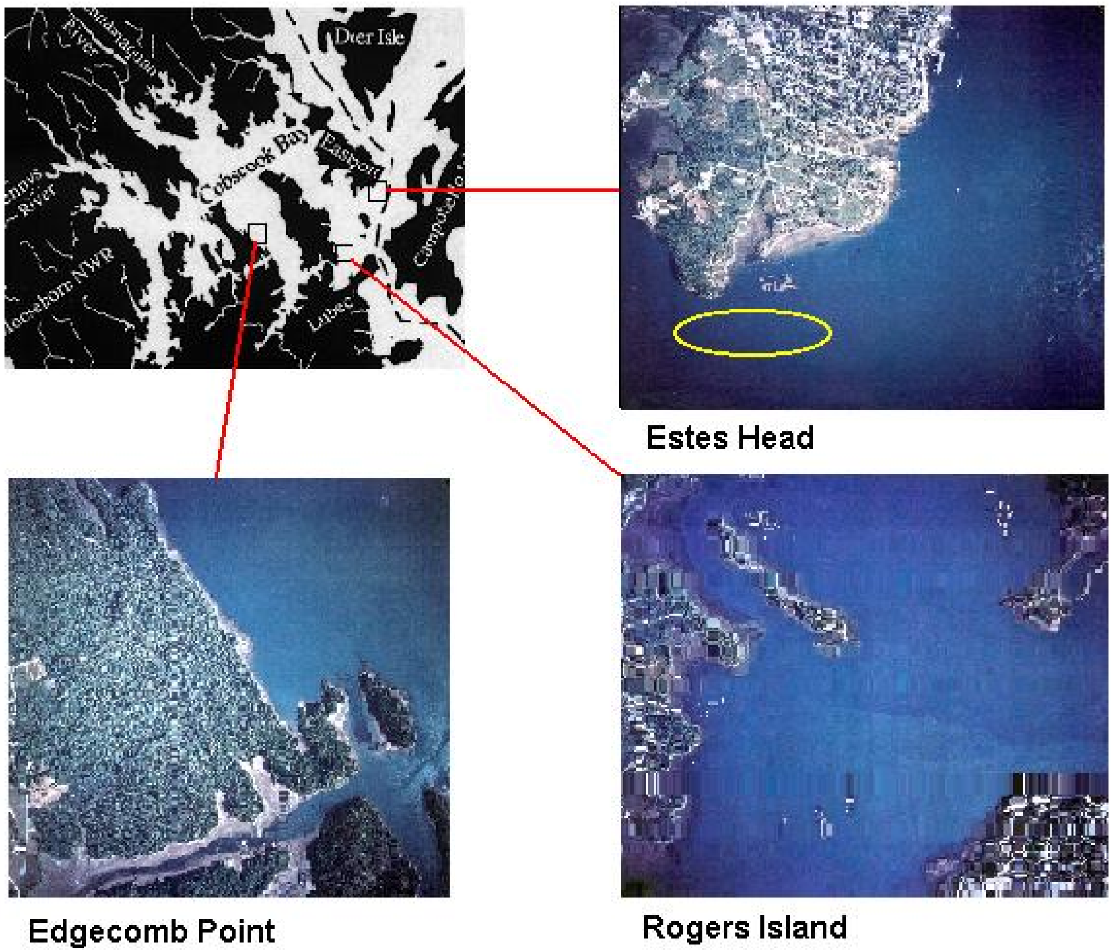


Figure 3. Sample grid layout. Squares represent quadrats. Not all quadrats are shown.

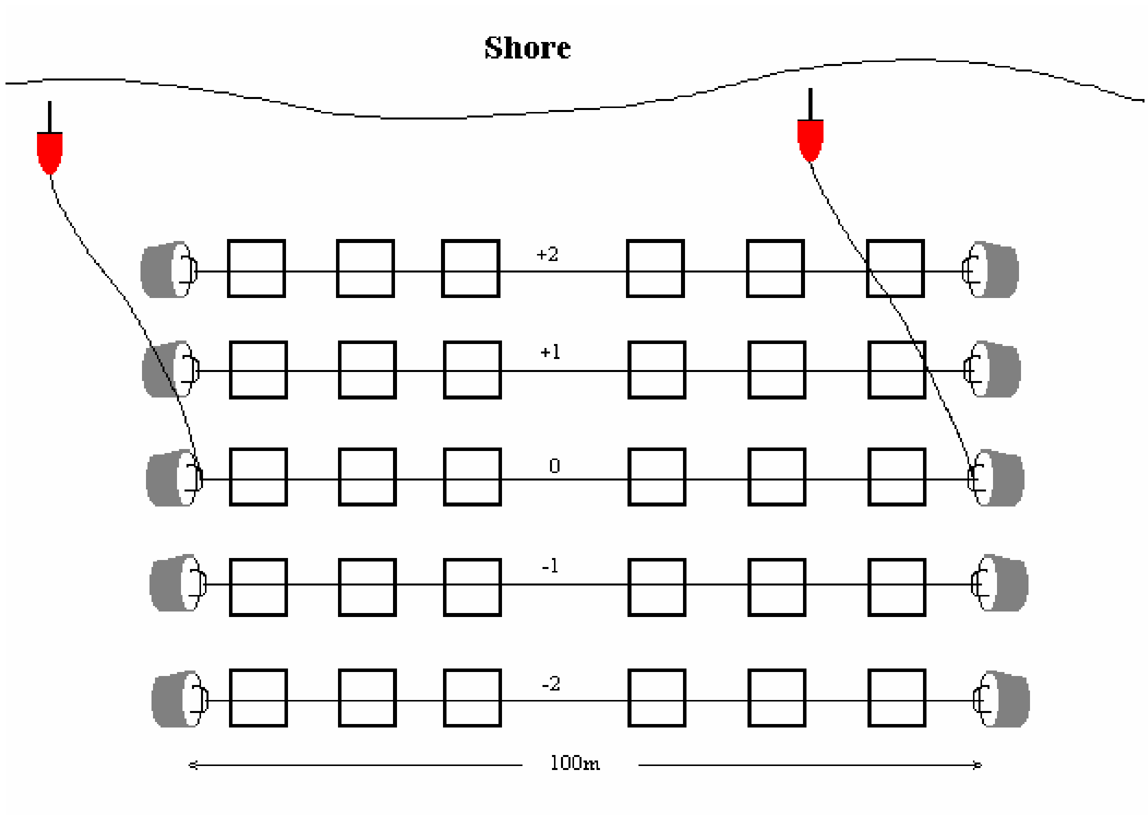


Figure 4. Size frequencies from deep-water urchins collected 3/26/01.

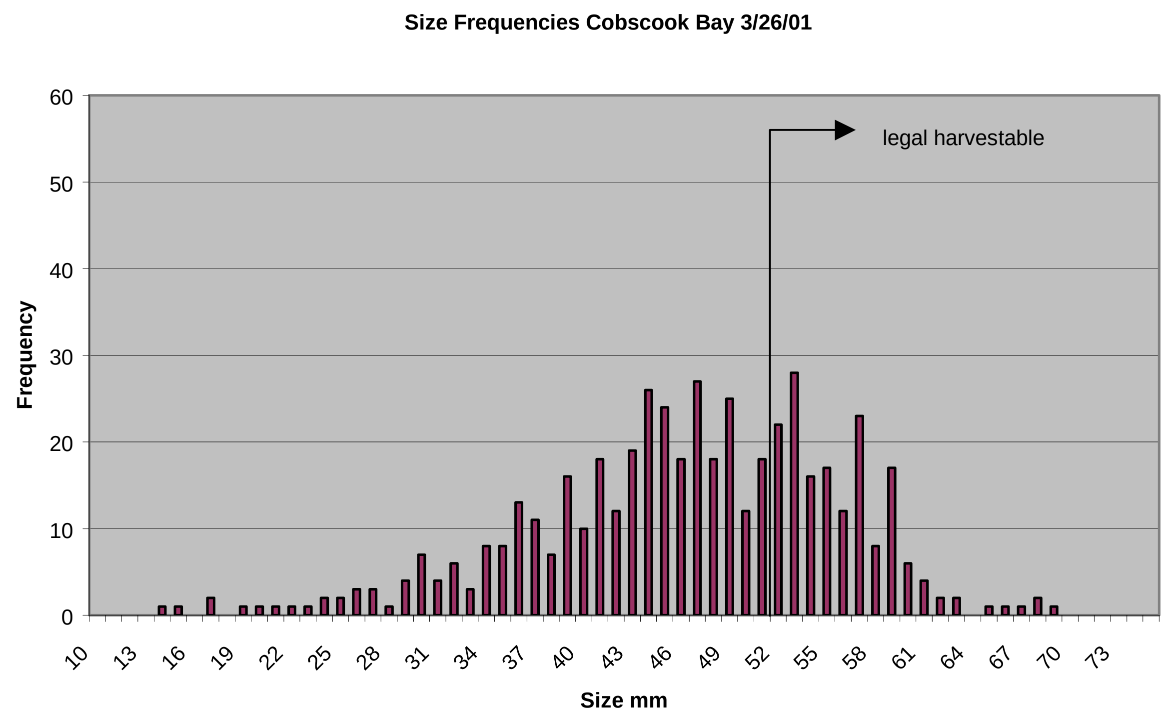


Figure 5. Gonad indices for all sites before and after relocation with SD error bars.

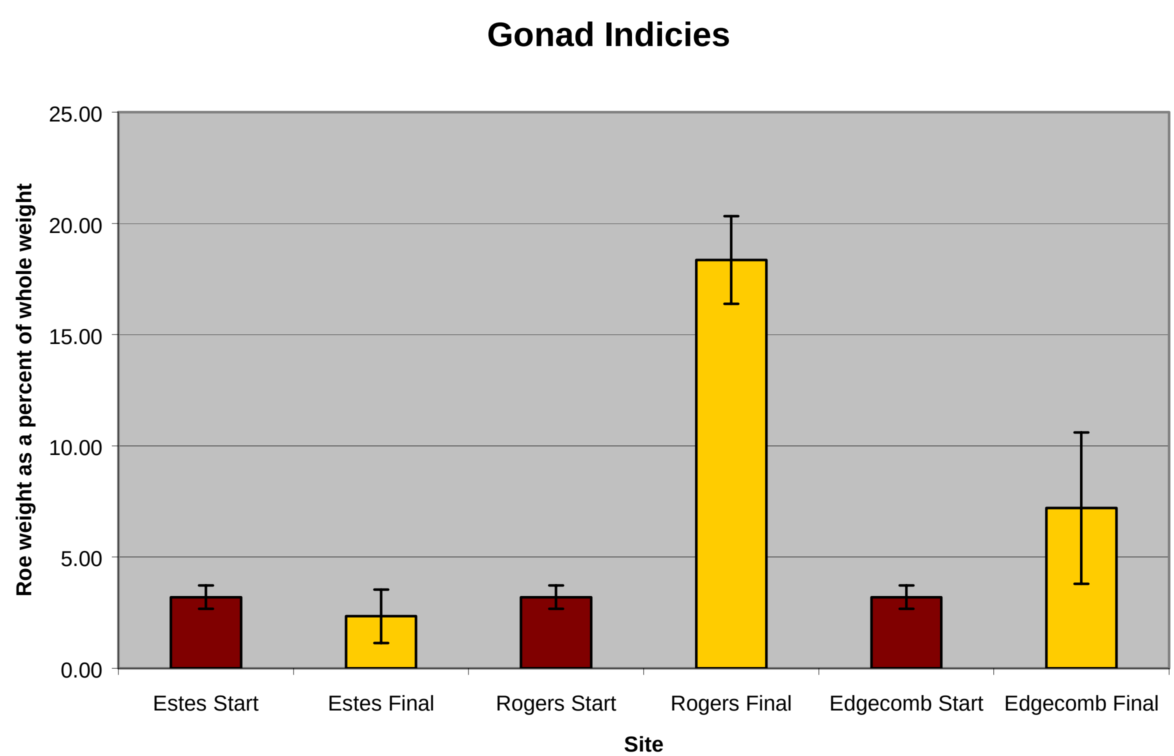
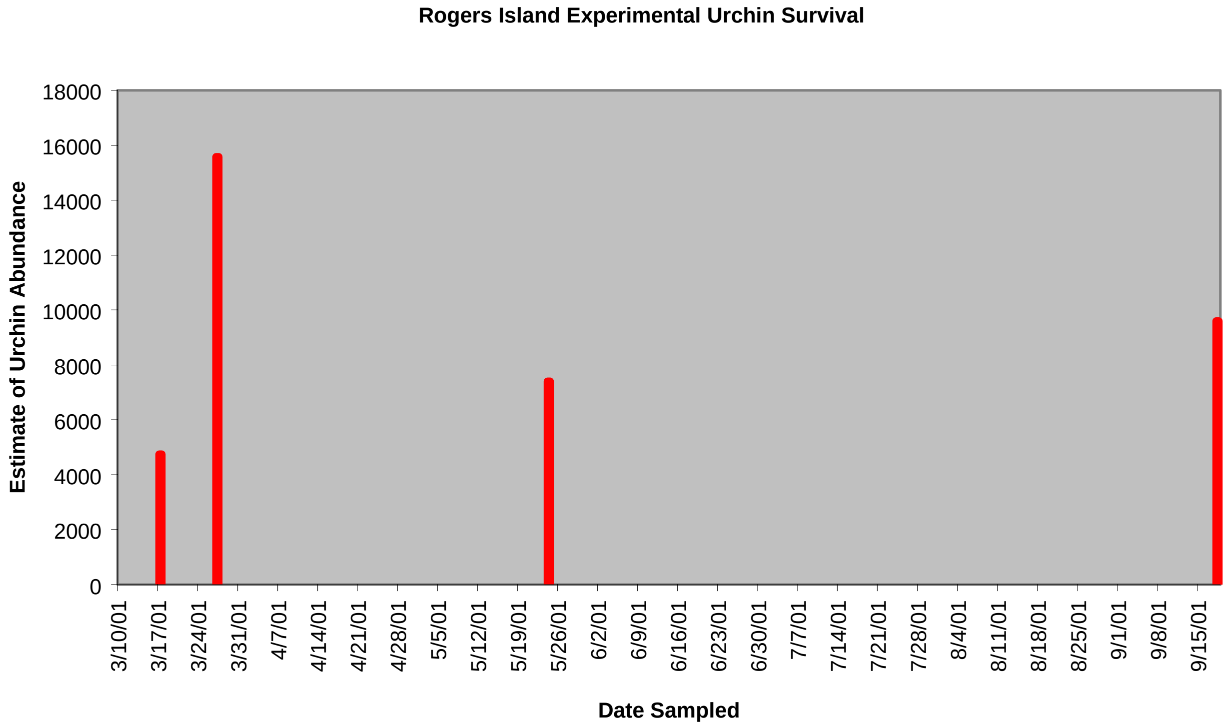


Figure 6. Urchin survival for experimental sites, Rogers Island (above) and Edgecomb Point (below).



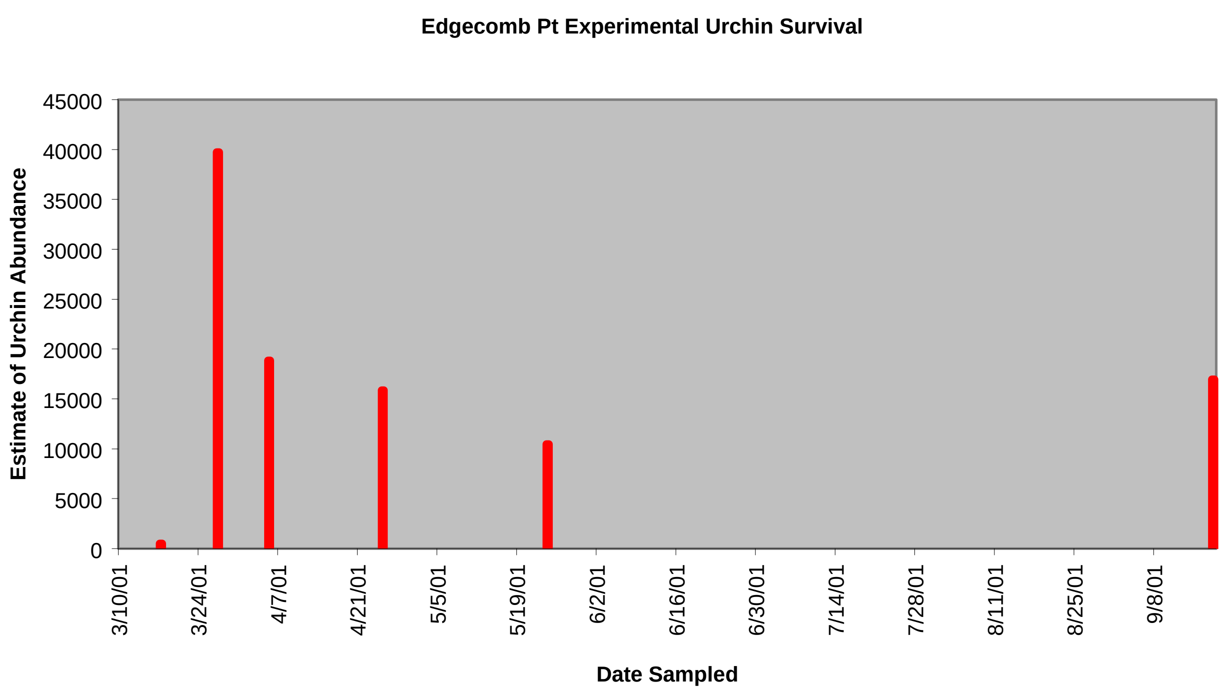


Figure 7. Urchin densities over time.

Rogers Experimental Plot Urchin Counts. Cells represent individual quadrats sampled with their
respective counts. Urchin densities are shaded based on 40 counted urchins per unit.

17-Mar	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	1	0	0	1	0	0	1	51	0	2	2	0	1	3	0	0	1	2	0	0
1	0	3	4	9	0	2	0	1	3	1	0	0	1	1	0	1	3	1	1	0
0	0	2	12	0	0	0	0	16	3	0	1	1	5	0	2	4	5	0	0	0
-1	0	1	1	0	1	1	5	6	2	1	1	3	6	1	1	2	0	0	0	1
-2	4	0	0	1	1	0	0	1	5	2	0	0	1	8	10	0	1	4	8	11

27-Mar	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	0	2	5	3	22	5	0	7	12	23	52	44	16	0	6	2	2	32	5	1
1	7	5	8	1	3	3	2	6	26	41	16	0	3	1	6	33	13	15	9	13
0	80	12	1	10	0	1	1	3	6	0	0	1	15	0	7	0	8	78	32	48
-1	1	0	0	1	0	0	0	0	0	0	3	0	0	0	0	1	1	7	0	0
-2	0	0	0	0	3	0	3	0	0	0	1	0	0	1	1	2	0	1	0	0

24-May	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	2	2	5	0	3	2	0	2	2	2	1	2	2	5	5	5	5	5	0	0
1	5	15	10	5	1	3	3	3	3	1	5	5	10	3	5	1	10	0	0	0
0	11	12	3	10	1	6	30	9	11	4	10	8	20	7	2	0	1	7	3	15
-1	5	10	7	2	5	4	4	0	0	2	0	0	0	0	0	2	1	0	2	5
-2	3	2	3	0	0	0	0	0	0	1	0	0	0	0	0	1	2	1	0	0

19-Sep	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	50	4	0	0	0	7	2	5	25	27	0	0	58	0	8	0	35	0	0	0
1	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	10	3	3	0	7	2	2	5	3	7	0	1	0	10	4	2	5	2	3	12
-1	7	3	4	3	2	3	11	4	2	8	4	23	7	0	10	8	3	5	20	10
-2	0	0	0	0	8	0	0	0	0	0	0	0	1	8	0	0	1	10	0	0

0	81-120	201-240
1--40	121-160	241-280
40-80	161-200	

* Not all dates were sampled due to technical problems with the site

Figure 7.continued

Edgecomb Point Experimental Plot Urchin Counts. Cells represent individual quadrats sampled
with their respective counts. Urchin Densities are shaded based on 40 counted urchins per unit.

17-Mar	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0
1	0	0	0	2	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
-2	0	0	0	0	1	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0

27-Mar	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	0	0	0	3	0	2	1	5	8	15	20	8	2	6	0	0	0	0	0	0
1	0	0	4	128	34	14	13	16	282	0	10	78	8	75	23	2	0	0	0	0
0	106	140	85	23	4	8	27	102	292	170	85	15	48	55	40	21	4	0	0	0
-1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
-2	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0

5-Apr	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	0	0	1	3	0	2	3	13	46	14	65	38	6	3	2	4	17	10	13	0
1	0	0	1	2	4	1	11	3	3	94	53	1	20	55	8	8	2	2	3	3
0	13	130	16	2	3	10	11	2	44	2	2	5	15	43	15	22	1	0	0	0
-1	3	4	1	2	2	0	3	4	6	14	5	4	3	3	2	1	4	2	0	0
-2	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	3	0	17	5	0

25-Apr	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	2	18	3	3	21	10	28	12	18	13	6	9	2	3	7	1	0	0	0	0
1	12	17	15	26	34	41	33	4	14	20	15	18	39	5	3	5	6	0	0	0
0	33	17	5	4	3	17	2	0	45	48	25	3	2	1	13	22	5	9	1	0
-1	27	1	1	1	2	0	0	8	0	2	0	0	0	7	0	0	1	0	0	0
-2	0	0	0	0	1	13	0	3	0	0	0	1	0	0	0	0	7	0	0	0

24-May	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	22	0	19	2	29	8	1	2	8	9	8	14	18	3	10	9	0	1	0	0
1	6	6	3	0	1	12	1	85	0	13	16	6	4	1	5	1	0	0	3	0
0	2	1	2	2	5	1	3	1	1	10	5	0	0	0	4	3	6	0	0	0
-1	1	1	5	2	8	6	7	0	26	13	9	0	0	0	0	0	4	0	0	1
-2	27	8	2	29	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1

19-Sep	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	0	3	4	26	31	48	61	52	65	18	67	55	62	38	19	25	7	5	8	7
1	0	0	1	0	27	0	3	0	1	1	4	0	0	0	1	0	0	0	0	2
0	1	0	6	2	1	10	5	9	3	3	3	1	9	4	5	12	5	4	3	4
-1	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	12	1	0	23
-2	4	0	0	0	1	5	0	3	10	21	2	4	1	1	1	1	0	1	7	0

0	81-120	201-240
1--40	121-160	241-280
40-80	161-200	