EARLY BENTHIC PHASE LOBSTER SURVEY FOR GLOUCESTER HARBOR

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December 1999

DECEMBER 1999

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1.0 INTRODUCTION

Sampling for early benthic phase (EBP) lobsters was conducted at ten transects in Gloucester Harbor in November 1999 as part of the Dredged Material Management Plan for Gloucester Harbor. EBP lobsters have been defined as having a carapace length (CL) of 5-40 mm (Incze and Wahle 1991) and are highly shelter-dependent, ranging out form their refuge as they reach 35-40 mm CL (MacKenzie and Moring 1985). This shelter dependent phase lasts for about two years, and when they reach about 45 mm CL, they may begin nocturnal foraging away from their shelter (Cooper and Uzmann 1980). The occurrence of these animals may indicate the need to consider the presence of lobster settlement habitat in the evaluation of disposal sites.

Sampling for EBP lobsters has traditionally focused on hard substrate such as cobble and boulders, as this is the preferred habitat (Palma et al. 1998). However, recent work in Portland Harbor, Maine, suggested that soft-bottom habitat may also be used to some extent as habitat for EBP lobsters (Heinig and Cowperthwaite 1998). Small juvenile lobsters >28 mm CL were found in burrows in soft bottom substrate of Portland Harbor. Burrows occupied by lobster were "U" shaped and the diameter of the opening was at least 40 mm.

Many of the potential disposal sites in Gloucester Harbor had a soft-bottom composition, and could provide some habitat for EBP lobsters. Therefore, it was decided to assess these areas as EBP lobster habitat using diver observations and soft-bottom suctioning. The techniques used in this study had been developed and refined in Salem Harbor, Massachusetts, (NAI 1999), and the experience gained in that study was applied to the Gloucester effort.

2.0 METHODS AND MATERIALS

The purpose of this study was to determine if EBP lobster habitat existed along ten transects in Gloucester Harbor (Table 1, Figure 1). Divers from Normandeau and a diver from the Massachusetts Division of Marine Fisheries (DMF) swam each transect in an attempt to locate burrows that may contain EBP lobsters. At each transect, observations were made as to substrate type, the presence and type of burrows, and other biological observations including the presence of fish, shellfish and lobsters. The beginning and end of each transect was located with differential GPS. A transect line was laid down on the harbor bottom and the divers swam along the line making observations one m to either side of the transect line. Counts of lobsters and burrows were totaled, and the other biological observations summarized for every 10 m length segment along the transect and recorded on underwater paper. An index of juvenile and adult lobster abundance was calculated as the number of lobsters observed per linear meter of transect.

Suction sampling was conducted if there was a high density of burrows with a diameter >40 mm, and if in the opinion of our divers and DMF there was a probability that the burrow contained EBP lobsters. Suction samples were collected using a PVC tube connected by an air

hose to a SCUBA tank. The valve on the SCUBA tank was opened and air entered the PVC tube near the bottom and the resulting suction carried water and sediment up the pipe. At the top of the pipe a 0.8 mm mesh bag was mounted at a 45° angle where the sample was collected. Air and fine sediment exited the sampling bag through the mesh and coarse sediment and EBP lobsters (if present) were retained by the mesh. A 1/16 m^2 frame with a floating curtain was placed on the quadrat to be sampled, and all sediment within the quadrat was suctioned to a depth of about 20 cm.

3.0 RESULTS

Six suction samples were collected at potential EBP lobster burrows at Transect 23-28, and no EBP lobsters were collected. No suction samples were collected at the other transects because the structure of the burrows was similar to those at Transect 23-28, and these were too large to be EBP burrows.

Juvenile and adult lobsters were present at every transect in Gloucester Harbor (Table 2). The substrate at all transects was silt, except for Transect 23-28 where some rock and ledge were present. In the silty substrate there were many burrows apparently constructed by juvenile and adult lobsters. Many of these burrows contained lobsters. Other organisms present along the transects were green crabs, hermit crabs, and *Cancer* crabs. Abandoned (ghost) lobster traps were present at all transects except 2, 5, and 12.

The number of lobsters per linear meter of transect can provide a crude measure of the relative abundance of lobsters present at each transect (Table 3). This provides only a snapshot of the distribution of lobsters in Gloucester Harbor in November, and this distribution will change seasonally. The index of lobster abundance was lowest at Transect 7 (0.06/m) and the two outer transects, 22-27 (0.07/m) and 23-28 (0.09/m). At the remaining transects, the index was relatively consistent, ranging from 0.10/m at Transect 2, to 0.20/m at Transects 12 and 15.

4.0 DISCUSSION

No EBP lobster habitat or EBP lobsters were found at the transects observed in Gloucester Harbor. Most of the burrows observed, including those sampled at Transect 23-28, were too large to contain EBP lobsters. The typical EBP burrow is "U" shaped with openings of about 40 to 50 mm. The burrows observed in Gloucester Harbor were either much smaller and not "U" shaped, or larger "U" shaped burrows that contained juvenile or adult lobsters.

Although not an objective of this study, Gloucester Harbor appears to be good habitat for juvenile and adult lobsters. The ideal lobster habitat has been described as sand substrate overlain with flattened rocks that the lobsters use as shelter (MacKenzie and Moring 1985). However, lobsters will readily use soft substrate habitat like that found in Gloucester Harbor and construct their own burrows for shelter. The presence of a commercial fishery for lobsters in Gloucester Harbor is further evidence of good quality habitat for adult lobsters.

The index of lobster abundance was highest at Transects 12 and 15, but these data represent the relative distribution of lobsters only at the time of sampling. The uniformity of habitat among transects suggests that lobsters may be abundant at any of the transects in response to seasonal and short-term movements.

5.0 LITERATURE CITED

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Table 1. Location of Sampling Transects in Gloucester Harbor.

	Beginning		End			
Transect	**Latitude**	**Longitude**	**Latitude**	**Longitude**	**Length (m)**	**Direction of Transect**
2	42°36.526'	70°39.242'	42°36.566'	70°39.184'	100	NE-SW
5	42°36.813'	70°39.337'	42°36.678'	70°39.161'	400	W-E
7	42°36.737'	70°39.415'	42°36.626'	70°39.257'	300	E-W
10	42°36.621'	70°39.533'	42°36.537'	70°39.411'	250	E-W
12	42°36.574'	70°39.651'	42°36.472'	70°39.520'	250	W-E
15	42°36.300'	70°39.613'	42°36.495'	70°39.791'	400	W-E
18	42°36.257'	70°39.724'	42°36.433'	70°39.881'	350	W-E
19	42°36.397	70°39.920'	42°36.231'	70°39.768'	350	W-E
22-27	42°36.305'	70°40.280'	42°36.093'	70°40.036'	550	W-E
23-28	42°36.239'	70°40.287'	42°36.054'	70°40.077'	500	W-E

Table 2. Biological Data Collected at Sampling Transects in Gloucester Harbor.

Transect	Segment (m)	Depth (m)	Substrate	Burrows	Lobsters	Observations
2	0-100	6.1-7.3	silt	0	10	Green crabs, mussels
5	0-100	4.2-8.7	silt	19	27	Green, hermit, *Cancer* crabs
5	100-200	4.2-5.2	silt	4	3	Mussels
5	200-300	5.9-6.3	silt	12	13	Mussels, seastar
5	300-400	6.3-8.0	silt	18	12	Green, hermit, *Cancer* crabs
7	0-100	10.0	silt	47	6	Green, hermit crab, gill net
7	100-200	9.7-10.1	silt	41	6	Green, hermit crab
7	200-300	9.4-10.4	silt	16	5	Green, hermit crab, ghost trap
10	0-100	4.2-10.8	silt	41	9	Green, *Cancer* crabs, ghost trap
10	100-200	10.1-10.4	silt	15	19	Green crabs, Nav. buoy
10	200-250	7.0-10.1	silt	10	7	Green, *Cancer* crabs
12	0-100	7.0-8.0	silt	19	7	Green, *Cancer* crabs
12	100-200	8.0-9.0	silt	83	39	Green, *Cancer* crabs
12	200-250	8.7-9.0	silt	26	5	Green, *Cancer* crabs

(continued)

Table 2. (Continued)

Transect	Segment (m)	Depth (m)	Substrate	Burrows	Lobsters	Observations
15	0-100	7.0-9.1	silt	23	22	Ghost traps, urchins, *Cancer* crabs
15	100-200	7.6-8.5	silt	102	29	Ghost traps, debris
15	200-300	7.3-9.8	silt	53	21	Gill net
15	300-400	5.2-7.6	silt	41	7	Ghost trap
18	0-100		silt	5	6	Hermit, *Cancer* crabs
18	100-200		silt	43	33	6 ghost traps
18	200-300		silt	5	2	1 ghost trap
18	300-350		silt	1	0	Hermit, *Cancer* crabs
19	0-100	9.1-10.4	silt	40	22	Green, *Cancer* crabs, ghost traps
19	100-200	9.8-10.7	silt	44	28	Ghost trap, *Cancer* crab
19	200-300	8.5-10.4	silt	4	4	Ghost trap, seastar
19	300-350	7.6-8.2	silt	0	0	Cunner
22-27	0-100	11.9	silt	39	0	Green, *Cancer* crabs
22-27	100-200	12.2	silt	26	12	Green, *Cancer* crabs
22-27	200-300	12.2	silt	18	5	Green, *Cancer* crabs
22-27	300-400	12.2	silt	8	14	Green, *Cancer* crabs
22-27	400-500	12.2	silt	9	8	Green, *Cancer* crabs, ghost trap, loose kelp
22-27	500-550	11.9-12.8	silt	1	2	Green, *Cancer* crabs

(continued)

Table 2. (Continued)

Transect	Segment (m)	Depth (m)	Substrate	Burrows	Lobsters	Observations
23-28	0-100	10.7-11.9	sit	6	5	Green, *Cancer* crabs
23-28	100-200	11.9	silt	58	1	Green, *Cancer* crabs
23-28	200-300	11.9	silt	28	2	Green, *Cancer* crabs, kelp
23-28	300-400	11.9-12.2	silt	25	18	Green, *Cancer* crabs, kelp, ghost trap
23-28	400-500	12.2	silt rock/silt	20	19	Green, *Cancer* crabs ghost trap, mussels, kelp

Table 3. Relative Index of Lobster Abundance (lobsters/linear m) at Sampling Transects in Gloucester Harbor.

Transect	Index (lobsters/linear m)
2	0.10
5	0.14
7	0.06
10	0.14
12	0.20
15	0.20
18	0.12
19	0.15
22-27	0.07
23-28	0.09

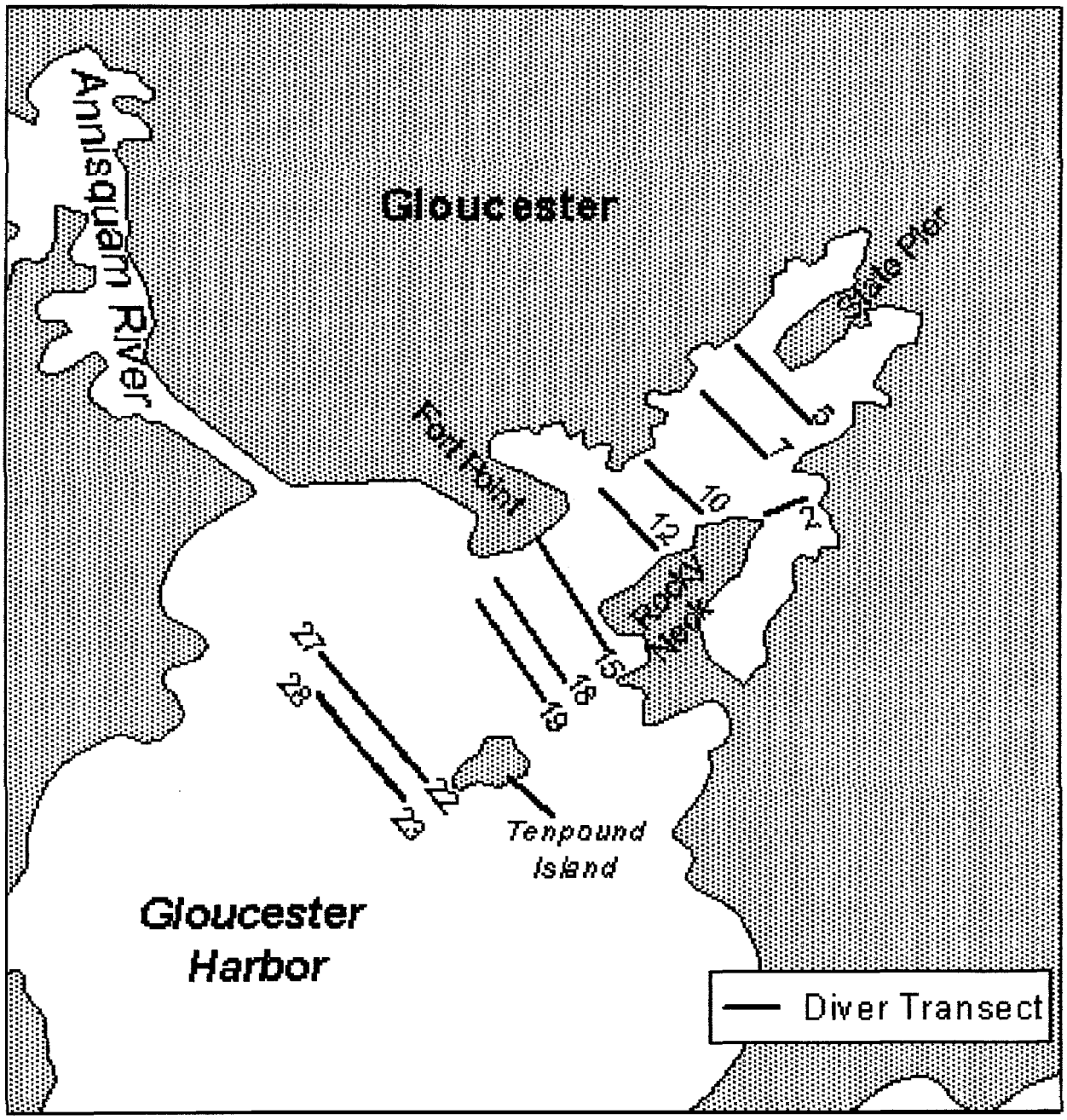

Figure 1. Location of Gloucester Harbor early benthic phase lobster sampling transects.

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