Distribution and Abundance of Corophium volutator (Pallas), Macoma Balthica (L.) and Heteromastus filiformis (Clara pede) in the Intertidal Zone of Cumberland Basin and Shepody Bay, Bay of Fundy

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DISTRIBUTION AND ABUNDANCE OF *COROPHIUM VOLUTATOR* (PALLAS), *MACOMA BALTHICA* (L.) AND *HETEROMASTUS FILIFORMIS* (CLARAPEDE) IN THE INTERTIDAL ZONE OF CUMBERLAND BASIN AND SHEPODY BAY, BAY OF FUNDY

by

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ABSTRACT

Nine intertidal flats in the upper Chignecto Bay region were sampled from May to October 1978, and three of them until April 1979, to determine the distribution and abundance of the amphipod Corophium volutator (Pallas), the polychaete Heteromastus filiformis (Clarapède) and the bivalve Macoma balthica (L.). The areas sampled were Mary's Point (New Horton Flats), Daniel's Flats, Grande Anse, Rockport Cove, Peck's Cove, Joggins, Minudie, Minudie Point and Elysian Fields. In summer, Corophium volutator was the most abundant both numerically and in biomass. Whereas Macoma was concentrated in the upper 200 m of flat, Corophium and Heteromastus were more cosmopolitan in distribution. All three species were scarce or lacking in the lowermost portion of flat nearest the low tide line. Highest densities of Corophium were recorded in July and September-October, the latter owing mainly to the presence of juveniles. Numbers were lowest in August and in January through February. The former appears to be a result of predation by shorebirds and fish and the latter owing to severe scouring by ice. Heteromastus was most abundant in spring (April-May). Macoma numbers fluctuated widely between sites at different times of the year with no obvious patterns.

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RESUME

L'échantillonnage de neuf estrans de la région de la baie Chignecto supérieure s'est poursuivi de mai à octobre 1978 (et jusqu'en avril 1979 pour trois d'entre eux). L'objet de ces travaux était de déterminer la répartition et l'abondance de l'amphipode Corophium volutator (Pallas), du polychète Heteromastus filiformis (Clarapède) et du bivalve Macoma balthica (L.). Voici les endroits étudiés: Mary's Point (New Horton Flats), Daniel's Flats, Grande Anse, Rockport, Peck's Cove, Joggins, Minudie, Minudie Point et Elysian Fields. C'est en été que le Corophium volutator s'est révélé plus abondant tant en nombre qu'en biomasse. Le Macoma était concentré dans les 200 m supérieurs de l'estran; le Corophium et l'Heteromastus étaient, eux, répartis plus également. Les trois espèces étaient rares, sinon inexistantes, dans la partie la plus basse de L'estran, soit près de la laisse de basse mer. On a enregistré les plus fortes concentrations en juillet et en septembre-octobre, lesquelles sont avant tout imputables dans ce dernier cas à la présence de petits. C'est en août et de janvier à février qu'on a dénombré le moins de spécimens. Dans le premier cas, il semble qu'il faille attribuer le résultat à L'action des oiseaux de rivage et poissons prédateurs et, dans le deuxième cas, au raclement des glaces. L'Heteromastus est très abondant au printemps (avril-mai). Quant au Macoma, le nombre varie énormément d'un endroit à l'autre à différents moments de l'année, sans qu'aucune tendance ne se dessine clairement.

I. INTRODUCTION

Twice daily, tidal waters expose about 30,000 hectares of intertidal mud and sand in the upper reaches of the Bay of Fundy. Almost two-thirds of this area is in Minas Basin and Cobequid Bay (Fig. 1) where extensive studies on the intertidal macrofauna have been undertaken (Risk et al. 1976; Craig 1977; Yeo 1977; Boates 1978; Hargrave 1978; Gratto 1979; McCurdy 1979; Yeo and Risk 1979). McCurdy (1979) identified from western Minas Basin 71 taxa of intertidal invertebrates of the phyla Platyhelminthes (1), Nematoda (1), Nemertina (2), Mollusca (8), Annelida (42) and Arthropoda (17). Of the individuals he collected, 76% were of three species: the amphipod Corophium volutator (Pallas) and the polychaetes Heteromastus filiformis (Clarapède) and Chaetozone setosa Malmgren. In Cobequid Bay, Yeo (1977) reported higher densities of the bivalves Macoma balthica (L.) and Mya arenaria (L.) than were found in Minas Basin. The abundant macrofauna provide an important food source for migrant shorebirds (Boates, in press; Hicklin and Smith, in press) and fish (I. Salinus, pers. comm.).

The tidal flats of Chignecto Bay have only been investigated recently, and comparatively few data have been published (Yeo 1977). This report presents data on the distribution and abundance of the dominant species: Corophium volutator, Heteromastus filiformis and Macoma balthica. These preliminary results were obtained in the course of projects on the determination of food resources for shorebirds (P.H. and L.L.) and on the secondary productivity of intertidal mudflats (D.P.). Although mainly descriptive in nature, the information presented herein should be of value for other ecological studies in the Bay of Fundy.

II. MATERIALS AND METHODS

Sampling transects were established on seven intertidal flats around the head of Chignecto Bay: Mary's Point (New Horton Flats), Daniel's Flats, Grande Anse, Peck's Cove, Joggins, Minudie and Elysian Fields (Figs. 2-8). Sampling began in May 1978. Three sites, Mary's Point, Grande Anse, and Peck's Cove, were sampled monthly through April 1979. Elysian Fields was only sampled through August 1978, and at Daniel's Flats, Joggins and Minudie sampling ended October 1978. At all sites the transects ran perpendicular to the tide line, starting from a point where fine mud and sand began below the neap tide high water mark and extending to the neap low water line when conditions permitted. Stations were numbered starting from the uppermost level of flat and increasing seaward; i.e., the station with the highest number was farthest from land and closest to neap low water. On low spring tides, the flats extended beyond the transects. On December 20, 1978 and March 21, 1979, we sampled only every second station at Mary's Point.

Tidal profiles of the transects (except Elysian Fields and Joggins) were drawn (Fig. 9) by noting the times at which stations were submerged by the rising tide and calculating the height of the station above chart datum by fitting a sine curve to the range and durations of the tide taken from Canadian Tide and Current Tables (Fisheries and Environment Canada).

Samples were taken with a circular core of diameter 11.3 cm, thus covering an area of 100 cm^2. The core was pushed through the soft surface sediments to a depth of 1 cm in the more compact subsurface layer. On average, the core penetrated 10 cm. Stations were established every 100 m along each transect except at Joggins where stations were 50 m apart. Two samples were taken, 1 m apart, at each station. The samples were put in plastic bags for transport to the laboratory. On the same or the following day, they were sieved through a 0.70 mm mesh screen. All organisms remaining on the screen were removed and placed in 4% formalin. These were later sorted and counted, and densities (no./m^2) for both samples at each station were computed and averaged. Specimens of Corophium volutator were measured from the tip of the rostrum to the end of the telson. Wet weights of Corophium and Macoma balthica (with shells) were determined with a Mettler P 162 N balance. Specimens of Heteromastus filiformis were not weighed or measured.

Samples were also collected using a 15 x 15 cm Ekman sampler mounted on a short section of 2 cm pipe. This instrument was used while standing in shallow water at the edge of the tide. The samples were loaded into a dory which was moved along the edge of the flats on a rising or falling tide, thus creating transects running diagonally across the flats. Samples were taken at irregular intervals (100-500 m) and approximate positions were obtained by visual alignment of known landmarks. The time of sampling was recorded and the height above chart datum was calculated (Table 1). Mary's Point, Daniel's Flats, Peck's Cove, Rockport Cove, Minudie and Minudie Point were sampled in this way but wind conditions prevented coverage of the other areas. This procedure provided a broader picture of the distribution and abundance of the invertebrate fauna in addition to that obtained from the transects and permitted collection of a much larger sample than could be carried out on foot. Sieving was done on board an 11 m fishing vessel anchored off the flat and also used for transportation to the sampling areas. Preservation and analysis were by the same methods as outlined above.

Wet weights of Heteromastus filiformis were not recorded.

III. RESULTS

Corophium volutator, Heteromastus filiformis and Macoma balthica dominated the macrofauna at all the areas we sampled. These species have a cosmopolitan distribution in Chignecto Bay and occur in high densities at some sites. To facilitate the description and interpretation of data, the distributions of these species are discussed below starting with the area having lowest density and continuing with more densely settled sites.

A. Transects

1. Elysian Fields - This area (Fig. 3) was unique in being composed largely of fine well sorted sand except for a 400 m wide belt of silt and clay and small areas of salt marsh in the uppermost region.

(a) Corophium volutator (Table 2a) - This species was concentrated in the upper 400 m of the transect. (Stations 1-4). The highest densities occurred at Stations 1 and 2 with a maximum density of 3,450/m^2 at Station 1 in August. Maximum numbers and biomass occurred during August although overall numbers were low.

(b) Heteromastus filiformis (Table 2b) Two individuals (100/m^2) were obtained from Station 3 in May. Single individuals (50/m^2) were taken from Station 2 in each of the three subsequent sampling periods. No specimens were found at any of the other stations throughout the summer months.

(c) Macoma balthica (Table 2c) - Macoma was found only in the upper three stations except that one individual was taken at Station 11 in July. Numbers and biomass increased throughout the summer with the highest value (1,350/m^2) recorded at Station 1 in August.

2. Joggins - This, the shortest transect (Fig. 4), was in an area of wet silty muds. The flat is bordered by a steep cobble beach.

(a) Corophium volutator (Table 3a; Fig. 10) - Corophium was found at all stations from May to October in relatively high densities, except at Station 5 in June. The mean density and biomass for the transect were highest in July 6,819/m^2 and 20.5 g/m^2, respectively). As well, the highest sample density for the transect was recorded on that month at Station 5 (16,550/m^2). Mean densities were lower during August (2,612/m^2) than September (5,125/m^2) and October (3,825/m^2).

(b) Heteromastus filiformis (Table 3b) In May, Heteromastus was found in 5 of the 8 stations sampled with a mean density of 294/m^2 for the transect. In subsequent sampling periods it occurred mainly in Stations 1 and 2. Mean density was lowest in August (31/m^2). The density increased in September and October (93 and 87/m^2, respectively) although it remained lower than in May.

(c) Macoma balthica (Table 3c) - Low numbers of Macoma were found in the uppermost four stations from May through July. Only single individuals were collected at Station 7 in August and September. None was found at any station during October. The highest density occurred at Station 1 in May (300/m^2), and the highest mean density for the transect also occurred in May (56/m^2).

3. Minudie - This was a relatively low level flat (see Fig. 9) which began at the edge of an extensive beach (Fig. 4).

(a) Corophium volutator (Table 4a; Fig. 11) - Corophium was found at all stations sampled June-October inclusive. None was collected at Stations 6, 8 and 9 in May. The lowest mean densities for the transect occurred in May (650/m^2) and June (1,081/m^2). Maximum values were recorded in July (6,100/m^2; 21.5g/m^2). Numbers were greatly reduced the following month (2,488/m^2). The mean densities for September and October (5,311/m^2 and 5,838/m^2, respectively) probably involved mainly juvenile animals, as suggested by the low biomass values (5.5 and 5.1g/m^2, respectively). More recent studies indeed show that a high proportion of the animals found in late summer and fall is comprised of juveniles (Hicklin and Linkletter, in prep.)

(b) Heteromastus filiformis (Table 4b) Heteromastus occured in relatively high densities throughout the sampling period, at all stations except Station 1. A mean density for the transect of 818/m^2 in June was the highest recorded. Numbers were lower throughout July, August and September.

(c) Macoma balthica (Table 4c) - Macoma was more widely distributed along this transect than at the sites previously described. Its numbers remained relatively low. The largest density for the transect was recorded in May (117/m^2). It appeared also to occupy fewer stations as monthly sampling progressed. None was collected in October.

4. Peck's Cove - This flat (Fig. 5) had a relatively level section which extended from the shore to Station 6 (Fig. 9). From Station 6 seaward it consisted of a steep slope. The upper 75 m consisted of a narrow band of Spartina alterniflora Loisel. bordered by a sand beach.

(a) Corophium volutator (Table 5a, Figs. 12a and b) - High densities of Corophium were recorded from July to December inclusive. On average, the higher numbers were

concentrated in the middle portion of the transect from Station 2 to 6 inclusive. In May, numbers were highest at Station 6 (2,400/m^2) with low numbers at Stations 7 (300/m^2) and 8(250/m^2). In June, abundance was greatest at the uppermost five stations with the highest density recorded at Station 4(1100/m^2). A large increase was noted in July with a maximum density of 5,600/m^2 at Station 3. The mean density for the transect that month was 2,777/m^2. Numbers increased progressively until November to a maximum mean density of 9,011/m^2. However, the maximum value for biomass occurred in August (15.0g/m^2) which again suggests the numerical dominance of smaller animals after August (Hicklin and Linkletter, in prep.). During January and February, ice cover prevented us from sampling the transect; samples were collected in January near Stations 1, 2 and 3 where some mud was exposed. A few animals, 450/m^2, were found at Stations 1 and 3. After the ice had left the area, low numbers were collected during March and April (385 and 378/m^2, respectively). These results suggest heavy mortalities in winter, possibly as a result of scouring by ice. Yeo (1977) similarly suggested high winter mortalities for Corophium in intertidal sediments in Cobequid Bay.

(b) Heteromastus filiformis (Table 5b) Heteromastus was distributed evenly along the transect with the larger concentrations between Stations 3 and 7. The highest mean densities occurred during April and May (622 and 738/m^2, respectively). There was no other noticeable trend in their abundance throughout the sampling period. Densities were almost identical between the months before and after the flats were covered by ice during January and February. In December the mean density along the transect was 267/m^2 and in March, 261/m^2. Heteromastus is better able than Corophium to burrow deeper in the mud during periods of severe ice scouring (D. Gordon, pers. comm.).

(c) Macoma balthica (Table 5c) - Macoma was also evenly distributed along the transect except at the lowest station where none was found. Higher densities occurred at Station 1 where maximum numbers of 500/m^2 were found in June. Maximum mean densities occurred in May (131/m^2) and June (106/m^2) although the greatest biomass was recorded in August (13.7 g wet weight/m^2). Densities were lowest in July (17/m^2), December 17/m^2), March (11/m^2) and April (28/m^2). Reductions in the latter three months could be due to cold temperatures and scouring by ice.

5. Grande Anse - This is an extensive flat (Fig. 6) that begins in the high intertidal with no salt marsh and is bordered by large boulders, used as fill for the highway, and steep cliffs. The seaward edge consisted of a relatively steep slope towards the water (Fig. 9 and personal observation). Because of a deep drainage channel, the transect could not be extended to the extreme low tide line.

(a) Corophium volutator (Table 6a; Figs. 13a and b) - Mean densities of Corophium were very low at this site during May (37/m^2) and June (118/m^2). In July, values for mean density and biomass had increased greatly (5,162/m^2 and 15.0g/m^2, respectively) which suggests a high rate of recruitment into the population at that time. Densities remained high until November. A maximum mean density of 6,908/m^2 was recorded for the transect in September. However, values for biomass remained relatively low because of the preence of numerous small individuals. During July, maximum numbers were concentrated in the middle portion of the flat, between Stations 5 and 9. Severe reductions in numbers, at all stations, occurred during August. This implies heavy predation on Corophium by shorebirds which occur in large numbers at that time (Hicklin, unpublished data). Fish also feed on Corophium (I. Salinus, pers. comm.). The relative effects of these factors remain unknown. The appearance of juvenile animals, which would have passed through our sieves in August, presumably initiated the increase in numbers during September.

Between September and December, numbers were widespread along the transect. In January the upper 400 m were covered in ice. One individual was found at Station 2 under 1 m of ice. In the exposed lower portion, some were found at Stations 5-12 with higher densities at Stations 7, 8 and 9. A maximum density of 8,450/m^2 was recovered at Station 9. Low mean densities for the transect were recorded during March (204/m^2) and April (83/m^2) after the ice had gone.

(b) Heteromastus filiformis (Table 6b) - Numbers of Heteromastus at this site were lower than values recorded at Minudie and Peck's Cove. A maximum mean density of 75/m^2 was recorded in July. Numbers were mainly concentrated in the middle portion of the mudflat between Stations 4 and 10. None was collected at the upper levels (Stations 1 and 2).

(c) Macoma balthica (Table 6c) - Densities of Macoma were high along this transect. The maximum mean density occurred in September (1787/m^2) although substantial numbers were recorded in August (1304/m^2), November (1496/m^2) and March (1233/m^2). Although numbers were low during May and June (358 and 386/m^2, respectively), the figures for biomass were relatively high (51.9 and 72.5 g/m^2, respectively) suggesting that large individuals survived winter conditions.

6. Daniel's Flats - This is the largest mudflat studied (Fig. 7). It begins high in the intertidal at an extensive salt marsh and continutes as a gradual slope to a shoal sub-

tidal area (Fig. 9 and personal observation).

(a) Corophium volutator (Table 7a; Fig. 14) - Mean densities of Corophium were low in May and June (6 and 125/m^2 respectively) and increased substantially during July (2,567/m^2). Numbers were lower again in August (1,678/m^2), but increased to high levels in September and October (9,861 and 5,189/m^2, respectively). In July and August, maximum numbers occurred between Stations 4 and 12. In September, numbers were high throughout the transet. In October, the larger densities were again restricted to the middle levels of mudflat.

(b) Heteromastus filiformis (Table 7b) The highest densities of Heteromastus occurred in May (247/m^2) and the lowest were recorded in July (100/m^2). Most were collected between Stations 4 and 15. Few were collected at the uppermost and lowermost three stations.

(c) Macoma balthica (Table 7c) - High densities of Macoma were found at Station 1 of the transect. A maximum density of 9,650/m^2 was recorded there in October. They remained in relatively high numbers at Stations 2 and 3. Beyond this point, numbers were very low and variable. This suggests a patchy distribution downshore along the transect. Mean densities for the transects were lowest in May (367/m^2) and highest in October (814/m^2).

7. Mary's Point - The area (Fig. 8) is somewhat similar to the preceding but with a steeper seaward slope (Fig. 9). The uppermost region is bordered by a sandy beach and less extensive salt marsh.

(a) Corophium volutator (Table 8a; Figs. 15a and b) - Maximum densities of Corophium were recorded at this site. Their numbers remained high from July to October inclusive. A maximum density of 18,000/m^2 was recorded at Station 12 in July. The values for mean density were almost identical during July and August (8,060 and 8,097/m^2, respectively) but those for biomass differed greatly (15.1 and 31.2 g wet weight, respectively). Numbers were highest in the middle portion of the mudflat in July (Stations 7-14) and extended slightly more downshore in August (Stations 8-17). From September to December, numbers were more uniformly distributed along the transect. In January, highest numbers again occurred at mid tide (Stations 7-11). As at Grande Anse and Peck's Cove, the greatest reductions in numbers occurred between January and April, presumably owing to the effects of heavy ice cover.

(b) Heteromastus filiformis (Table 8b) Heteromastus densities did not exceed values recorded at other sites. A maximum mean density of 234/m^2 was recorded in April. The lowest numbers were found in November (92/m^2). Densities were highest at the upper and mid-levels of the transect; few were recovered at the lowermost portions between Stations 13-19, inclusively, throughout the sampling period.

(c) Macoma balthica (Table 8c) - The distribution and abundance of Macoma at this transect was similar to that described for Daniel's Flats. The highest densities were recorded at Station 1. A maximum of 7,550/m^2 was recorded there in July. Numbers decreased substantially downshore.

B. Boat Samples

Samples were collected by boat laterally across the flats at Daniel's Flats, Mary's Point, Peck's Cove, Rockport Cove, Minudie and Minudie Point on 15 July and 13, 14 August, 1978. This procedure allowed us to reach some sites we could not have sampled otherwise. The results are discussed in order of site locations from east to west.

1. Minudie Point (Fig. 4) - Densities of Corophium were concentrated in samples 4-9, August 14 (Table 9). Densities were high in four samples taken at a more elevated portion nearest Minudie Point on July 15 (Table 10). Heteromastus occurred between Samples 5-13 (Table 9), with a maximum density of 133/m^2 in Sample 9. No Macoma was found.

2. Minudie (Fig. 4) - Samples were taken on July 15 along the transect and beyond to the low tide line (Table 11). The highest densities were recorded from samples taken closest to the transect. Numbers decreased as samples extended farther downshore beyond the transect. Similarly, the highest densities of Heteromastus occurred at the transect (Sample 1) and diminished downshore. No Macoma was collected.

3. Rockport Cove and Peck's Cove (Fig. 6) The samples collected at Peck's Cove on July 15 (Table 12) had densities similar to what was found on the transect. Heteromastus was taken in low densities at the last four sites. No Macoma was collected.

Densities of Corophium at Rockport Cove (Samples 1-7; Table 13) were much lower than that computed for the single sample collected at Peck's Cove (6,899/m^2n) on August 13 (Table 14). At Rockport, the maximum density occurred in Sample 2 (2,880/m^2) at a site closest to shore. One Heteromastus was collected in Sample 6. Macoma was absent.

4. Daniel's Flats (Fig. 7) - Samples 1-5 (Table 15) were taken in the southwestern portion of Daniel's Flats adjacent to the mouth of the Shepody River. None of the three species was recovered at this site. Samples 6-13 were taken closer to the sampling transect and the results showed densities of Corophium similar to those previously encountered

there. Heteromastus and Macoma were recovered only in Samples 10-13, close to shore.

5. Mary's Point (Fig. 8) - Only three samples were taken (Table 16). Corophium was found in only one (Sample 1); Heteromastus and Macoma were absent.

IV. DISCUSSION

The results indicate fluctuating patterns in invertebrate numbers between stations, sites and different times of the year. It is evident from the boat samples that the three species occur in low numbers or are completely lacking in areas at lower tide levels beyond the end of the transect (e.g. Minudie) which are generally characterized by strong wave action, a steeper slope, and coarse sediments. It appears likely that reductions in the numbers of Corophium volutator, at most sites, particularly in August, are due mainly to the effects of predation by birds and fish. Certainly, shorebirds play an important role. Sandpipers occur in large numbers during July and August (Hicklin, unpublished data) and feed mainly on Corophium (Hicklin and Smith, in press). Predation by fish is known to occur and is presently under study in Cumberland Basin at Peck's Cove (M. Dadswell, pers. comm.). During the summer months, the recruitment rate of Corophium is very high as evidenced by the sudden rise in numbers. By late July and August, if predation pressure on Corophium is greater than the recruitment rate, then their numbers would be reduced.

We believe that reductions in numbers and biomass of Corophium recorded during August at Joggins, Minudie, Grande Anse and Daniel's Flats are due to the effects of predation. At Peck's Cove, densities and biomass of Corophium were highest in August. Relatively fewer birds forage at Peck's Cove owing to the lack of suitable roosting areas (Hicklin, unpublished data). Hence, fewer predators in relation to existing Corophium densities and a high rate of recruitment would allow for the increases we recorded. At Mary's Point, numbers of Corophium were similar during July and August and biomass was highest in August. The largest numbers of shorebirds occur at Mary's Point throughout the migration period in the Bay of Fundy (Hicklin, unpublished data). Conditions there may be such that predation pressure by birds and fish is not as great relative to the numbers foraging there and the high density of prey available. Hence, the density and recruitment rate of Corophium may be high enough to withstand substantial pressure from predation without considerable losses in numbers during August comparable to the low density areas. We have some evidence (unpublished) that adult Corophium die soon after breeding although the extent of this mortality is unknown. Clearly, more studies are needed to delineate the relative effects of natural mortality and predation by birds and fish. Greater abundances of Corophium during September and October, recorded at most sites, appear to be due to the presence of growing juveniles recently recruited into the population. Large reductions in numbers of Corophium and Macoma were also noted soon after the occurrence of heavy ice in January and February. Yeo (1977) suggested mortalities of Corophium as high as 95% in Cobequid Bay during the winter months, and Hicklin (unpublished data) computed similar losses at some sites in the Southern Bight of Minas Basin. Mean lengths of Corophium were greater during May and June (Fig. 16) which suggests that large individuals survived winter conditions or that growth is rapid after the ice is gone.

Numbers of Heteromastus filiformis did not decrease appreciably during the winter months. This polychaete sheds ova in January and experiences heavy post-breeding mortality (McCurdy 1979). Hence, the larger numbers collected in spring would be due to the presence of young recruited into the populaion.

Differences in the abundance of all three species were noted between the nine sites selected for this study. Yeo (1977) considered particle size and water content of the sediments as important factors influencing invertebrate abundance and distribution. Other investigations in Europe outlined similar relationships for Corophium (Meadows 1964), polychaetes (Longbottom 1970; Anderson 1972) and Macoma (Anderson 1972). Differences in the physical and biological characteristics of the sediments between sites may account for variations in distribution and abundance of the three species described in this report. Clearly, Mary's Point (New Horton Flats) and Daniel's Flats best provide the necessary requirements for the growth and development of large populations of Corophium, Heteromastus and Macoma. More detailed studies are needed for these relationships to be clarified.

V. SUMMARY

1. Corophium volutator was most abundant at Mary's Point (New Horton Flats) and Daniel's Flats. Lesser numbers were encountered at Grande Anse, Peck's Cove and Minudie. The lowest densities were found at Joggins and Elysian Fields. At Elysian Fields they occurred mainly in the upper 400 m of the intertidal zone.

2. Numbers of Corophium were reduced in August at most sites except Peck's Cove and Mary's Point. Substantial reductions were also noted in February. Reduction in numbers is thought to be due to predation by shorebirds and fish during August. Low numbers of birds at Peck's Cove and very high densities and recruitment rates of Corophium at Mary's Point are presumed to lessen the effects of predation and thus permit increases in overall

numbers and biomass there in August. Mortality during winter is most likely caused by ice scouring.

3. Heteromastus filiformis was abundant at most sites except at Joggins and Elysian Fields.

4. Macoma balthica was found on all sites. Most were confined to the upper reaches of the mudflat. The greatest densities occurred at Mary's Point and Daniel's Flats.

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REFERENCES

ANDERSON, S.S. 1972. The ecology of Morecambe Bay. II. Studies on the intertidal invertebrates of Morecambe Bay and factors affecting their distribution. J. Appl. Ecol. 9: 161-178.

BOATES, J.S. 1978. Investigations on the ecology of the Bay of Fundy. Invertebrate and sediment characteristics of the Starrs Point lower intertidal region. Final Report of Federal Summer Job Corps Project. The National Research Council, Atlantic Region Laboratory, Halifax, Nova Scotia. 109 pp.

_____. In press. Length-dry weight relationships, energy content and the effects of predation on Corophium volutator (Pallas) (Crustacea: Amphipoda). Proc. N.S. Inst. Sci., 28(3/4).

CRAIG, H.D. 1977. Intertidal animal and trace zonations in a macrotidal environment, Minas Basin, Bay of Fundy. Unpublished M.Sc. Thesis, Department of Geology, McMaster University, Hamilton.

GRATTO, G.W. 1979. The biology of the amphipod Corophium volutator (Pallas) in the western Minas Basin, Nova Scotia. Unpublished M.Sc. Thesis, Department of Biology, Acadia University, Wolfville.

HARGRAVE, B.T. (Ed.) 1978. Geochemical and Biological Observations in Intertidal Sediments from Cobequid Bay, Bay of Fundy, Nova Scotia. Fish. Mar. Serv. Tech. Rep. 782: 43 pp.

HICKLIN, P.W. and P.C. Smith. In press. The diets of five species of migrant shorebirds in the Bay of Fundy. Proc. N.S. Inst. Sci. 28(3/4).

LONGBOTTOM, M.R. 1970. The distribution of Arenicola marina (L.) with particular reference to the effects of particle size and organic matter of the sediments. J. exp. mar. Biol. Ecol., 5: 138-157.

MCCURDY, E.P. 1979. Intertidal invertebrates of Scots Bay and western Minas Basin, Nova Scotia. Unpublished M.Sc. Thesis, Department of Biology, Acadia University, Wolfville.

MEADOWS, P.S. 1964. Experiments on substrate selection by Corophium species: films and bacteria on sand particles. Jour. Exper. Biol. 41: 499-511.

RISK, M.J., R.K. Yeo and H.D. Craig. 1977. Aspects of the marine ecology of the Minas Basin relevent to tidal power development. Workshop on Environmental Implications of Fundy Tidal Power, edited by G. Daborn, Acadia University, Wolfville, N.S.

YEO, R.K. 1977. Animal-sediment relationships in the Minas Basin, Bay of Fundy. Unpublished M. Sc. thesis, Department of Geology, McMaster University, Canada.

_____ and M.J. Risk. 1979. Intertidal catastrophes: effects of storms and hurricanes on intertidal benthos of the Minas Basin, Bay of Fundy. J. Fish. Res. Board Can. 36: 667-669.

FIGURE CAPTIONS

FIG. 1. The upper regions of the Bay of Fundy.

FIG. 2. Locations of figures showing the nine mudflats sampled. Numbers on left hand corner of rectangle refer to figure numbers indicated in the text.

FIG. 3. The Elysian Fields flat. Transect sampling stations are represented by closed circles (0). The transect was established on the east side of the flat running S-N.

FIG. 4. The Minudie Point, Minudie and Joggins flats. Transect sampling stations are represented by closed circles (0). The Minudie transect was established on a line running SE-NW and the Joggins transect E-W. The numbered open circles represent samples taken by boat on July 15 and August 14.

FIG. 5. Peck's Cove and Rockport Cove flats. Transect sampling stations are represented by closed circles (0). The Peck's Cove sampling transect was established on a line running W-E. Boat samples are shown as open circles numbered from 1-9 (Peck's Cove, July 15), 1A (Peck's Cove, August 13) and 1-7 (Rockport Cove, August 13).

FIG. 6. The Grande Anse flat. Transect sampling stations are represented by closed circles (0). The transect was established on a line running NE-SW.

FIG. 7. Daniel's Flats. Transect sampling stations are represented by closed circles (0). The transect was established on a line running NW-SE. Boat samples are shown as open circles numbered 1-13 (collected on August 13).

FIG. 8. Mary's Point (New Horton Flats). Transect sampling stations are represented by closed circles (0). Boat samples are the open circles numbered 1-3 (collected on August 13).

FIG. 9. Transect profiles showing locations of stations in relation to height of tide above chart datum. Extremes in tidal levels (spring and neap tides) are indicated.

FIG. 10. Average density (histogram) and biomass (solid and dashed line) of Corophium volutator per station Joggins, May-October, 1978.

FIG. 11. Average density (histogram) and biomass (solid and dashed line) of Corophium volutator per station at Minudie, May-October, 1978.

FIG. 12a. Average density (histogram) and biomass (solid and dashed line) of Corophium volutator per station at Peck's Cove, May-October, 1978.

FIG. 12b. Average density (histogram) and biomass (solid line) of Corophium volutator per station at Peck's Cove, November-April, 1978-1979. Stations 4-9 in January and all stations in February were not sampled due to ice conditions.

FIG. 13a. Average density (histogram) and biomass (solid line) of Corophium volutator per station at Grande Anse, May-October, 1978.

FIG. 13b. Average density (histogram) and biomass (solid line) of Corophium volutator per station at Grande Anse, November-April, 1978-1979. Stations 1-8 in February were not sampled due to ice conditions.

FIG. 14. Average density (histogram) and biomass (solid and dashed line) of Corophium volutator per station at Daniel's Flats, May-October, 1978.

FIG. 15a. Average density (histogram) and biomass (solid line) of Corophium volutator per station at Mary's Point, May-October, 1978.

FIG. 15b. Mean density (histogram) and biomass (solid and dashed line) of Corophium volutator at Mary's Point, November-April, 1978-1979. Only station 5 sampled in February due to ice conditions.

FIG. 16. Mean (±S.D.) monthly lengths (mm) of Corophium volutator.

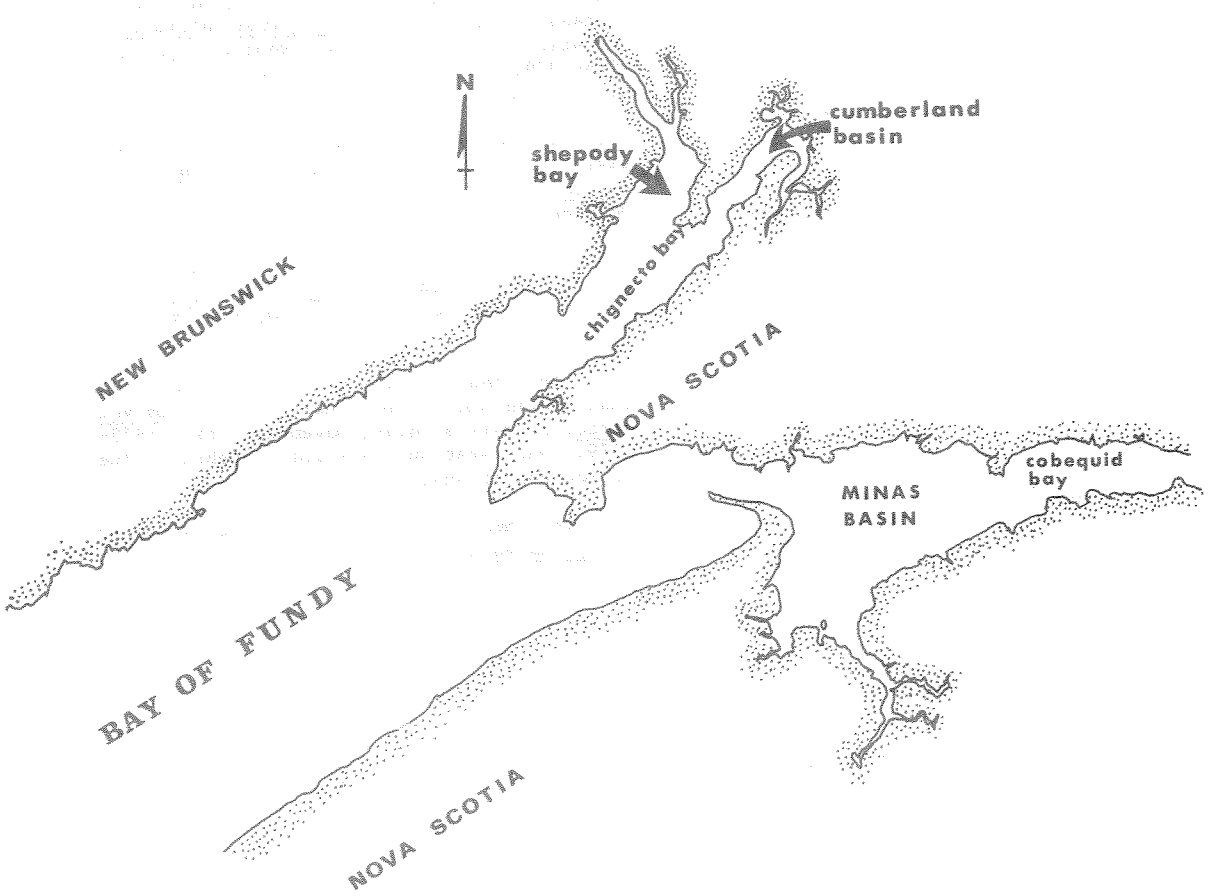


Fig. 1. The upper regions of the Bay of Fundy.

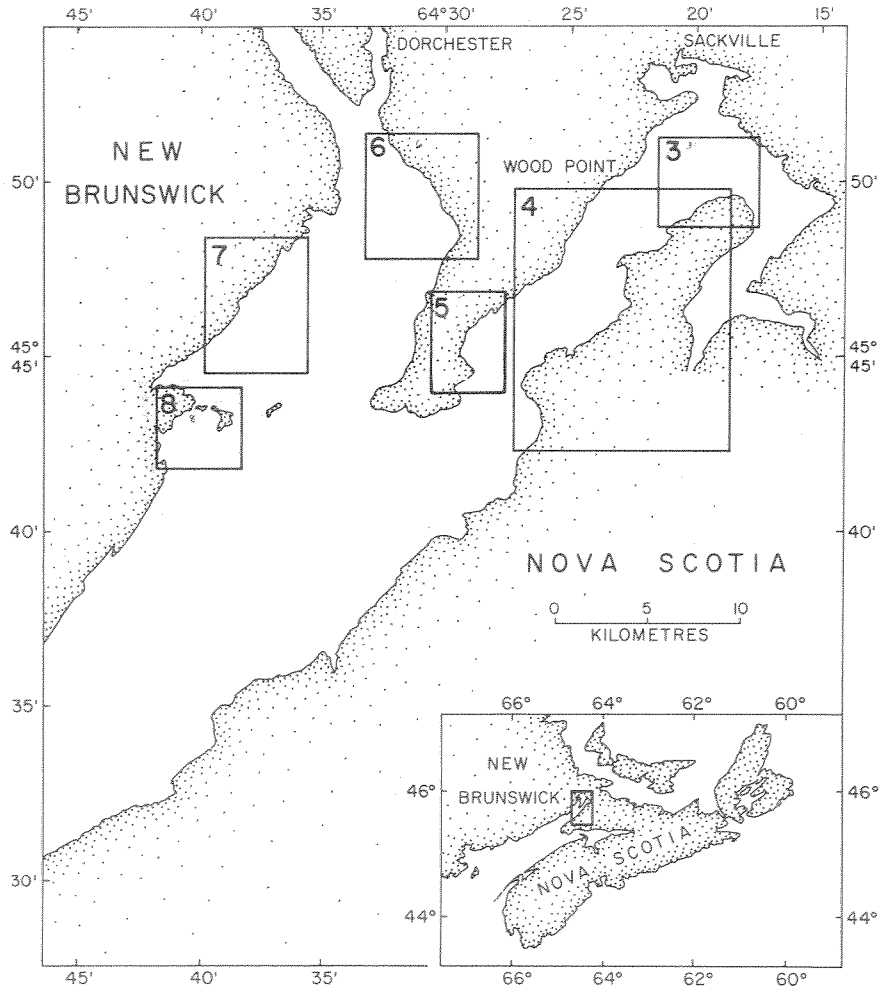


Fig. 2. Locations of figures showing the nine mudflats sampled. Numbers on left hand corner of rectangle refer to figure numbers indicated in the text.

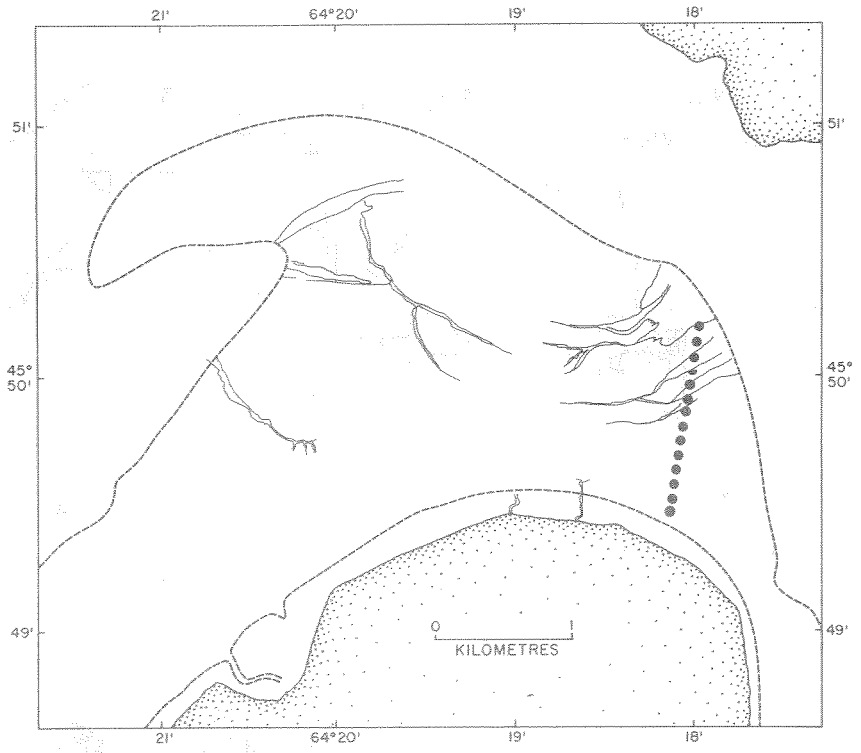


Fig. 3. The Elysian Fields flat. Transect sampling stations are represented by closed circles (●). The transect was established on the east side of the flat running S-N.

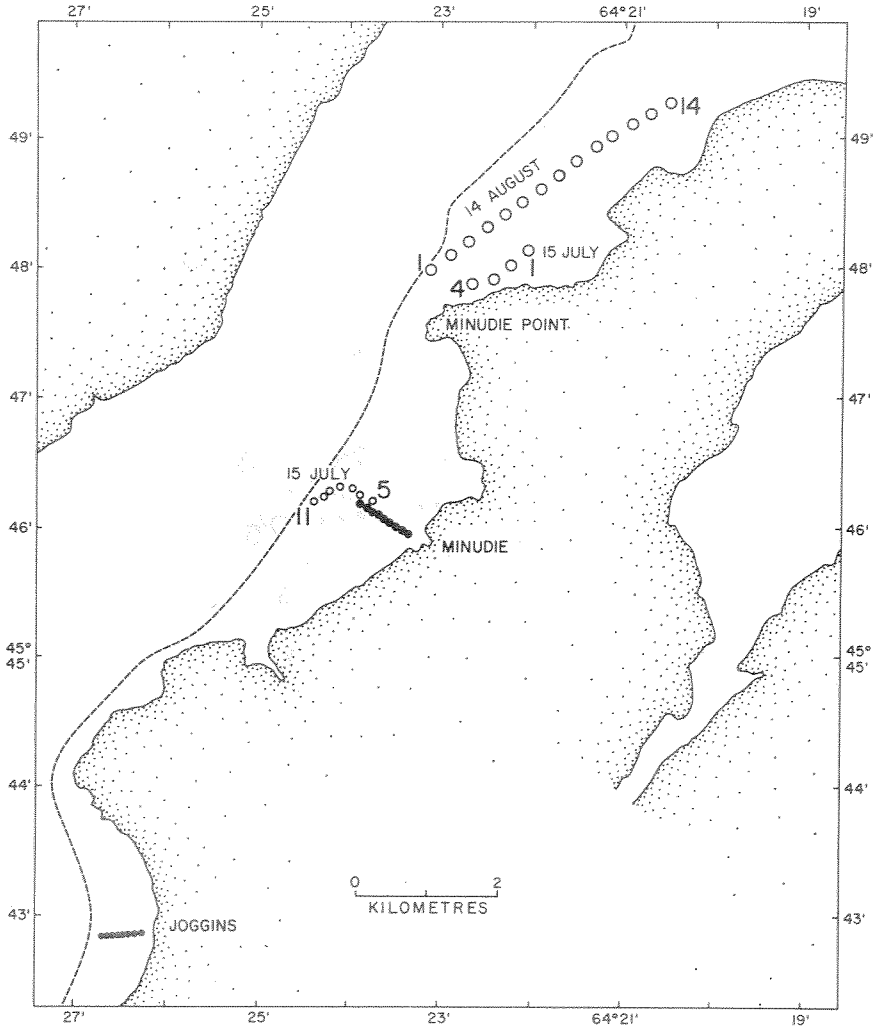


Fig. 4. The Minudie Point, Minudie and Joggins flats. Transect sampling stations are represented by closed circles (●). The Minudie transect was established on a line running SE-NW and the Joggins transect E-W. The numbered open circles represent samples taken by boat on July 15 and August 14.

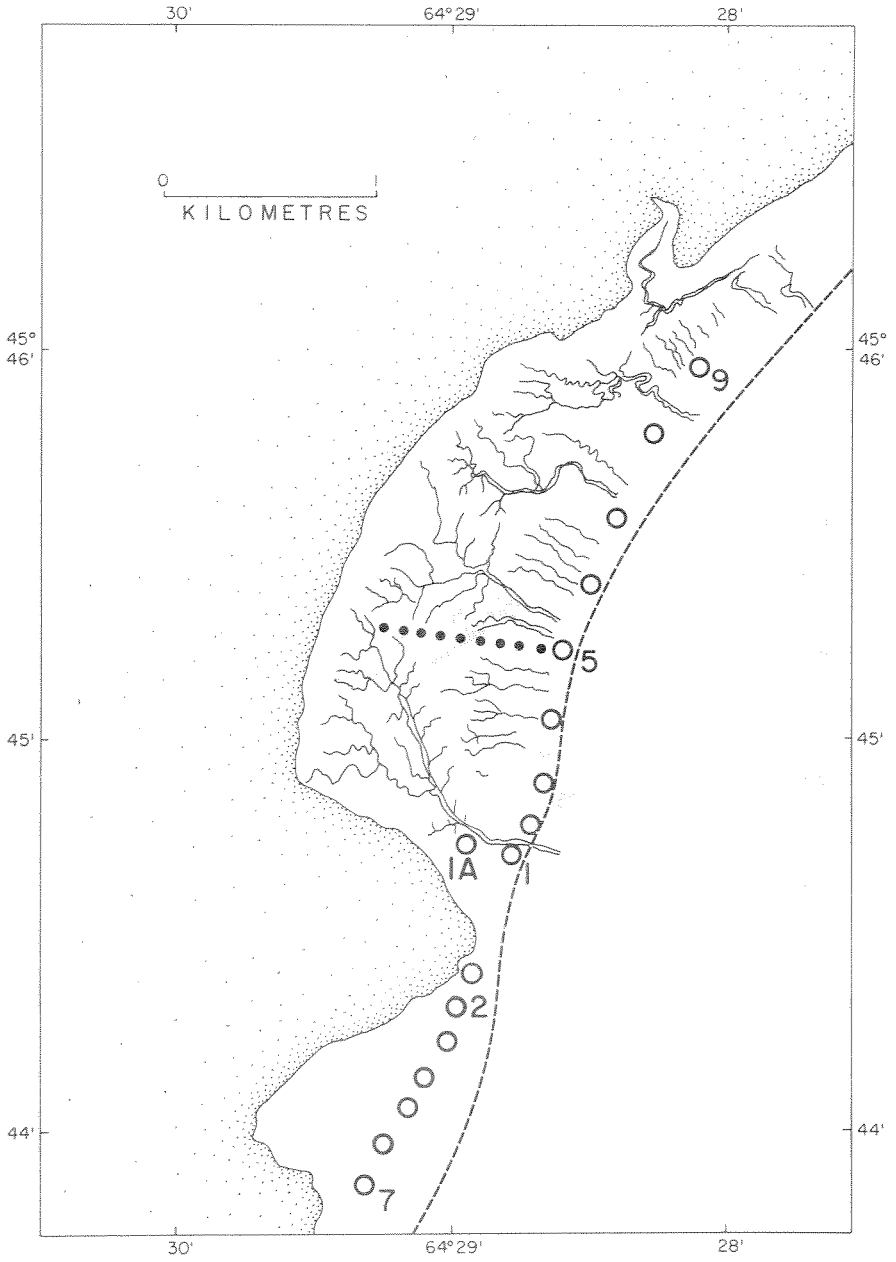


Fig. 5. Peck's Cove and Rockport Cove flats. Transect sampling stations are representeed by closed circles (●). The Peck's Cove sampling transect was established on a line running W-E. Boat samples are shown as open circles numbered from 1-9 (Peck's Cove, July 15), 1A (Peck's Cove, August 13) and 1-7 (Rockport Cove, August 13).

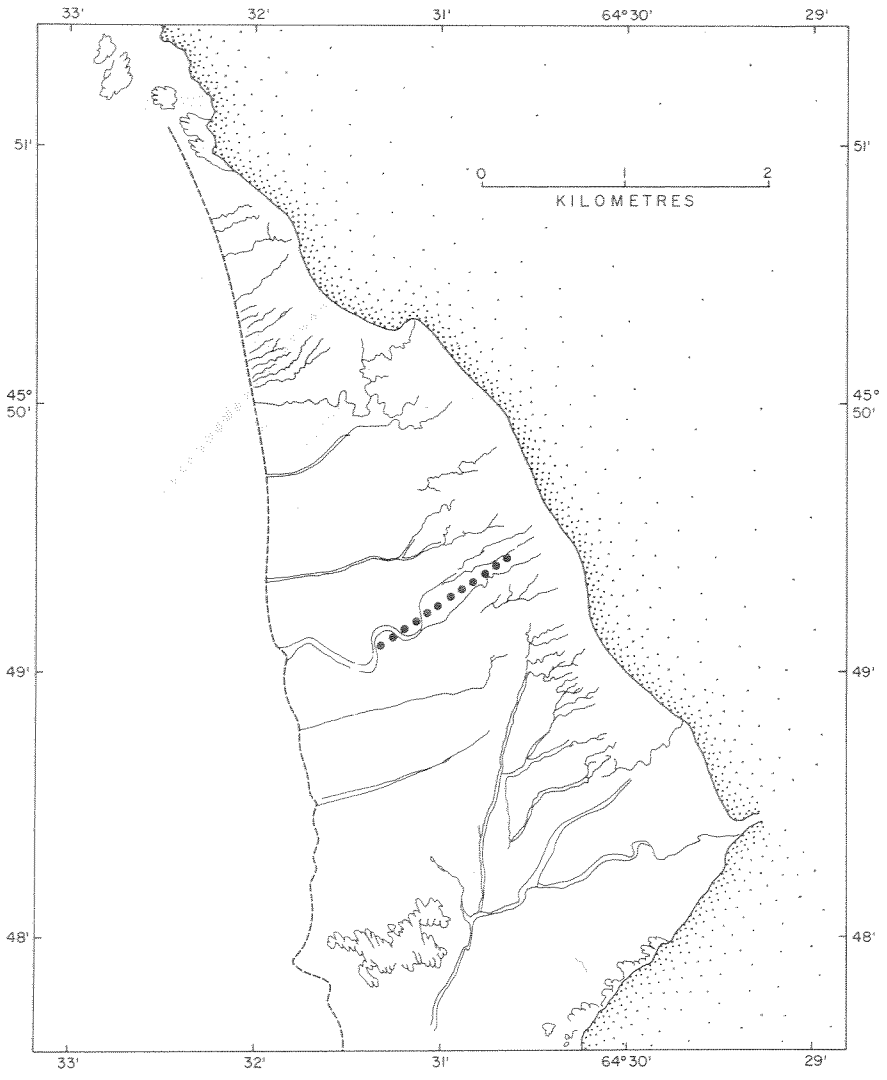


Fig. 6. The Grande Anse flat. Transect sampling stations are represented by closed circles (●). The transect was established on a line running NE-SW.

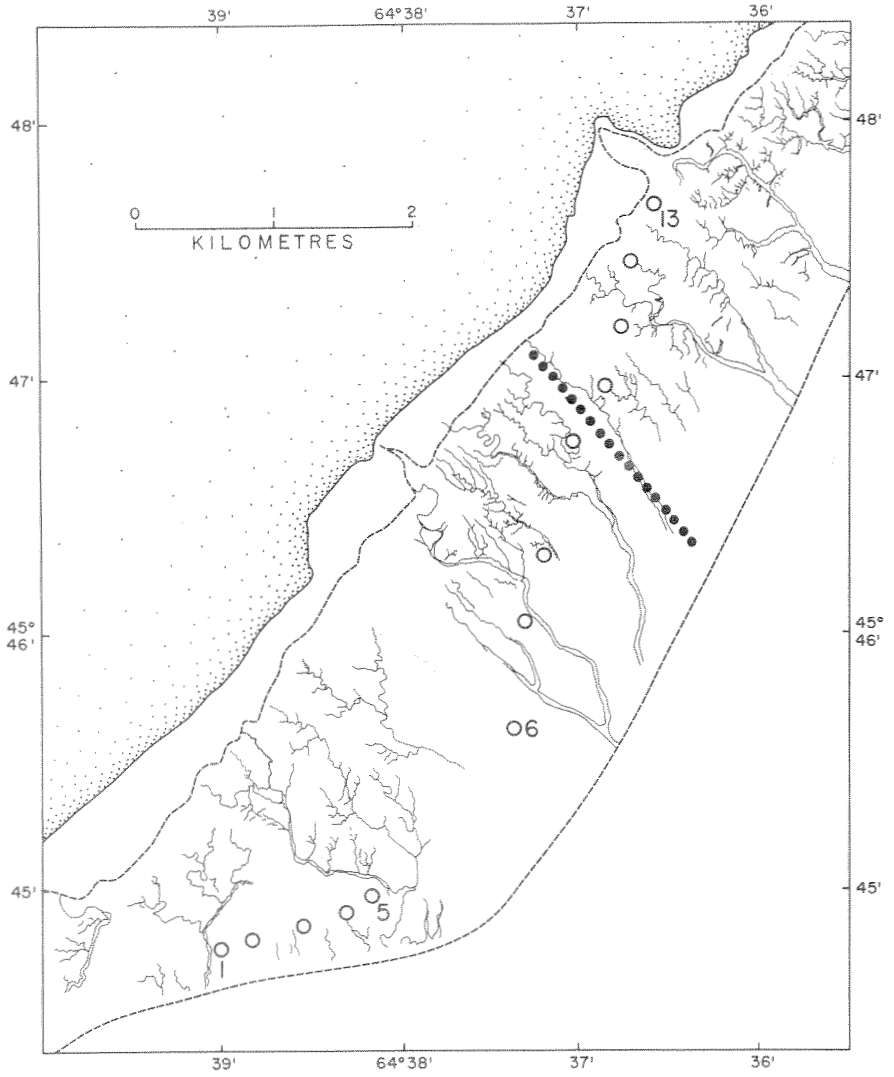


Fig. 7. Daniel's Flats. Transect sampling stations are represented by closed circles (●). The transect was established on a line running NW-SE. Boat samples are shown as open circles numbered 1-13 (collected on August 13).

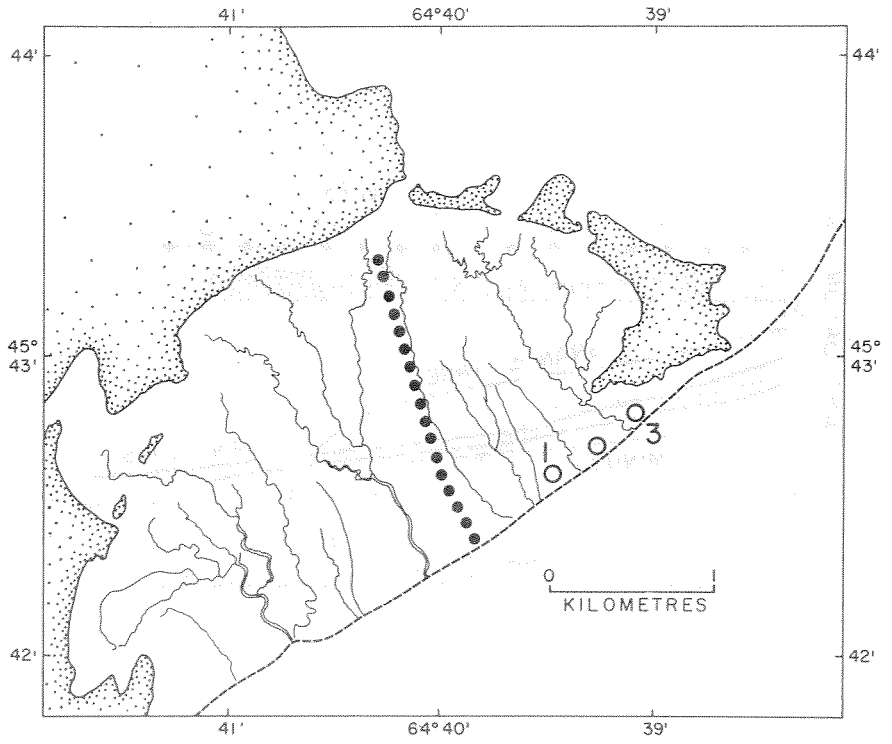
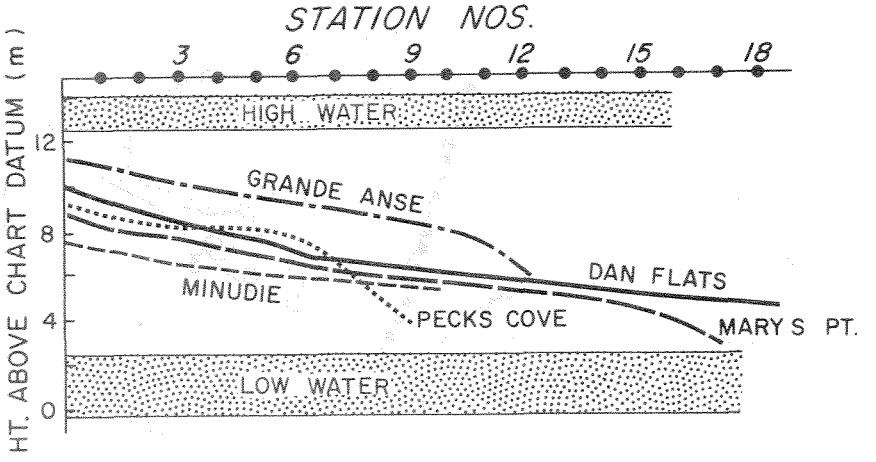


Fig. 8. Mary's Point (New Horton Flats). Transect sampling stations are represented by closed circles (●). Boat samples are the open circles numbered 1-3 (collected on August 13).



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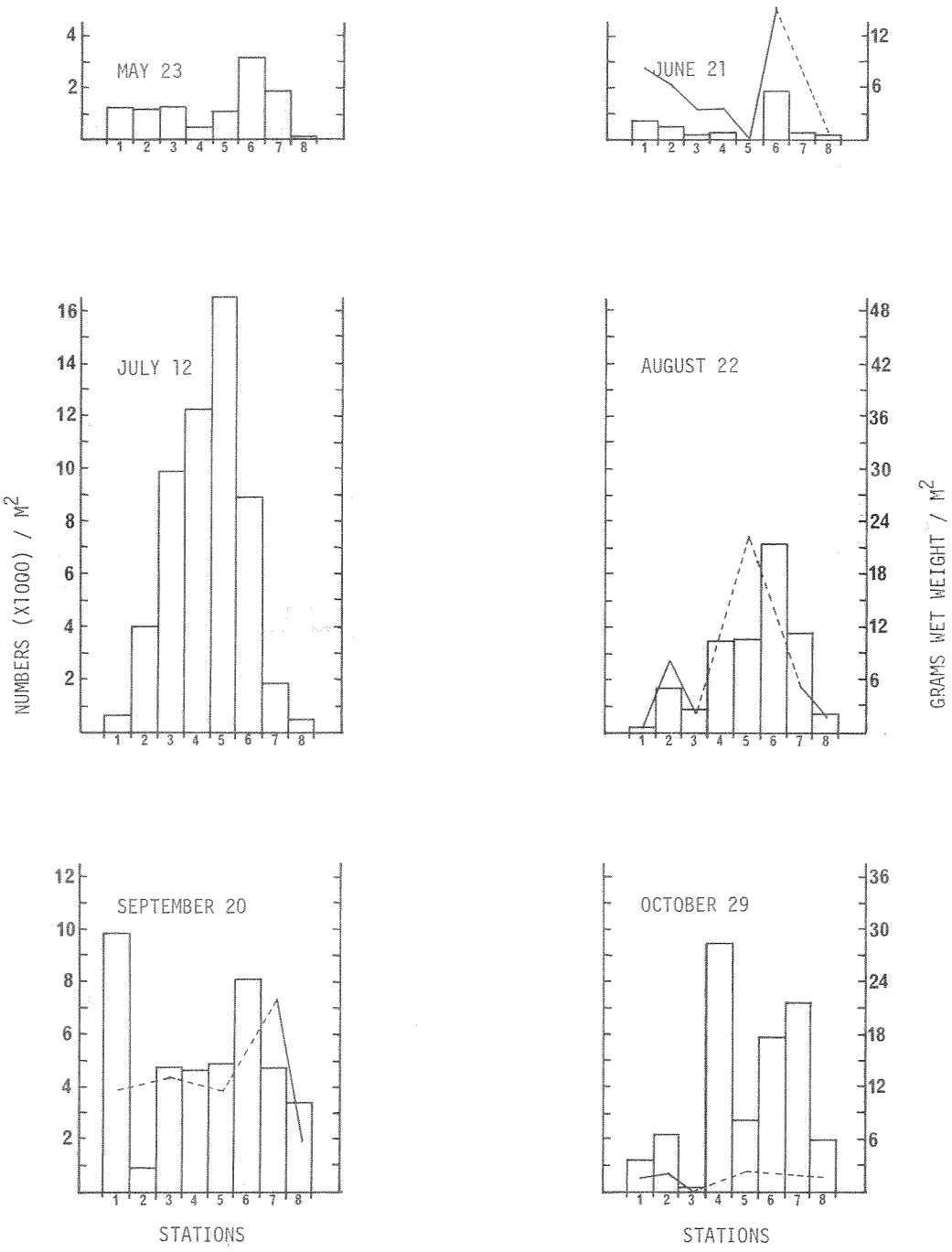

Fig. 10. Average density (histogram) and biomass (solid and dashed line) of Corophium volutator per station at Joggins, May-October, 1978.

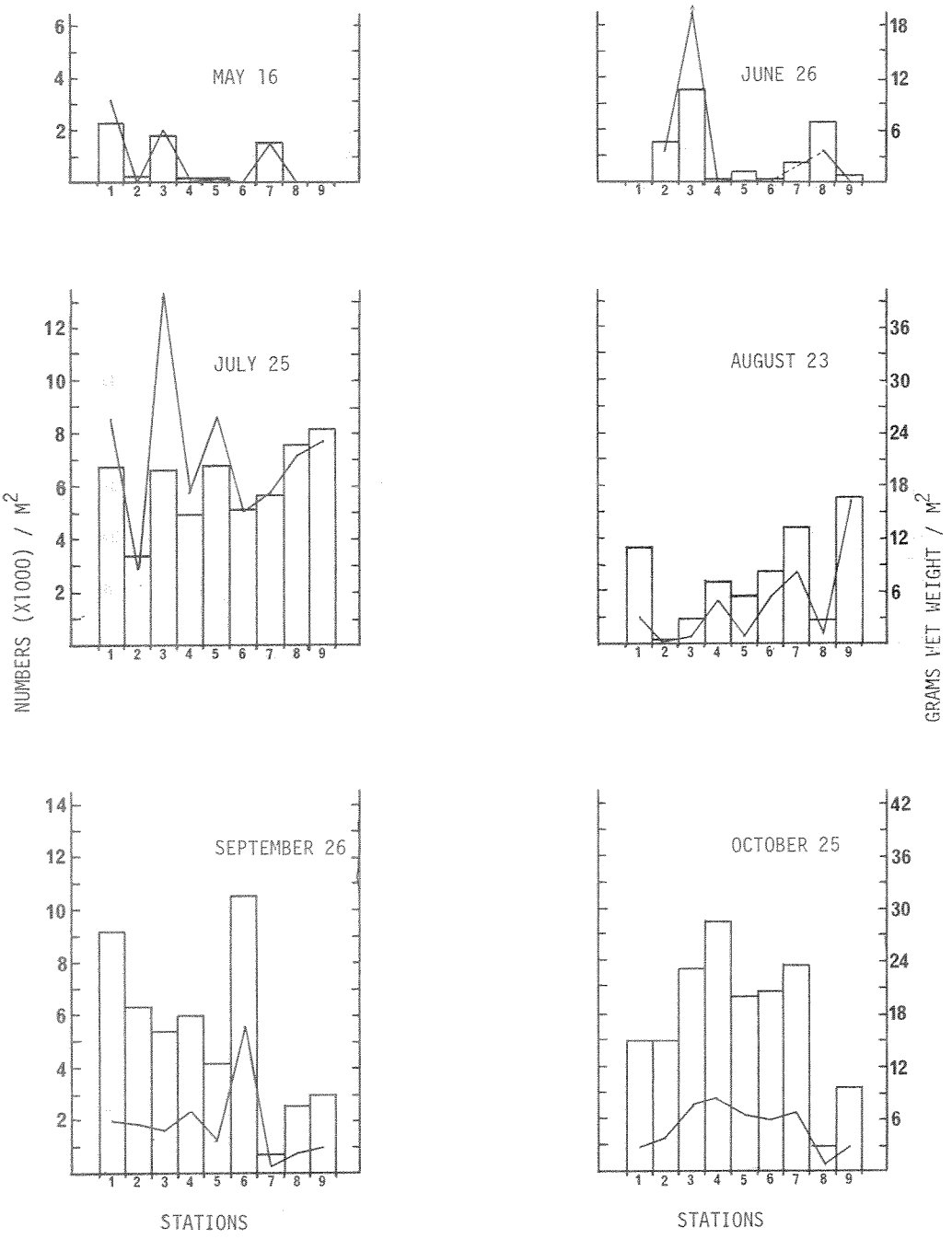

Fig. 11. Average density (histogram) and biomass (solid and dashed line) of Corophium volutator per station at Minudie, May-October, 1978.

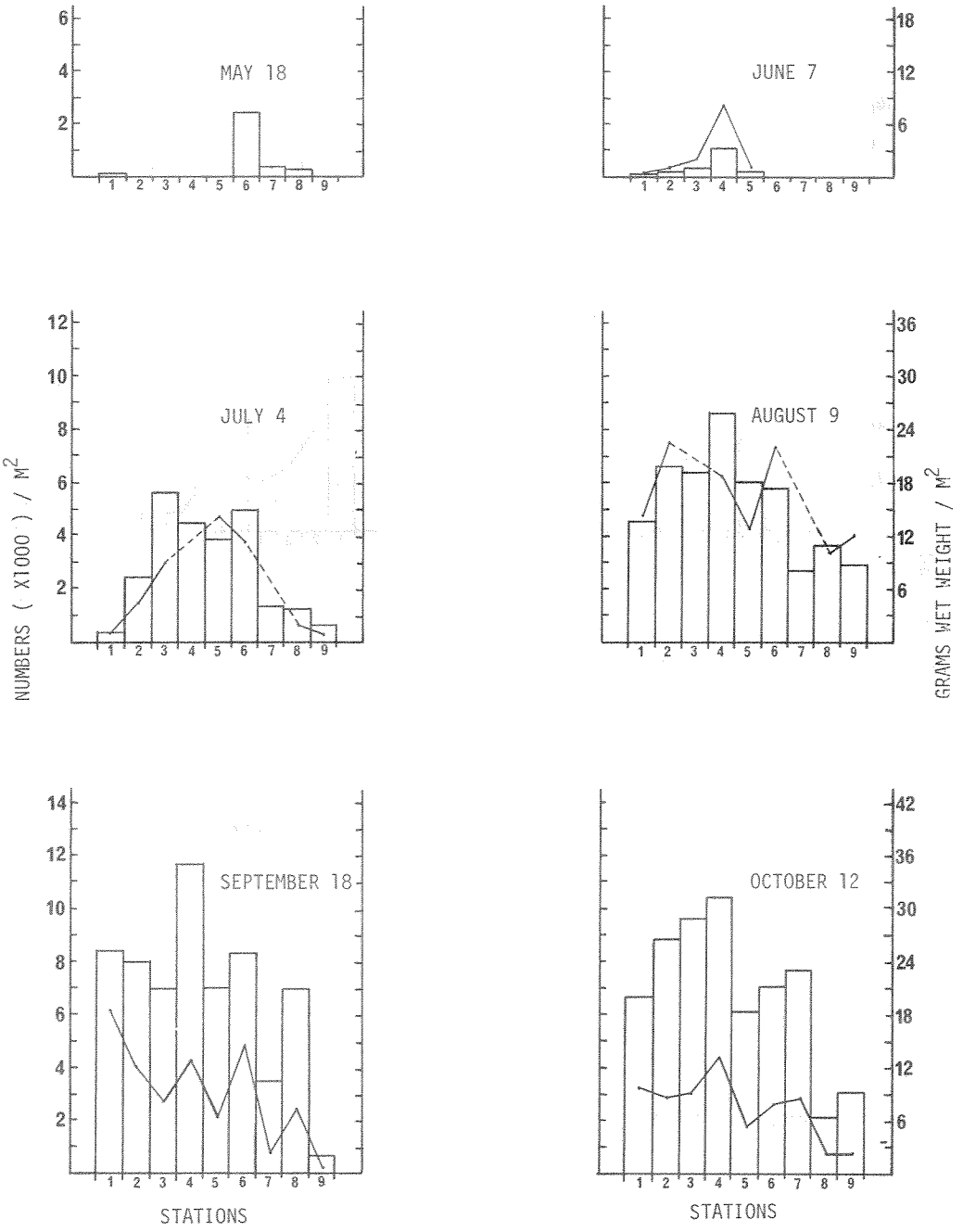

Fig. 12a. Average density (histogram) and biomass (solid and dashed line) of Corophium volutator per station at Peck's Cove, May-October, 1978.

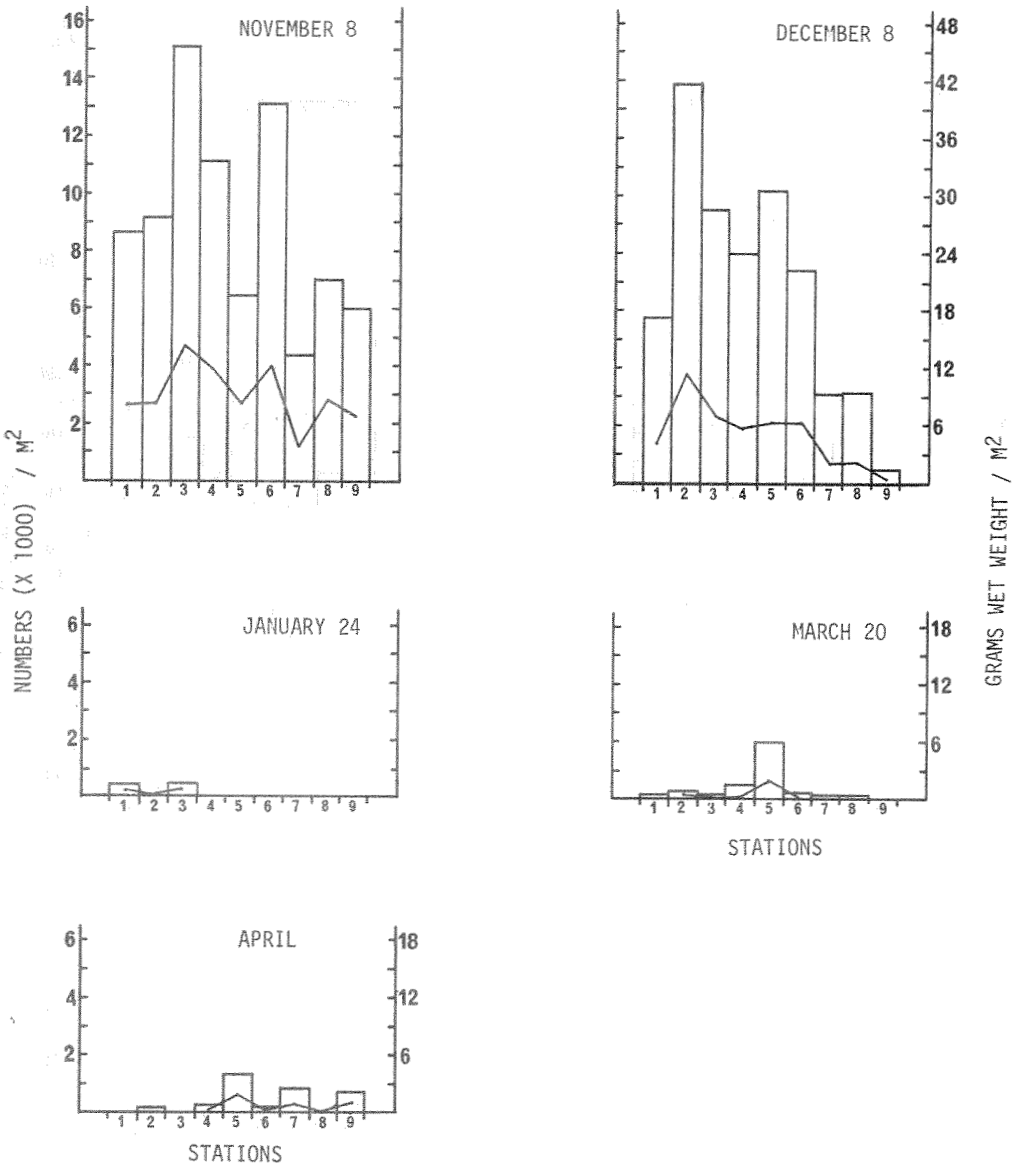

Fig. 12b. Average density (histogram) and biomass (solid line) of Corophium volutator per station at Peck's Cove, November-April, 1978-1979. Stations 4-9 in January and all stations in February were not sampled due to ice conditions.

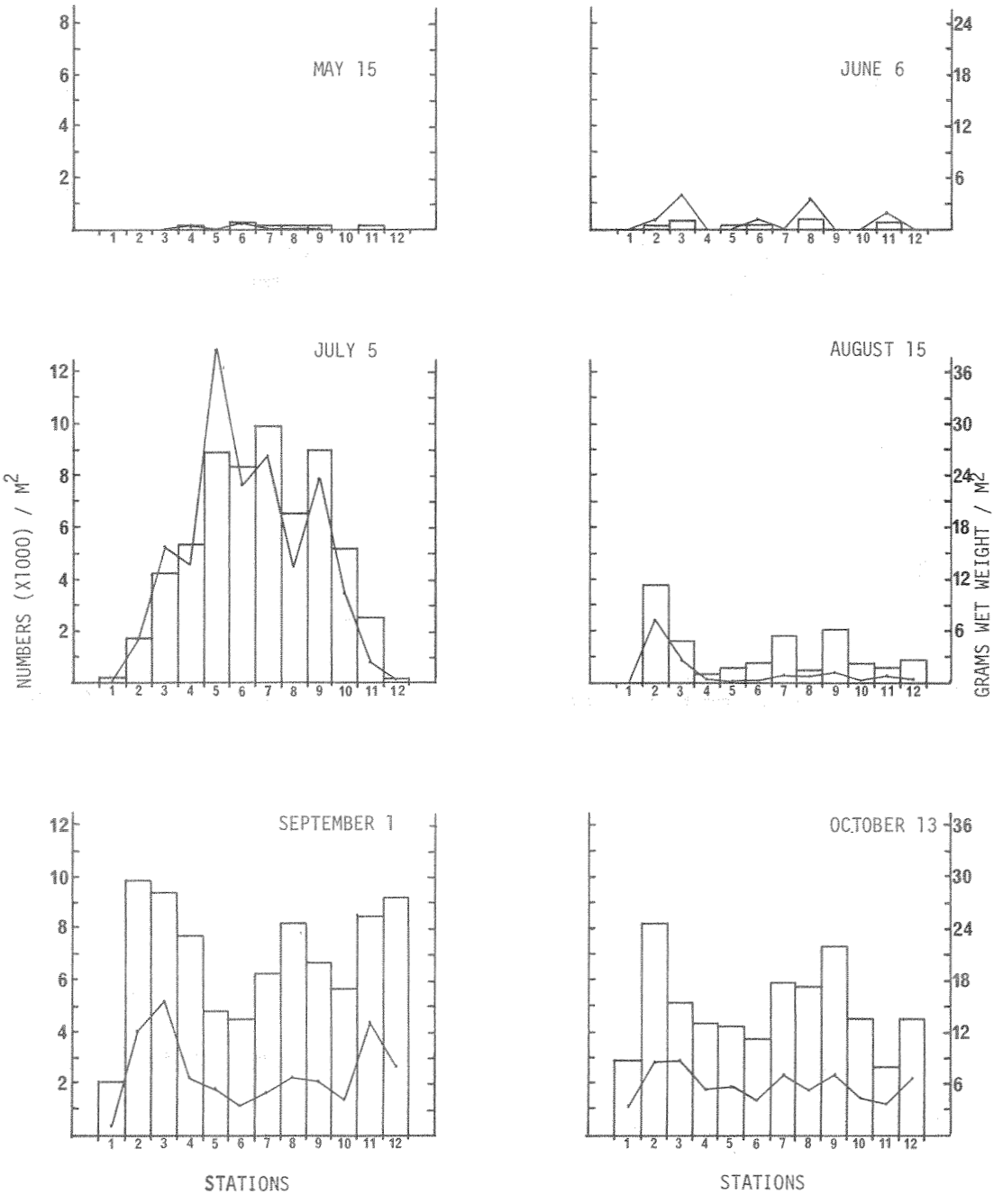

Fig. 13a. Average density (histogram) and biomass (solid line) of Corophium volutator per station at Grande Anse, May-October, 1978.

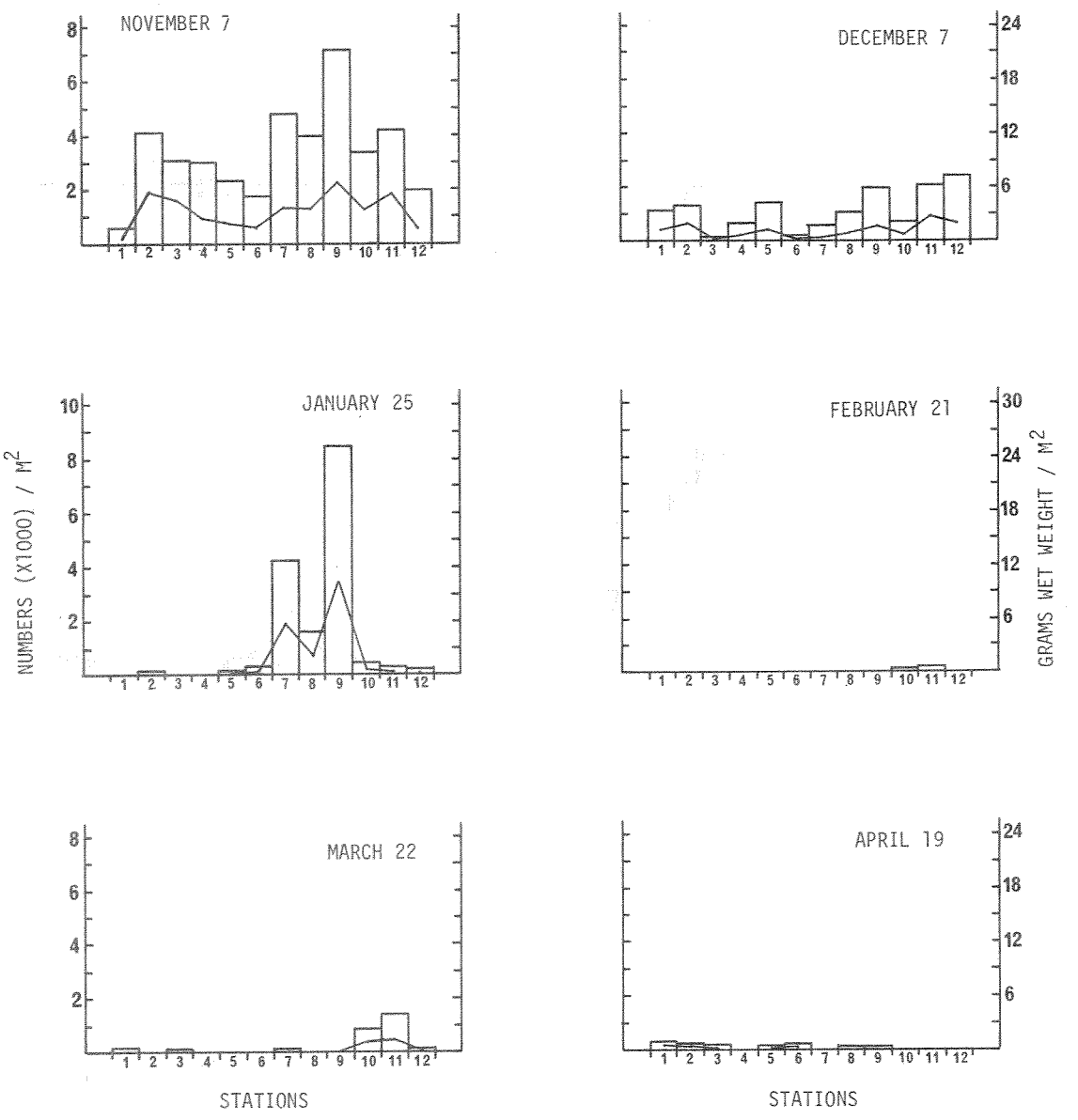

Fig. 13b. Average density (histogram) and biomass (solid line) of Corophium volutator per station at Grande Anse, November-April, 1978-1979. Stations 1-8 in February were not sampled due to ice conditions.

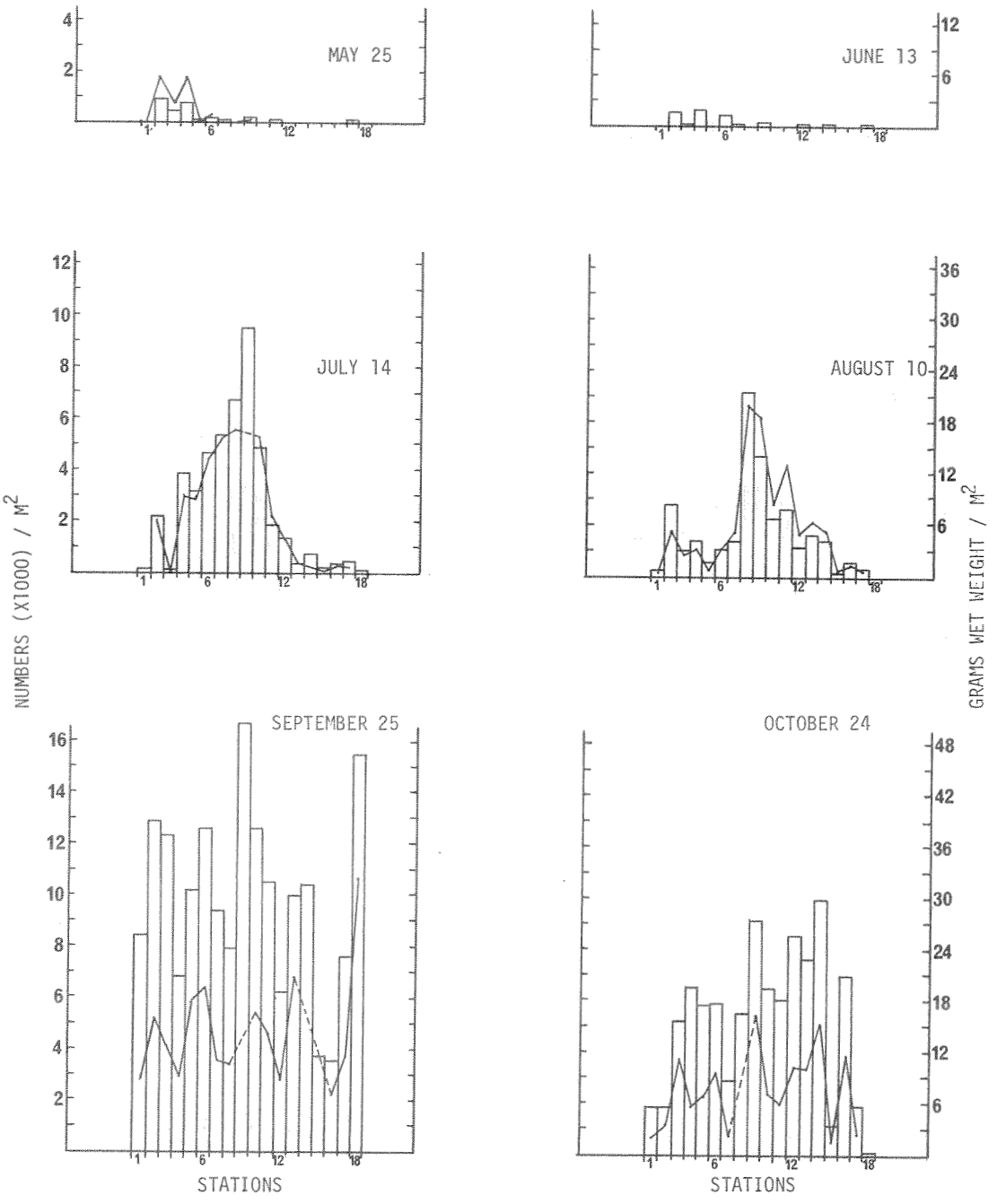

Fig. 14. Average density (histogram) and biomass (solid and dashed line) of Corophium volutator per station at Daniel's Flats, May-October, 1978.

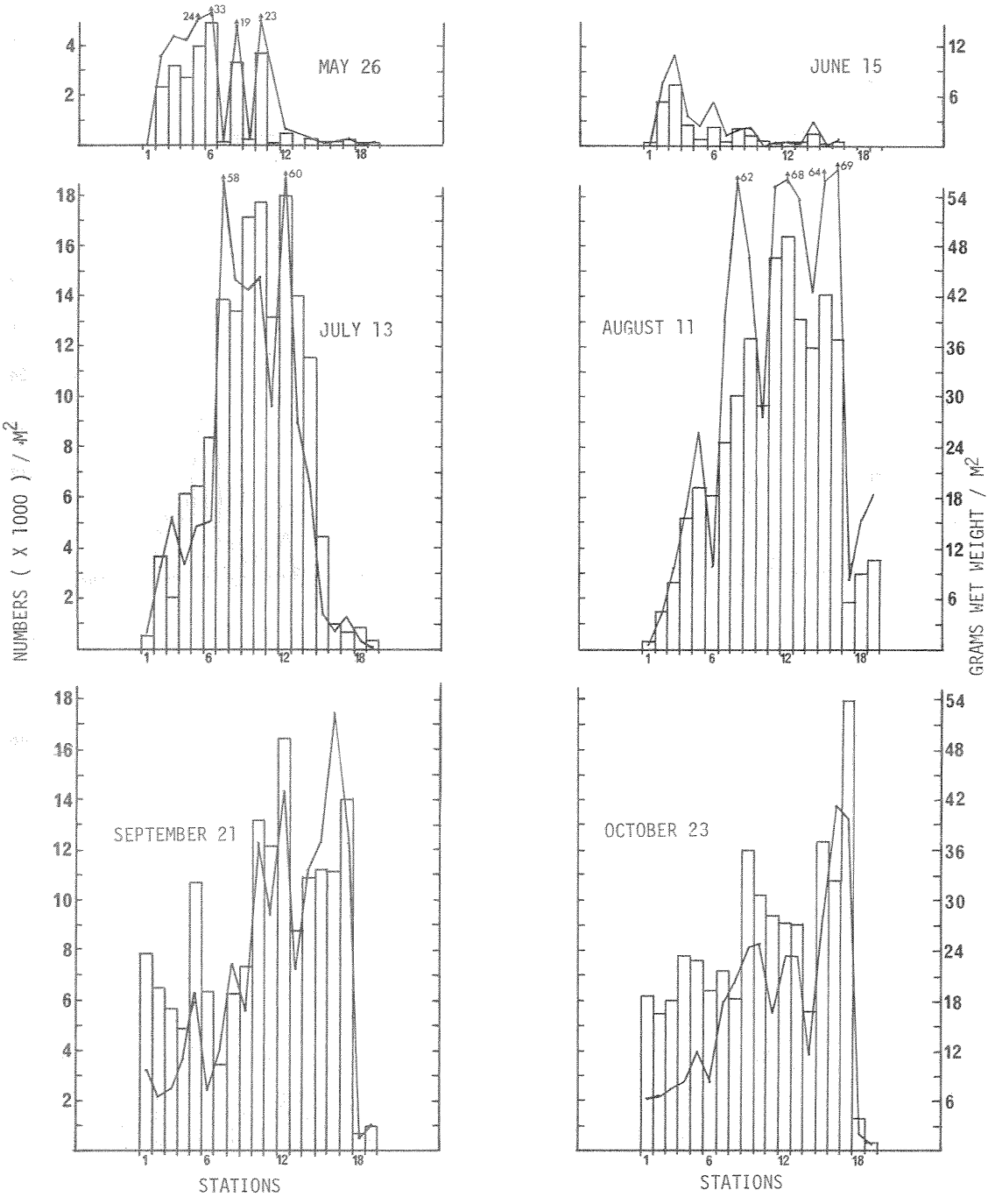

Fig. 15a. Average density (histogram) and biomass (solid line) of Corophium volutator per station at Mary's Point, May-October, 1978.

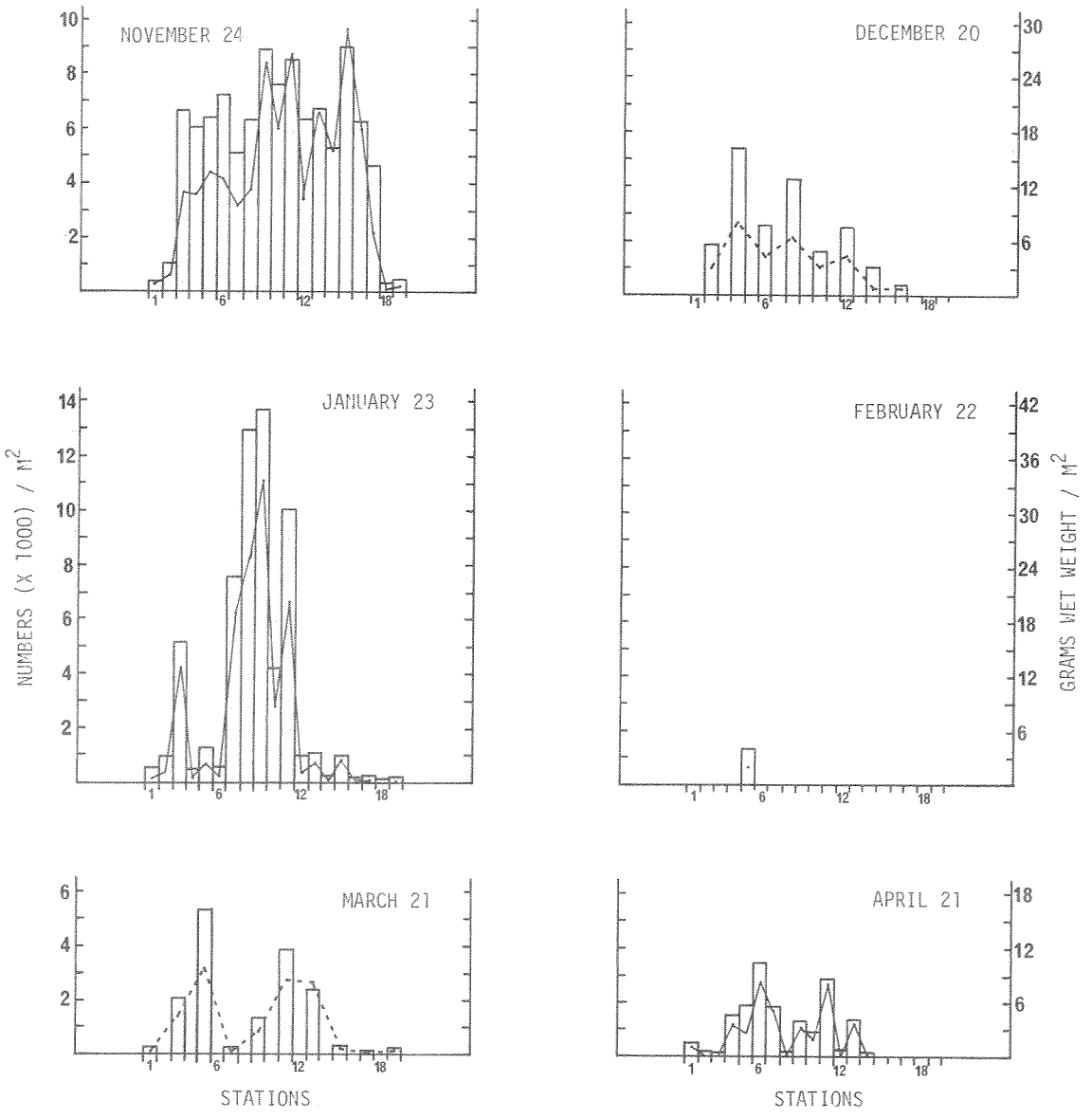

Fig. 15b. Average density (histogram) and biomass (solid and dashed line) of Corophium volutator at Mary's Point, November-April, 1978-1979. Only Station 5 sampled in February due to ice conditions.

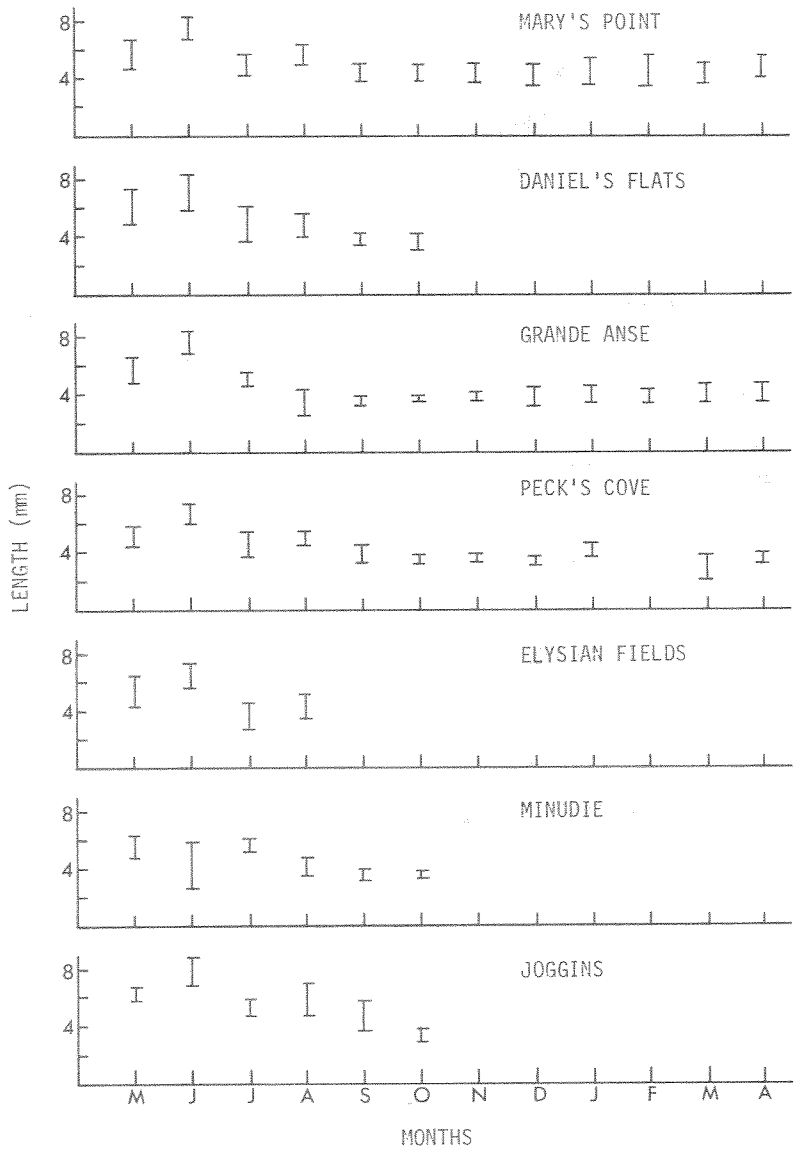

Fig. 16. Mean (±S.D.) monthly lengths (mm) of Corophium volutator.

Table 1. Height (in metres) above chart datum of boat samples.

Location and date	Sample	Ht. above chart datum
Mary's Point August 13	1	1.7
	2	1.8
	3	1.9
Daniel's Flats August 13	1	2.6
	2	3.0
	3	3.1
	4	3.7
	5	5.0
	6	5.4
	7	5.7
	8	6.3
	9	6.7
	10	7.2
	11	8.4
	12	8.7
	13	9.1
Rockport Cove August 13	1	4.4
	2	4.3
	3	4.1
	4	3.7
	5	3.1
	6	3.0
	7	2.9
Peck's Cove July 15	1	0.5
	2	1.6
	3	1.8
	4	2.0
	5	2.4
	6	2.8
Peck's Cove July 15 (cont'd.)	7	3.2
	8	3.6
	9	4.0
Peck's Cove August 13	1	4.8
Minudie July 15	1	8.9
	2	8.0
	3	7.9
	4	7.4
	5	4.3
	6	3.9
	7	3.1
	8	2.3
	9	1.8
	10	1.1
	11	0.6
Minudie Point August 14	1	2.3
	2	2.4
	3	2.6
	4	2.8
	5	3.3
	6	3.6
	7	3.8
	8	4.1
	9	5.2
	10	5.6
	11	6.0
	12	6.5
	13	7.5
	14	7.5

Table 2a. Density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator* at Elysian Fields, 1978.

STATION	MAY 29	JUNE 27	JULY 26	AUGUST 24
1	150 (0.55)	150 (0.30)	550 (0.95)	3450 (6.05)
2	150 (0.40)	550 (2.25)	800 (0.85)	350 (0.25)
3	0	50 (0.40)	300 (0.25)	50 (na)*
4	0	50 (0.15)	100 (0.10)	100 (0.05)
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	100 (0.05)
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	250 (0.20)	0
13	0	50 (0.25)	0	0
14	0	0	0	100 (0.05)
$\bar{X}$	21.4 (0.07)	60.7 (0.24)	142.9 (0.17)	296.4 (0.50)
S.D.	54.5 (0.17)	147.0 (0.59)	251.0 (0.32)	912.6 (1.67)

* weights not available

Table 2b. Density (/m^2) of *Heteromastus filiformis* at Elysian Fields, 1978.

STATION	MAY 29	JUNE 27	JULY 26	AUGUST 24
1	0	0	0	0
2	0	50	50	50
3	100	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
X	7.1	3.6	3.6	3.6
S.D.	26.7	13.4	13.4	13.4

Table 2c. Density (without brackets) and biomass (grams wet weight-with shell) per m^2 of *Macoma balthica* at Elysian Fields, 1978.

STATION	MAY 29	JUNE 27	JULY 26	AUGUST 24
1	800 (263.1)	650 (218.70)	1000 (304.40)	1350 (615.30)
2	150 (14.6)	150 (2.75)	0	150 (na)*
3	0	200 (94.90)	150 (3.55)	150 (na)
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	50 (0.95)	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
$\bar{X}$	67.9 (19.84)	71.4 (22.60)	85.7 (22.71)	117.9 (51.28)
S.D.	214.5 (70.12)	178.4 (61.83)	266.3 (81.12)	358.7 (177.62)

* weights not available

Table 3a. Density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator* at Joggins, 1978.

STATION	MAY 23	JUNE 21	JULY 12	AUGUST 22	SEPTEMBER 20	OCTOBER 29
1	1250 (6.05)	750 (8.20)	600 (na)*	200 (0.25)	9850 (11.45)	1150 (1.50)
2	1200 (na)	550 (6.15)	4050 (17.00)	1650 (7.75)	850 (na)	2100 (1.75)
3	1250 (na)	250 (3.45)	9900 (na)	850 (2.05)	4750 (12.85)	150 (na)
4	450 (na)	350 (3.50)	12250 (na)	3500 (na)	4600 (11.00)	9450 (na)
5	1100 (na)	0	16550 (41.30)	3550 (22.30)	4800 (11.50)	2700 (2.10)
6	3150 (16.10)	1900 (17.90)	8900 (na)	6700 (na)	8050 (25.50)	5900 (na)
7	1850 (na)	350 (na)	1850 (3.20)	3750 (23.20)	4700 (22.15)	7200 (na)
8	50 (na)	150 (1.00)	450 (na)	700 (4.95)	3400 (5.60)	1950 (1.55)
$\bar{X}$	1287.5 (11.08)	537.5 (5.74)	6818.8 (20.50)	2612.5 (10.08)	5125.0 (14.29)	3825.0 (1.73)
S.D.	930.7 (7.11)	596.9 (6.05)	5971.5 (19.29)	2177.1 (10.14)	2747.3 (6.97)	3289.7 (0.27)

* weights not available

Table 3b. Density (/m^2) of *Heteromastus filiformis* at Joggins, 1978.

STATION	MAY 23	JUNE 21	JULY 12	AUGUST 22	SEPTEMBER 20	OCTOBER 29
1	950	300	700	100	250	400
2	850	300	150	100	250	250
3	0	250	100	0	0	0
4	100	0	0	50	0	50
5	150	0	0	0	0	0
6	0	100	0	0	50	0
7	0	0	0	0	0	0
8	300	0	0	0	200	0
$\bar{X}$	293.8	118.8	118.8	31.3	93.8	87.5
S.D.	388.6	141.3	241.9	45.8	117.8	152.9

Table 3C Density (without brackets) and biomass (grams wet weight - with shell) per m^2 of *Macoma balthica* at Joggins, 1978.

STATION	MAY 23	JUNE 21	JULY 12	AUGUST 22	SEPTEMBER 20	OCTOBER 29
1	300 (2.45)	0	50 (na)*	0	0	0
2	100 (na)	100 (1.60)	50 (0.20)	0	0	0
3	50 (na)	0	0	0	0	0
4	0	0	100 (0.95)	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	50 (0.50)	50 (9.15)	0
8	0	0	0	0	0	0
$\bar{X}$	56.3 (0.40)	12.5 (0.20)	25.0 (0.16)	6.3 (0.06)	6.3 (1.14)	0.0
S.D.	105.0 (1.00)	35.4 (0.57)	37.8 (0.35)	17.7 (0.18)	17.7 (3.24)	

* weights not available

Table 4a. Density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator* at Minudie, 1978.

STATION	MAY 16	JUNE 26	JULY 25	AUGUST 23	SEPTEMBER 26	OCTOBER 25
1	2250 (9.50)	—*	6750 (25.50)	3600 (3.05)	9200 (6.00)	4950 (3.00)
2	150 (na)**	1500 (3.50)	3400 (8.65)	100 (0.20)	6300 (5.80)	4950 (4.10)
3	1750 (6.00)	3550 (29.25)	6600 (39.60)	950 (0.90)	5400 (4.95)	7750 (7.60)
4	100 na	50 (na)	4950 (17.10)	2350 (5.00)	6000 (7.15)	9500 (8.50)
5	100 (0.50)	400 (na)	6750 (25.70)	1800 (1.00)	4150 (3.45)	6600 (6.30)
6	0	50 (na)	5100 (15.20)	2570 (5.40)	10550 (16.55)	6850 (6.00)
7	1500 (4.50)	650 (na)	5650 (17.10)	4400 (8.15)	700 (0.55)	7800 (6.80)
8	0	2250 (3.50)	7550 (21.35)	900 (1.35)	2550 (2.45)	950 (0.70)
9	0	200 (na)	8150 (23.35)	5550 (16.30)	2950 (3.00)	3200 (3.00)
$\bar{X}$	650.0 (2.93)	1081.3 (12.08)	6100.0 (21.51)	2488.9 (4.59)	5311.1 (5.54)	5838.9 (5.11)
S.D.	909.3 (3.80)	1264.3 (3.48)	1466.9 (8.72)	1782.5 (5.11)	3159.1 (4.61)	2620.8 (2.55)

*not sampled

**weights not available

Table 15. Density ($/m^2$) of *Heteromastus filiformis* at Minudie, 1978.

STATION	MAY 16	JUNE 26	JULY 25	AUGUST 23	SEPTEMBER 26	OCTOBER 25
1	0	—*	200	50	0	100
2	200	750	250	300	200	50
3	500	400	400	500	550	800
4	750	1550	300	450	350	600
5	600	900	950	1700	1000	950
6	1550	200	350	300	100	200
7	450	600	850	600	650	350
8	1100	1000	800	400	550	1700
9	400	1150	1350	900	700	550
$\bar{X}$	616.7	818.8	605.6	577.8	455.6	588.9
S.D.	469.7	430.6	397.2	481.0	320.6	518.3

*not sampled

Table 4c. Density (without brackets) and biomass (grams wet weight - with shell) per m^2 of *Macoma balthica* at Minudie, 1978.

STATION	MAY 16	JUNE 26	JULY 25	AUGUST 23	SEPTEMBER 26	OCTOBER 25
1	100 (2.00)	—*	0	0	0	0
2	100 (1.00)	0	100 (na)**	50 (na)	0	0
3	350 (13.50)	250 (27.35)	0	0	50 (na)	0
4	50 (4.00)	50 (na)	0	100 (5.95)	100 (na)	0
5	200 (3.50)	100 (5.45)	0	0	0	0
6	200 (na)	150 (13.65)	50 (na)	50 (na)	100 (na)	0
7	0	0	0	0	0	0
8	50 (na)	50 (na)	0	50 (4.15)	0	0
9	0	0	0	0	0	0
$\bar{X}$	116.67 (3.43)	75.00 (7.74)	16.67	27.78 (1.44)	27.78	0.0
S.D.	114.56 (4.71)	88.64 (10.99)	35.36	36.32 (2.52)	44.10	0.0

* not sampled

** weights not available

Table 5a. Density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator* at Peck's Cove, 1978-1979.

STATION	MAY 18	JUNE 7	JULY 4	AUGUST 9	SEPTEMBER 18	OCTOBER 12	NOVEMBER 8	DECEMBER 8	JANUARY 24	FEBRUARY**	MARCH 20	APRIL 20
1	50 (0.05)	100 (0.50)	400 (1.15)	4550 (14.10)	8400 (18.4)	6700 (9.75)	8700 (7.75)	5750 (3.90)	450 (0.70)	-	50 (na)***	0
2	0	200 (1.05)	2450 (4.45)	6600 (na)	7950 (12.15)	8850 (8.45)	9200 (7.95)	13850 (11.00)	0	-	250 (0.15)	100 (na)
3	0	350 (1.90)	5600 (9.00)	6400 (na)	6950 (8.00)	9700 (9.15)	15150 (13.90)	9500 (6.90)	450 (0.60)	-	50 (na)	0
4	0	1100 (8.10)	4450 (na)	8600 (18.50)	11600 (na)	10400 (13.00)	11150 (11.65)	7950 (5.85)	-	-	450 (0.25)	250 (0.40)
5	0	200 (0.85)	3850 (14.20)	6050 (12.90)	7000 (6.30)	6100 (5.60)	6450 (7.85)	10200 (6.15)	-	-	1950 (1.80)	1300 (1.70)
6	2400 (4.55)	0	4950 (11.60)	5800 (22.05)	8350 (14.75)	7100 (7.85)	13150 (11.80)	7400 (6.10)	-	-	150 (na)	200 (0.15)
7	300 (1.15)	0	1350 (1.50)	2750 (na)	3500 (2.40)	7650 (8.75)	4350 (3.20)	3100 (1.80)	-	-	50 (na)	800 (0.80)
8	250 (0.90)	0	1300 (1.85)	3650 (10.50)	6950 (7.40)	2200 (2.60)	7000 (8.20)	3150 (1.95)	-	-	50 (na)	0
9	—*	0	650 (0.95)	2950 (12.10)	650 (0.30)	3100 (2.55)	5950 (6.50)	450 (0.25)	-	-	-	750 (0.90)
$\bar{X}$	375.0 (0.83)	216.6 (1.38)	2777.8 (5.59)	5261.1 (15.03)	6816.6 (8.71)	6866.6 (7.52)	9011.1 (8.76)	6816.6 (4.88)	300.0 (0.43)		375.0 (0.56)	377.7 (0.49)
S.D.	827.2 (1.57)	353.6 (2.60)	1973.0 (5.28)	1933.2 (4.38)	3124.9 (6.10)	2777.0 (3.40)	3557.1 (3.22)	4163.3 (3.28)	259.8 (0.38)		651.9 (0.66)	463.7 (0.61)

* not sampled ** not sampled due to ice conditions *** weights not available

Table 5b. Density of ($/m^2$) of *Heteromastus filiformis* at Peck's Cove, 1978-1979

STATION	MAY 13	JUNE 7	JULY 4	AUGUST 9	SEPTEMBER 18	OCTOBER 12	NOVEMBER 8	DECEMBER 8	JANUARY 24	FEBRUARY**	MARCH 20	APRIL 20
1	350	50	0	250	150	200	250	100	200	-	250	200
2	200	550	200	100	50	200	250	200	100	-	250	550
3	1000	900	0	400	250	700	850	400	250	-	350	700
4	1600	400	150	500	500	400	150	200	-	-	350	1450
5	1100	850	200	500	250	50	300	250	-	-	250	600
6	800	1350	0	900	150	200	1000	600	-	-	50	450
7	550	150	500	200	0	300	550	500	-	-	350	1000
8	300	200	50	200	400	350	250	50	-	-	400	600
9	—*	150	0	50	0	0	100	100	-	-	100	50
$\bar{X}$	737.50	511.11	122.22	344.44	194.44	266.67	411.11	266.67	183.33	-	261.11	622.22
S.D.	480.14	440.72	166.04	263.92	174.01	207.67	318.96	192.03	76.38	-	119.32	414.66

* not sampled **not sampled due to ice conditions

Table 5c. Density (without brackets) and biomass (grams wet weight - with shell) per m^2 of *Macoma balthica* at Peck's Cove, 1978-79.

STATION	MAY 18	JUNE 7	JULY 4	AUGUST 9	SEPTEMBER 13	OCTOBER 12	NOVEMBER 8	DECEMBER 8	JANUARY 24	FEBRUARY**	MARCH 20	APRIL 20
1	350 (36.35)	500 (38.60)	0	150 (7.85)	50 (18.50)	100 (5.05)	50 (na)	0	0	-	50 (na)	100 (na)
2	50 (na)*	250 (6.20)	100 (6.30)	150 (7.45)	100 (12.85)	150 (na)	50 (na)	0	50 (na)	-	50	100
3	0	50 (0.40)	50 (23.60)	250 (89.90)	0	0	100 (na)	100 (na)	0	-	50 (na)	0
4	50 (3.90)	50 (0.55)	0	50 (2.40)	100 (7.50)	0	0	50 (na)	-	-	0	0
5	100 (na)	100 (2.55)	0	0	0	50 (na)	50 (na)	0	-	-	0	0
6	0	0	50 (1.70)	50 (8.30)	50 (6.95)	0	0	0	-	-	0	50 (na)
7	450 (3.90)	0	0	100 (6.70)	0	50 (na)	50 (na)	0	-	-	0	50 (na)
8	50 (0.25)	0	0	100 (0.25)	0	0	0	0	-	-	0	50 (na)
9	—***	0	0	0	0	0	0	0	-	-	0	0
$\bar{X}$	131.3 (7.40)	105.6 (5.37)	16.7 (3.51)	83.3 (13.65)	33.3 (5.09)	38.9 (0.84)	33.3	16.7	16.7	-	11.1	27.8
S.D.	171.00 (14.31)	168.53 (12.63)	35.36 (7.81)	86.60 (28.81)	43.30 (6.88)	54.65 (2.06)	35.36	35.36	28.87	-	22.05	36.32

* weights not available **not sampled due to ice conditions ***not sampled

Table 6a. Density (without brackets) and biomass (gram wet weight) per m^2 of *Corophium volutator* at Grande Anse, 1978-1979.

STATION	MAY 15	JUNE 6	JULY 5	AUGUST 15	SEPTEMBER 19	OCTOBER 13	NOVEMBER 7	DECEMBER 7	JANUARY 25	FEBRUARY 21***	MARCH 22	APRIL 19
1	0	0	150 (na)	0	2050 (1.45)	2900 (3.35)	550 (0.55)	1150 (1.05)	-	-	100 (na)	250 (0.50)
2	0	100 (1.20)	1700 (5.05)	3750 (7.40)	9900 (12.20)	8100 (8.55)	4100 (5.75)	1300 (1.75)	50 (na)	-	0	200 (0.30)
3	0	350 (4.20)	4200 (15.90)	1600 (2.65)	9400 (15.70)	5100 (8.90)	3100 (4.65)	100 (0.20)	-	-	50 (na)	150 (0.15)
4	50 (na)*	0	5350 (13.70)	350 (0.55)	7700 (6.75)	4350 (5.35)	3000 (2.70)	650 (0.55)	-	-	0	0
5	0	100 (na)	8900 (38.75)	550 (0.20)	4850 (5.60)	4200 (5.80)	2300 (2.15)	1450 (1.20)	50 (na)	-	0	100 (0.15)
6	200 (0.75)	100 (1.35)	8300 (19.85)	750 (0.25)	4500 (3.35)	3700 (4.15)	1750 (1.80)	200 (0.10)	300 (0.30)	-	0	200 (0.20)
7	50 (0.10)	0	9900 (21.80)	1400 (1.05)	6250 (4.95)	5900 (6.90)	4750 (3.85)	550 (0.30)	4250 (5.70)	-	50 (na)	0
8	50 (0.05)	400 (3.55)	6550 (13.50)	450 (1.05)	8200 (6.80)	5750 (5.15)	3950 (3.60)	1050 (0.70)	1600 (2.05)	-	0	50 (na)
9	50 (0.10)	0	9000 (23.90)	2050 (na)	6700 (6.30)	7300 (7.05)	7150 (8.05)	1950 (1.55)	8450 (10.35)	0	0	50 (na)
10	0	0	5200 (10.50)	700 (0.25)	5700 (4.45)	4500 (4.35)	3350 (3.60)	700 (0.60)	450 (0.50)	0	800 (1.15)	0
11	50 (na)	250 (1.90)	2550 (2.05)	550 (1.00)	8500 (13.30)	2650 (3.30)	4200 (7.00)	2050 (2.70)	250 (0.25)	50 (na)	1400 (1.35)	0
12	0	-**	150 (0.30)	850 (0.30)	9150 (8.25)	4500 (6.55)	1950 (1.55)	2400 (1.80)	200 (0.20)	100 (na)	50 (na)	0
$\bar{X}$	37.5 (0.10)	118.2 (1.22)	5162.5 (15.03)	1083.3 (1.34)	6908.3 (7.43)	4912.5 (5.78)	3345.8 (3.77)	1129.2 (1.04)	1733.3 (2.76)	37.5	204.2 (0.31)	83.3 (0.13)
S.D.	56.9 (0.23)	148.8 (1.57)	3476.4 (11.05)	1018.3 (2.14)	2346.9 (4.26)	1634.2 (1.86)	1697.4 (2.27)	735.3 (0.79)	2858.9 (3.89)	47.9	438.7 (0.58)	93.7 (0.17)

*weights not available **not sampled ***stations 1-8 not sampled due to ice conditions

Table 6b. Density (/m^2) of *Heteromastus filiformis* at Grand Anse, 1978-1979.

STATION	MAY 15	JUNE 6	JULY [illegible]	AUGUST 15	SEPTEMBER 19	OCTOBER 13	NOVEMBER 7	DECEMBER 7	JANUARY 25	FEBRUARY 21***	MARCH 22	APRIL 19
1	0	0	0	0	0	0	0	0	-	-	0	0
2	0	0	0	0	0	0	0	0	0	-	0	0
3	0	0	50	0	100	0	0	0	-	-	0	50
4	100	50	100	0	0	0	0	0	-	-	0	50
5	0	100	50	50	0	50	0	0	0	-	50	50
6	50	50	50	50	50	0	0	100	50	-	150	0
7	50	0	200	150	100	50	150	100	0	-	100	0
8	0	100	250	100	0	50	0	0	0	-	50	0
9	200	100	0	0	50	100	150	100	0	50	50	250
10	50	100	150	0	50	100	50	50	0	0	0	50
11	50	0	0	50	0	0	100	50	50	0	0	100
12	0	-*	50	100	0	0	0	0	50	50	100	100
$\bar{X}$	41.66	45.45	75.00	41.67	29.17	29.17	37.5	33.33	16.67	25.00	41.67	54.17
S.D.	59.67	47.19	83.94	51.49	39.65	39.65	60.77	44.38	25.00	28.87	51.49	72.17

*not sampled **stations 1-8 not sampled due ice conditions

Table 6c. Density (without brackets) and biomass (grams wet weight - with shell) per m^2 of *Macoma balthica* at Grande Anse, 1978-1979.

STATION	MAY 15	JUNE 6	JULY 5	AUGUST 15	SEPTEMBER 19	OCTOBER 15	NOVEMBER 7	DECEMBER 7	JANUARY 25	FEBRUARY 21***	MARCH 22	APRIL 19
1	2400 (515.0)	2250 (485.8)	1150 (136.6)	7250 (na)	7200 (867.8)	400 (27.75)	8100 (na)	250 (na)	-	-	4300 (na)	1000 (na)
2	450 (13.00)	650 (67.05)	800 (128.3)	800 (179.6)	1150 (26.95)	900 (7.80)	600 (na)	1400 (na)	2850 (na)	-	900 (na)	1950 (na)
3	450 (51.00)	550 (na)*	0	900 (na)	2000 (19.30)	850 (11.20)	1800 (na)	950 (na)	-	-	2450 (na)	1250 (na)
4	200 (12.50)	200 (13.65)	0	1750 (1.45)	2750 (12.75)	1450 (8.80)	1850 (na)	1000 (na)	-	-	2250 (na)	750 (na)
5	500 (18.50)	400 (na)	0	250 (na)	1400 (5.75)	700 (3.85)	1350 (na)	200 (na)	650 (na)	-	2450 (na)	200 (na)
6	50 (0.50)	150 (13.70)	0	600 (0.40)	3150 (3.60)	1850 (6.75)	2150 (na)	1600 (na)	300 (na)	-	1000 (na)	100 (na)
7	50 (5.00)	50 (na)	50 (0.45)	50 (na)	1950 (2.70)	1050 (3.45)	1100 (na)	550 (na)	450 (na)	-	550 (na)	400 (na)
8	50 (1.00)	0	50 (11.65)	750 (0.50)	700 (2.75)	500 (1.55)	200 (na)	150 (na)	250 (na)	-	200 (na)	200 (na)
9	50 (0.20)	0	0	650 (1.80)	400 (0.50)	550 (0.80)	200 (na)	200 (na)	100 (na)	200 (na)	500 (na)	350 (na)
10	50 (0.50)	0	0	800 (0.35)	200 (1.05)	200 (0.45)	0	0	50 (na)	150 (na)	0	100 (na)
11	50 (4.50)	0	0	400 (na)	550 (2.50)	100 (0.45)	500 (na)	200 (na)	0	100 (na)	150 (na)	150 (na)
12	0	-**	0	1450 (0.85)	0	50 (na)	100 (na)	50 (na)	50 (na)	150 (na)	50 (na)	0
$\bar{X}$	358.33 (51.81)	386.36 (72.53)	170.83 (23.08)	1304.17 (26.42)	1787.5 (78.80)	716.67 (6.62)	1495.83	545.83	522.22	150.00	1233.33	537.50
S.D.	669.41 (146.58)	661.09 (168.52)	383.44 (51.22)	1930.08 (67.55)	1978.54 (248.61)	543.70 (7.92)	2211.07	552.46	898.65	40.22	1339.32	592.81

*not available ** not sampled *** stations 1-8 not sampled due ice conditions

Table 7a. Density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator* at Daniel's Flats, 1978.

STATION	MAY 25	JUNE 13	JULY 14	AUGUST 10	SEPTEMBER 25	OCTOBER 24
1	0	0	150 (na)	250 (0.25)	8450 (8.15)	1850 (1.65)
2	900 (5.05)	600 (na)	2250 (6.15)	2750 (4.80)	12800 (15.35)	1850 (3.20)
3	450 (2.15)	100 (na)	100 (na)	1000 (2.45)	12300 (12.5)	5200 (11.00)
4	750 (5.05)	700 (na)	3800 (9.00)	1400 (3.05)	6800 (8.85)	6500 (5.50)
5	50 (na)*	0	3200 (8.55)	550 (0.65)	10150 (17.55)	5850 (6.75)
6	150 (1.10)	450 (na)	4700 (13.15)	1050 (3.05)	12550 (19.15)	5900 (9.30)
7	50 (na)	100 (0.70)	5350 (15.55)	1400 (4.85)	9400 (10.60)	2900 (2.00)
8	0	0	6700 (16.40)	7150 (19.80)	7900 (8.95)	5500 (na)
9	150 (0.15)	150 (0.60)	9500 (29.35)	4700 (18.30)	16650 (24.95)	9150 (16.05)
10	0	0	4900 (15.60)	2250 (8.20)	12550 (16.15)	6450 (6.95)
11	50 (na)	0	1850 (6.50)	2600 (12.90)	10500 (13.50)	6050 (5.85)
12	0	50 (na)	1350 (3.90)	1150 (4.85)	6700 (8.10)	8550 (10.25)
13	0	0	400 (1.20)	1600 (6.20)	10000 (20.60)	7600 (10.00)
14	0	50 (0.30)	750 (na)	1400 (5.25)	10400 (18.45)	10000 (15.05)
15	0	0	250 (0.20)	100 (0.70)	3700 (na)	1100 (1.55)
16	0	0	400 (1.20)	550 (1.45)	3550 (6.35)	6950 (11.35)
17	50 (0.15)	50 (na)	450 (0.70)	300 (0.65)	7650 (10.95)	1900 (2.30)
18	0	0	100 (0.10)	0	15450 (31.90)	100 (0.05)
$\bar{X}$	5.56 (0.91)	125.00 (0.13)	2566.67 (8.50)	1677.78 (5.41)	9861.11 (14.83)	5188.89 (6.99)
S.D.	309.6 (1.78)	219.8 (0.26)	2738.2 (8.27)	1791.5 (5.93)	3558.5 (6.80)	2921.6 (4.86)

* weights not available

Table 7b. Density (/m^2) of *Heteromastus filiformis* at Daniel's Flats, 1978.

STATION	MAY 25	JUNE 13	JULY 14	AUGUST 10	SEPTEMBER 25	OCTOBER 24
1	0	0	0	0	0	0
2	250	0	50	0	50	0
3	50	200	50	0	100	100
4	600	100	0	100	150	0
5	300	50	150	200	250	300
6	50	0	350	300	650	150
7	900	200	200	200	150	100
8	350	300	150	200	300	100
9	650	250	200	150	200	350
10	500	200	200	50	450	100
11	50	0	100	200	150	100
12	100	250	0	500	200	50
13	350	200	50	250	300	250
14	50	200	150	50	150	150
15	50	250	100	200	100	150
16	200	50	0	100	0	0
17	0	50	50	0	0	0
18	0	100	0	0	50	50
$\bar{X}$	247.22	133.33	100.00	138.89	180.56	108.33
S.D.	265.95	104.32	97.01	133.46	167.28	104.67

Table 7c. Density (without brackets) and biomass (gram wet weight - with shell) per m^2 of *Macoma balthica* at Daniel's Flats, 1973.

STATION	MAY 25	JUNE 13	JULY 14	AUGUST 10	SEPTEMBER 25	OCTOBER 24
1	1950 (49.90)	3050 (390.00)	6200 (309.05)	5550 (323.45)	6800 (432.55)	9650 (524.55)
2	1900 (49.50)	1950 (na)*	50 (0.15)	1150 (87.85)	2600 (17.35)	3050 (243.45)
3	1100 (21.85)	1150 (na)	100 (na)	300 (14.70)	1300 (na)	250 (0.65)
4	550 (15.30)	800 (na)	100 (5.55)	700 (na)	1650 (2.80)	1150 (3.00)
5	650 (13.60)	200 (na)	0	400 (na)	600 (8.30)	300 (na)
6	250 (na)	200 (na)	0	200 (7.45)	150 (na)	50 (na)
7	0	150 (3.45)	0	400 (na)	100 (na)	50 (na)
8	0	0	100 (4.00)	150 (na)	200 (na)	0
9	0	0	0	0	50 (na)	50 (2.00)
10	50 (na)	100 (0.75)	0	0	100 (na)	50 (4.20)
11	0	50 (na)	0	300 (na)	0	0
12	0	200 (na)	0	100 (na)	100 (na)	0
13	0	0	0	200 (na)	150 (na)	0
14	50 (na)	0	0	0	150 (na)	0
15	100 (na)	0	0	0	200 (na)	0
16	0	0	0	200 (na)	50 (na)	0
17	0	0	0	0	0	0
18	0	0	0	0	0	50 (na)
$\bar{X}$	366.67 (10.73)	436.11 (35.84)	363.89 (18.75)	536.11 (43.35)	788.89 (65.86)	813.89 (55.56)
S.D.	641.92 (18.03)	833.10 (117.47)	1457.01 (74.83)	1285.53 (102.10)	1658.36 (161.82)	2326.18 (149.67)

* weights not available

Table 8a. Density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator* at Mary's Point, 1978-1979.

STATION	MAY 26	JUNE 15	JULY 13	AUGUST 11	SEPTEMBER 21	OCTOBER 23	NOVEMBER 24	DECEMBER 20	JANUARY 23	FEBRUARY 22***	MARCH 21	APRIL 21
1	0	0	500 (1.75)	250 (0.65)	7800 (9.55)	6150 (6.30)	450 (1.25)	- **	550 (0.40)	-	250 (0.15)	500 (0.90)
2	2300 (10.60)	1750 (15.10)	3650 (9.60)	1500 (7.35)	6500 (6.40)	5450 (6.65)	1100 (1.80)	3350 (3.05)	900 (1.00)	-	-	150 (na)
3	3200 (13.15)	1950 (19.90)	2000 (15.45)	2600 (9.40)	5600 (7.10)	5950 (7.45)	6700 (10.95)	-	5150 (12.65)	-	2100 (4.30)	100 (na)
4	2700 (12.70)	800 (6.55)	6150 (10.00)	5200 (16.60)	4900 (10.95)	7750 (8.30)	6050 (10.65)	5450 (8.00)	400 (0.35)	-	-	1500 (3.45)
5	3950 (24.30)	250 (2.55)	6450 (14.50)	6400 (25.70)	10650 (20.20)	7550 (11.95)	6450 (13.25)	-	1250 (1.80)	1344 (1.87)	5300 (9.35)	1850 (2.85)
6	4850 (32.85)	-	8400 (15.10)	6050 (na)*	6350 (7.25)	6400 (8.20)	7300 (12.35)	2650 (4.40)	550 (0.50)	-	-	3450 (8.15)
7	100 (0.30)	100 (1.30)	13850 (na)	8150 (39.05)	3450 (12.05)	7200 (17.95)	5150 (9.55)	-	7600 (18.35)	-	200 (na)	1850 (5.15)
8	3300 (18.95)	700 (3.45)	13400 (na)	10050 (na)	6250 (22.40)	6050 (na)	6350 (11.35)	4250 (6.30)	12850 (24.60)	-	-	100 (0.35)
9	200 (0.40)	400 (2.25)	17150 (42.70)	12350 (46.60)	7400 (16.75)	11950 (24.10)	8900 (25.25)	-	13650 (33.30)	-	1350 (2.70)	1300 (3.10)
10	3700 (23.05)	200 (na)	17700 (44.20)	9650 (27.45)	13200 (36.45)	10200 (24.85)	7650 (18.05)	1600 (3.05)	4200 (8.50)	-	-	300 (1.90)
11	50 (na)	50 (0.40)	13200 (28.80)	15550 (55.20)	12100 (28.25)	9400 (16.60)	8550 (26.05)	-	10050 (19.80)	-	3800 (8.15)	2850 (8.05)
12	500 (3.35)	100 (0.55)	18000 (na)	16400 (na)	16350 (43.05)	9050 (23.20)	6350 (9.90)	2500 (4.45)	1000 (1.10)	-	-	250 (0.30)
13	0	100 (0.20)	14000 (26.95)	13100 (53.60)	8750 (21.55)	9000 (23.10)	6700 (19.95)	-	1100 (1.95)	-	2400 (7.95)	1350 (3.30)
14	250 (0.85)	500 (2.90)	11550 (19.20)	11950 (42.35)	10900 (33.55)	5550 (11.55)	5300 (15.70)	1100 (0.80)	250 (0.25)	-	-	100 (0.15)
15	100 (0.25)	50 (0.10)	4450 (7.05)	14100 (63.90)	11200 (36.60)	12350 (28.10)	9000 (29.05)	-	1000 (2.50)	-	300 (0.70)	0
16	100 (0.35)	150 (0.85)	950 (2.00)	12300 (69.05)	11100 (na)	10750 (44.30)	6250 (17.95)	400 (0.95)	200 (0.35)	-	-	0
17	150 (0.75)	0	600 (3.65)	1800 (8.30)	13950 (36.75)	17900 (42.50)	4650 (6.40)	-	250 (0.15)	-	50 (na)	0
18	50 (0.05)	0	800 (1.05)	2950 (15.25)	600 (1.50)	1300 (2.40)	300 (0.25)	-	100 (na)	-	-	0
19	50 (0.30)	0	350 (0.20)	3500 (18.45)	950 (3.15)	350 (1.20)	450 (0.60)	-	200 (0.10)	-	200 (0.35)	0
X	1344.7 (7.90)	394.4 (3.30)	8060.5 (15.14)	8097.4 (31.18)	8315.8 (19.64)	7910.5 (17.15)	5455.3 (12.65)	2662.5 (3.88)	3223.7 (7.09)	1344.0 (1.87)	1595.0 (4,21)	850.0 (2.21)
S.D.	1709.1 (10.56)	582.3 (5.68)	6503.6 (14.08)	5166.3 (21.88)	4294.0 (13.33)	3941.6 (12.58)	2841.4 (8.63)	1668.1 (2.47)	4493.7 (10.25)		1804.8 (3.82)	1051.7 (2.73)

*not available **not sampled ***station 5 sampled only due to ice conditions

Table 8b. Density (/m^2) of *Heteromastus filiformis* at Mary's Point, 1978-1979.

STATION	MAY 26	JUNE 15	JULY 13	AUGUST 11	SEPTEMBER 21	OCTOBER 23	NOVEMBER 24	DECEMBER 20	JANUARY 23	FEBRUARY 22*	MARCH 21	APRIL 21
1	50	50	0	0	250	100	0	-**	50	-	50	50
2	200	600	250	150	150	0	0	100	50	-	-	150
3	300	350	150	200	400	300	400	-	650	-	500	300
4	250	400	300	300	200	100	0	200	300	-	-	650
5	200	750	300	250	300	950	150	-	200	244	150	800
6	150	300	200	350	200	150	150	450	450	-	-	350
7	450	50	0	150	100	100	50	-	250	-	200	250
8	50	100	100	250	150	0	150	50	350	-	-	150
9	600	150	350	200	50	250	250	-	250	-	0	50
10	350	400	350	600	150	300	50	250	150	-	-	500
11	250	200	200	250	200	150	50	-	100	-	200	150
12	0	50	200	300	250	150	150	50	0	-	-	700
13	150	50	200	100	200	50	200	-	300	-	100	50
14	50	0	100	0	100	100	50	50	250	-	-	50
15	50	0	50	0	50	0	50	-	0	-	0	150
16	50	0	0	0	0	100	50	0	100	-	-	50
17	0	0	0	0	0	0	0	-	0	-	0	50
18	0	0	50	0	0	0	0	-	0	-	-	0
19	0	0	50	0	0	50	0	-	0	-	0	0
$\bar{X}$	155.8	181.6	150.0	163.2	144.7	150.0	92.1	143.8	181.6	244.0	120.0	234.2
S.D.	169.2	225.0	122.5	163.2	112.9	216.0	107.1	149.9	178.9		156.7	251.7

*station 5 sampled only due to ice conditions **not sampled

Table 8c. Density (without brackets) and biomass (gram wet weight - with shell) per m^2 of *Macoma balthica* at Mary's Point, 1978-1979.

STATION	MAY 15	JUNE 15	JULY 13	AUGUST 11	SEPTEMBER 21	OCTOBER 23	NOVEMBER 24	DECEMBER 20	JANUARY 23	FEBRUARY 22*	MARCH 21	APRIL 21
1	6550 (757.2)	5800 (393.3)	7550 (714.9)	3600 (1222.6)	3600 (203.2)	350 (na)***	350 (na)	-**	400 (na)	-	3200 (na)	2100 (na)
2	350 (5.20)	1450 (67.45)	700 (41.10)	500 (25.40)	850 (39.15)	650 (na)	350 (na)	250 (na)	700 (na)	-	-	700 (na)
3	450 (9.15)	100 (na)	200 (7.50)	250 (na)	850 (na)	350 (na)	1500 (na)	-	450 (na)	-	150 (na)	350 (na)
4	250 (2.00)	50 (2.00)	50 (0.15)	50 (1.00)	600 (9.45)	1200 (na)	150 (na)	600 (na)	400 (na)	-	-	150 (na)
5	400 (5.85)	50 (na)	200 (11.65)	700 (26.30)	300 (na)	450 (na)	300 (na)	-	300 (na)	478 (na)	0	50 (na)
6	150 (na)	0	0	0	400 (na)	100 (na)	150 (na)	50 (na)	100 (na)	-	-	0
7	300 (na)	250 (23.40)	100 (6.10)	700 (118.25)	100 (na)	250 (na)	750 (na)	-	50 (na)	-	50 (na)	50 (na)
8	0	50 (0.25)	0	50 (4.20)	350 (56.35)	200 (na)	0	0	50 (na)	-	-	500 (na)
9	150 (1.05)	0	0	0	150 (na)	250 (na)	0	-	0	-	0	0
10	0	0	50 (0.20)	0	50 (3.15)	0	100 (na)	50 (na)	0	-	-	50 (na)
11	0	0	0	150 (na)	0	0	0	-	100 (na)	-	0	0
12	0	0	0	0	0	0	0	50 (na)	0	-	-	0
13	0	0	0	0	0	0	0	-	0	-	0	50 (na)
14	0	0	0	0	0	0	0	0	50 (na)	-	-	0
15	50 (na)	0	0	0	50 (5.40)	0	0	-	0	-	0	50 (na)
16	0	0	0	0	50 (na)	0	100 (na)	0	0	-	-	0
17	100 (0.50)	0	0	50 (0.50)	0	0	0	-	0	-	0	0
18	50 (na)	0	50 (1.35)	0	0	0	0	-	0	-	-	0
19	0	0	50 (0.15)	0	0	0	0	-	0	-	0	50 (na)
$\bar{X}$	463.2 (52.06)	407.9 (28.61)	471.1 (41.22)	318.4 (82.25)	386.8 (24.36)	200.0	197.4	125.0	136.8	478.0	340.0	215.8
S.D.	1481.8 (195.1)	1347.0 (95.5)	1722.0 (163.4)	828.5 (295.3)	827.8 (56.6)	309.6	370.6	208.7	207.4		1006.0	495.8

* station 5 sampled only due to ice conditions **not sampled *** not available

Table 9. Boat samples: density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator*, *Heteromastus filiformis* and *Macoma balthica* at Minudie Point, August 14, 1978.

Sample	*Corophium volutator*	*Heteromastus filiformis*	*Macoma balthica*
1	0	0	0
2	0	0	0
3	0	0	0
4	133 (1.33)	0	0
5	311 (1.11)	44 (1.96)	0
6	2133 (9.07)	44 (0.84)	0
7	9022 (38.67)	44 (2.36)	0
8	17466 (53.24)	0	0
9	311 (0.71)	133 (1.78)	0
10	0	89 (1.11)	0
11	0	0	0
12	0	0	0
13	0	44 (1.33)	0
14	0	0	0

Table 10,. Boat samples: density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator*, *Heteromastus filiformis* and *Macoma balthica* (with shell) at Minudie Point, July 15, 1978.

Sample	*Corophium volutator*	*Heteromastus filiformis*	*Macoma balthica*
1	2977 (10.36)	0	3377 (320.98)
2	10000 (39.11)	0	1155 (97.51)
3	1777 (7.11)	0	3777 (332.67)
4	15466 (53.78)	0	488 (28.44)

Table 11.. Boat samples: density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator*, *Heteromastus filiformis* and *Macoma balthica* (with shell) at Minudie, July 15, 1978.

Sample	*Corophium volutator*	*Heteromastus filiformis*	*Macoma balthica*
5	22533 (63.11)	1066 (17.33)	0
6	19822 (55.20)	444 (14.40)	0
7	1111 (2.44)	222 (5.73)	0
8	6488 (14.49)	178 (4.93)	0
9	4622 (11.33)	0	0
10	1955 (5.20)	44 (4.67)	0
11	222 (na)*	0	0

*weights not available

Table 12. Boat samples: density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator*, *Heteromastus filiformis* and *Macoma balthica* at Peck's Cove, July 15, 1978.

Sample	*Corophium volutator*	*Heteromastus filiformis*	*Macoma balthica*
1	3955 (13.07)	0	0
2	755 (1.56)	0	0
3	4978 (19.82)	0	0
4	4755 (13.16)	0	0
5	1164 (34.09)	0	0
6	7289 (19.29)	178 (2.04)	0
7	8267 (26.13)	178 (4.44)	0
8	2667 (9.33)	622 (7.51)	0
9	400 (0.98)	800 (8.89)	0

Table 13. Boat samples: density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator*, *Heteromastus filiformis* and *Macoma balthica* (with shell) at Rockport Cove August 13, 1978.

Sample	*Corophium volutator*	*Heteromastus filiformis*	*Macoma balthica*
1	2622 (10.13)	0	0
2	2889 (11.20)	0	0
3	1867 (7.11)	0	0
4	1600 (7.29)	0	0
5	1111 (3.24)	0	0
6	133 (0.62)	44 (1.11)	0
7	444 (1.24)	0	0

Table 14. Boat sample: density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator*, *Heteromastus filiformis* and *Macoma balthica* (with shell) at Peck's Cove, August 13, 1978.

Sample	*Corophium volutator*	*Heteromastus filiformis*	*Macoma balthica*
1A	6899 (24.89)	0	89 (1.78)

Table 15. Boat samples: density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator*, *Heteromastus filiformis* and *Macoma balthica* (with shell) at Daniel's Flats, August 13, 1978.

Sample	*Corophium volutator*	*Heteromastus filiformis*	*Macoma balthica*
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	15111 (15.11)	0	0
7	9155 (36.89)	0	0
8	10933 (57.16)	0	0
9	6177 (27.33)	0	0
10	9022 (33.38)	178 (1.87)	0
11	5378 (15.11)	0	133 (5.78)
12	9288 (20.76)	311 (1.91)	0
13	5378 (10.67)	0	89 (5.69)

Table 16. Boat samples: density (without brackets) and biomass (grams wet weight) per m^2 of *Corophium volutator*, *Heteromastus filiformis* and *Macoma balthica* at Mary's Point, August 13, 1978.

Sample	*Corophium volutator*	*Heteromastus filiformis*	*Macoma balthica*
1	89 (0.53)	0	0
2	0	0	0
3	0	0	0