Some aspects of the flora and fauna of the Western Minas Basin and Minas Channel: final report of Federal Summer Job Corps project 16-01-002

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Publisher's version / Version de l'éditeur:
https://doi.org/10.4224/23000797
Investigation on the ecology of the Bay of Fundy, 1978-10

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Investigations on the Ecology of the Bay of Fundy

SOME ASPECTS OF THE FLORA AND FAUNA OF THE WESTERN MINAS BASIN AND MINAS CHANNEL

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Project 16-01-002

October 1978

A series of projects on the enumeration and interactions of the flora, fauna, chemistry hydrology and geology of the Bay of Fundy with an emphasis on the Minas Basin and Scots Bay. The projects were conducted under the Summer Job Corps Program supported by the Department of Manpower and Immigration, the Atlantic Regional Laboratory of the National Research Council, the Biology and Chemistry Departments of Acadia University, Atlantic Geoscience Centre - Bedford Institute of Oceanography and the Biology Department of the University of New Brunswick.

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Dr. C. Amos - Geosciences Centre - Bedford Inst. of Oceanography

The advice, guidance and assistance so freely given by the above to the project leaders and students was responsible for the success of the program.

F. J. Simpson
Director, ARL/NRC

Some aspects of the flora and fauna of the western Minas Basin and Minas Channel

Final report of
Summer Job Corps Project 16-01-002

edited by GARY GRATTO (project leader)

October 1978

INTRODUCTION

The official title of this project as defined in the contract was: "Flora and fauna survey of the Minas Basin, Scot's Bay and adjacent drainage areas". To best accomplish this broad objective it became apparent that the project be broken down somewhat to deal with various aspects of this theme. This report is, in effect, a volume containing four separate reports.

The first report deals with the macrophytic algae found along five transects in the vicinity of Black Rock, on the Minas Channel. The zonation and percent biomass of the species present was investigated.

The second study was a continuation of a saltmarsh insect survey which was started last year (Fuller and Trevors, 1977). This year, work mainly centered on gathering data on the distribution and determining the number of species present of leafhoppers (Cicadellidae) and planthoppers (Delphacidae). All the work this year was done in the saltmarshes adjacent to the town of Wolfville.

The two remaining projects delt with the invertebrate populations found on the intertidal flats in the southern bight of the Minas Basin and at Scot's Bay.

One is a continuation of a subproject started last year (Fuller and Trevors, 1977) involving the collection of samples along six permanent transects. As data collected in this manner is used to predict future variations in invertebrate populations due, for example, to the effect of climatic changes or changes induced by the building of a barrage in the area, more than one season's data is invaluable if not necessary.

The remaining project was just initiated this year. It involved extensive sampling of the intertidal flats from Cape Blomidon to Horton Bluff in the western end of the Minas Basin. In all over nine hundred samples were taken along the forty km of coastline. Further surveys of this extent, after a few years have past, are best suited to show the gross changes in distribution which may occur with time.

Gary Gratto
project leader

ACKNOWLEDGEMENTS

This project could never had taken place had it not been for a Federal Summer Job Corps Project (16-01-002) through the Canada Employment and Immigration Commission (CEIC) and the National Research Council (NRC).

The CEIC provided the monies necessary to run the project and their facilities to locate the students necessary to carry out the project. The NRC provided additional equipment not covered by the project's contract: the hundreds of jars and vials etc. required by a project of this scope.

To Acadia University goes special acknowledgements as the university provided the space and utilities which were used this summer.

Thanks to J.S. Bleakney for his assistance this summer and for helping to polish this report to its present form.

Gary Gratto

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INVESTIGATION OF ALGAL BIOMASS AT BLACK ROCK, KINGS CO.,N.S.

A.R. Jamieson

ABSTRACT

The littoral algal biomass and zonation at Black Rock, Kings Co., N.S. was investigated. Data was collected in June 1978 from five transects. Biomass values were based on carbon weights.

The wet weight was 649.579 g/m^2. The dry weight and carbon weight were 137.982 g/m^2 and 53.401 g/m^2 respectively. Thus dry weight was 21.2% of the wet weight and carbon content was 8.2% of the wet weight.

Eleven species of algae were collected. *Ascophyllum nodosum* (L.)Le.Jol. comprised 88.78% of the total carbon weight while *Gigartina stellata* Batt. (5.52%) and *Fucus vesiculosus* L. (4.37%) were next in abundance.

INTRODUCTION

My initial project was a biomass study of the littoral algal macrophytes in the Minas Basin. After examination of the sample area (Blomidon to Avonport) it was decided that there were too few macrophytic algae in this area so my study area was changed to Black Rock.

I also took part in the collection, identification, and preservation of about 300 algal specimens from various places in Nova Scotia. These specimens were added to the E.C. Smith Herbarium at Acadia University.

The report on the biomass of algae at Black Rock follows. Algal zonation was also considered.

Black Rock (N 45° 11'18" latitude, 64° 45'48" longitude) is located on the south shore of the Minas Channel, one kilometer west of Canada Creek. The upper littoral area of the beach is comprised mostly of loose, small rocks, an unsuitable substrate for attachment of macrophytic algae. The lower littoral zone contains larger rocks and basalt outcroppings, and thus is suitable for algal attachment.

MATERIALS AND METHODS

A) Field operations:

The transects were located at Black Rock. The baseline was chosen to be above the littoral zone and parallel to the shoreline. It was placed so that the harvested area would include the littoral basalt outcropping, the "black rock" which gives the place its name.

A line was extended from the benchmark (#7780) beside the lighthouse on a bearing of 113° Mag., where a stake was driven. This marked point A, the beginning of the baseline. A line was extended from point A, 180 meters on a bearing of 93 Mag. and was marked off in 20 meter sections. This was the baseline with 10 points, A - K, excluding I.

Transects were established to datum from each of these points and perpendicular to the baseline. Quadrats ($\frac{1}{4}$ m^2) were established every 20 m from the baseline. Only data from transects F, G, H, J, and K was included in this report. The elevation of each quadrat was determined with an inclinometer and a stadia rod, using Hanic's (1974) method.

Samples were collected on June 14, 21 and 22, 1978. All of the macrophytic algae, including holdfast, within a $\frac{1}{4}$ m^2 quadrat were harvested and placed in a plastic bag. The bags were then frozen until the laboratory operations were undertaken.

B) Laboratory operations:

Algae from each quadrat were sorted to species and identified using the standard reference volume, Marine Algae of the North Eastern Coast of North America, by Taylor (1957).

The wet weight of all specimens of each species from each quadrat was taken and recorded after foreign material was washed from the algae. Dry weights were taken after the algae was dried for 24 hours at 40 - 45° C then oven dried at 100° C to constant weight. Ash weights were taken after the dried algae was kept at 600° C in a muffle furnace (Thermolyne, Type 10500) for 12 hours. This period of time allowed for a constant weight to be reached. Subunits were made for samples too large to ash in one crucible.

The carbon content is approximately $\frac{1}{2}$ the organic value according to Friedrich (1969) and Westlake (1963). The organic value is equal to the difference between dry weight and ashed weight.

RESULTS

A) Zonation patterns:

Fifty-two quadrats were marked out but only 25 of these contained macrophytic algae (Figures 1 - 5). None of the quadrats over five meters above datum contained algae. This was due to the lack of suitable substrate for attachment. On the upper part of the beach, the rocks were small and much movement occurred due to wave action. On the lower littoral beach the rocks were larger and there was a basalt outcropping as shown in Figures 4 and 5.

The area between two and five meters above datum was dominated by Ascophyllum nodosum (L.)Le.Jol. which was often epiphytized by Polysiphonia lanosa (L.)Tandy and Pilayella littoralis (L.)Kjellm. This range included most of the basalt outcropping which was covered by Ascophyllum nodosum (Figure 4). Quadrat eleven (220 m) on transect J and quadrat eleven (220 m) on transect K, (Figures 4 and 5) were in tide pools and therefore did not contain Ascophyllum nodosum. The pool at 220 m on transect J had a sand-covered bottom and therefore contained no algae.

Fucus vesiculosus L. was generally found between two and five meters above datum.

the area from zero to two meters above datum was dominated by Gigartina stellata Batt. Small quantities of other species of algae were found in this area, including Corallina officinalis L., Polyides rotundus (Huds.)Grev., Cladophora rupestris (L.)Kutz, Chaetomorpha linum (O.F.Mull.)Kutz, and Cystoclonium purpureum (Huds.)Batt. Tidal pools of the Ascophyllum zone contained similar species composition as the Gigartia zone.

B) Biomass:

The wet weight of macrophytic algae at Black Rock was 649.579 g/m^2 (Table 1). The dry weight was 21.2% of the wet weight or 137.982 g/m^2. The carbon weight was 8.2% of the wet weight, 38.7% of the dry weight, or 53.401 g/m^2. The number of quadrats without algae was large so there was much more than 53 g/m^2 on the lower (zero to five meters above datum) part of the beach.

The biomass was made up mostly of Ascophyllum nodosum (L.)Le.Jol. which was 88.78% of the carbon weight. Gigartina stellata Batt. made up 5.52% of the carbon weight and Fucus vesiculosus L. made up 4.37%. The remaining eight species comprised less than 2% of the carbon weight.

DISCUSSION

Two zones of littoral macrophytic algae were evident from the transect data; the Ascophyllum zone and the Gigartina zone. These zones were clearly delineated on the north side of the basalt outcropping where suitable substrate for algal attachment was available. The greatest diversity of algae was found from zero to two meters above datum and in tide pools.

The carbon weight of macrophytic algae was 53.401 g/m^2. A study, conducted on another area of the beach at Black Rock, by Paul M. Macdonald (1978) found the carbon weight to be 70.288 g/m^2 in October 1977. His transect was located over more suitable substrate than mine, so he had less quadrats with no algae, thus a larger carbon weight.

Macdonald's data showed that the dry weight was 28.7% of the wet weight. My data showed 21.2%. This can be partly explained by the different months in which we sampled. Macdonald sampled in October when the presence of large numbers of newly formed, succulent, receptacles of Ascophyllum were less common than in June, the month of my sampling.

The remainder of Macdonald's results were very similar to mine.

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TABLE 1

Table 1: The total wet, dry, organic and carbon weights and percentage carbon weight for all algae collected along transects F, G, H, J, and K. Weight is given in grams.

SPECIES	WET WEIGHT	DRY WEIGHT	ORGANIC WEIGHT	CARBON WEIGHT	PERCENTAGE CARBON WEIGHT
Ascophyllum nodosum	7270.890	1576.568	1232.685	616.342	88.78
Gigartina stellata	498.196	106.240	76.699	38.349	5.52
Fucus vesiculosus	467.083	79.197	60.622	30.311	4.37
Polysiphonia lanosa	131.877	17.994	12.074	6.037	0.87
Pilayella littoralis	32.918	2.955	1.781	0.891	0.13
Fucus sp.	8.503	2.244	1.868	0.934	0.13
Corallina officinalis	17.016	6.375	1.526	0.763	0.11
Cystoclonium purpureum	11.152	0.896	0.481	0.241	0.03
Cladophora rupestris	3.480	0.776	0.413	0.206	0.03
Chaetomorpha linum	3.232	0.453	0.211	0.106	0.02
Polyides rotundus	0.159	0.046	0.043	0.021	0.01
Antithamnion floccosum	0.020	0.017	0.010	0.005	0.01
TOTALS	8444.532	1793.761	1388.418	694.209	
TOTALS PER m^2	649.579g/m^2	137.982g/m^2	106.801	53.401g/m^2	

Figures 1 - 5: Zonation at transects F, G, H, J, and K. The x-axis represents height above chart datum. The y-axis represents the horizontal distance down the transect. Species abbreviations are in order of decreasing biomass, reading downward.

An	<u>Ascophyllum</u> <u>nodosum</u> (L.)Le.Jol.
Gs	<u>Gigartina</u> <u>stellata</u> Batt.
Fv	<u>Fucus</u> <u>vesiculosus</u> L.
Pl	<u>Polysiphonia</u> <u>lanosa</u> (L.)Tandy
Pli	<u>Pilayella</u> <u>littoralis</u> (L)Kjellm.
F	<u>Fucus</u> sp.
Co	<u>Corallina</u> <u>officinalis</u> L.
Cp	<u>Cystoclonium</u> <u>purpureum</u> (Huds.)Batt.
Cr	<u>Cladophora</u> <u>rupestris</u> (L.)Kutz.
Cl	<u>Chaetomorpha</u> <u>linum</u> (O.F.Mull.)Kutz.
Pr	<u>Polyides</u> <u>rotundus</u> (Huds.)Grev.
Af	<u>Antithamnion</u> <u>floccosum</u> (O.F.Mull.)Kleen

Figure 1: Transect F

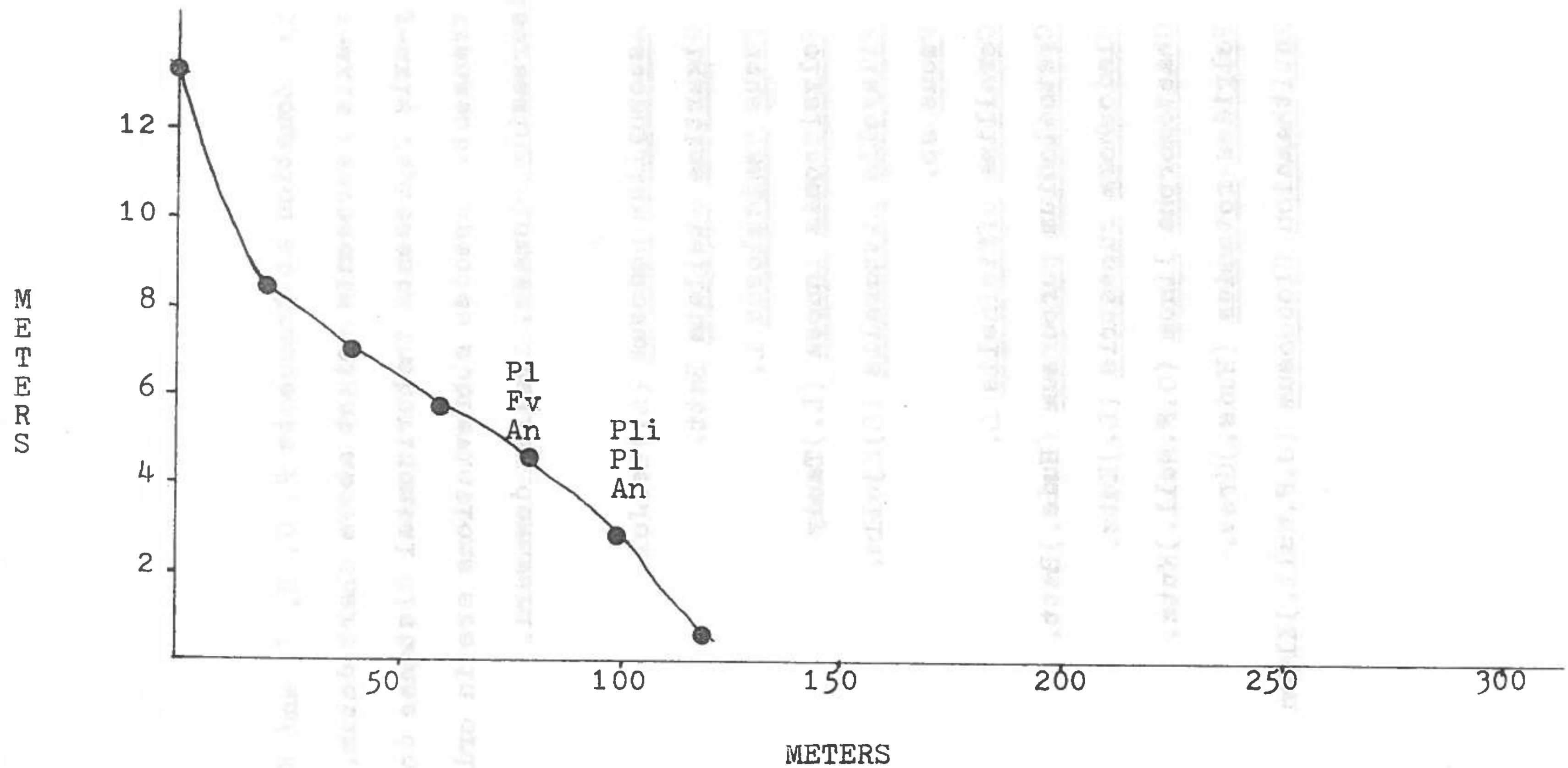


Figure 2: Transect G

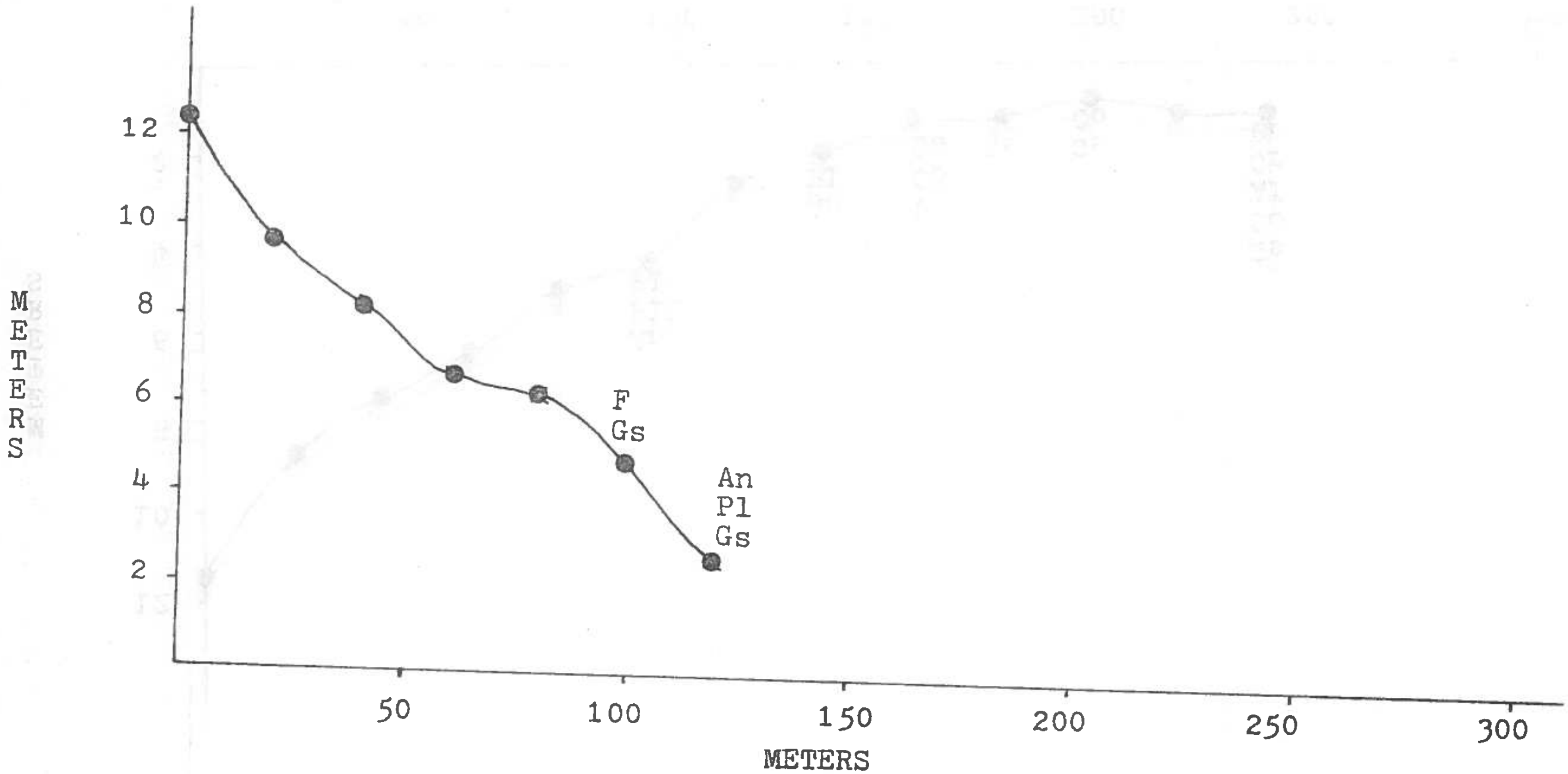


Figure 3: Transect H

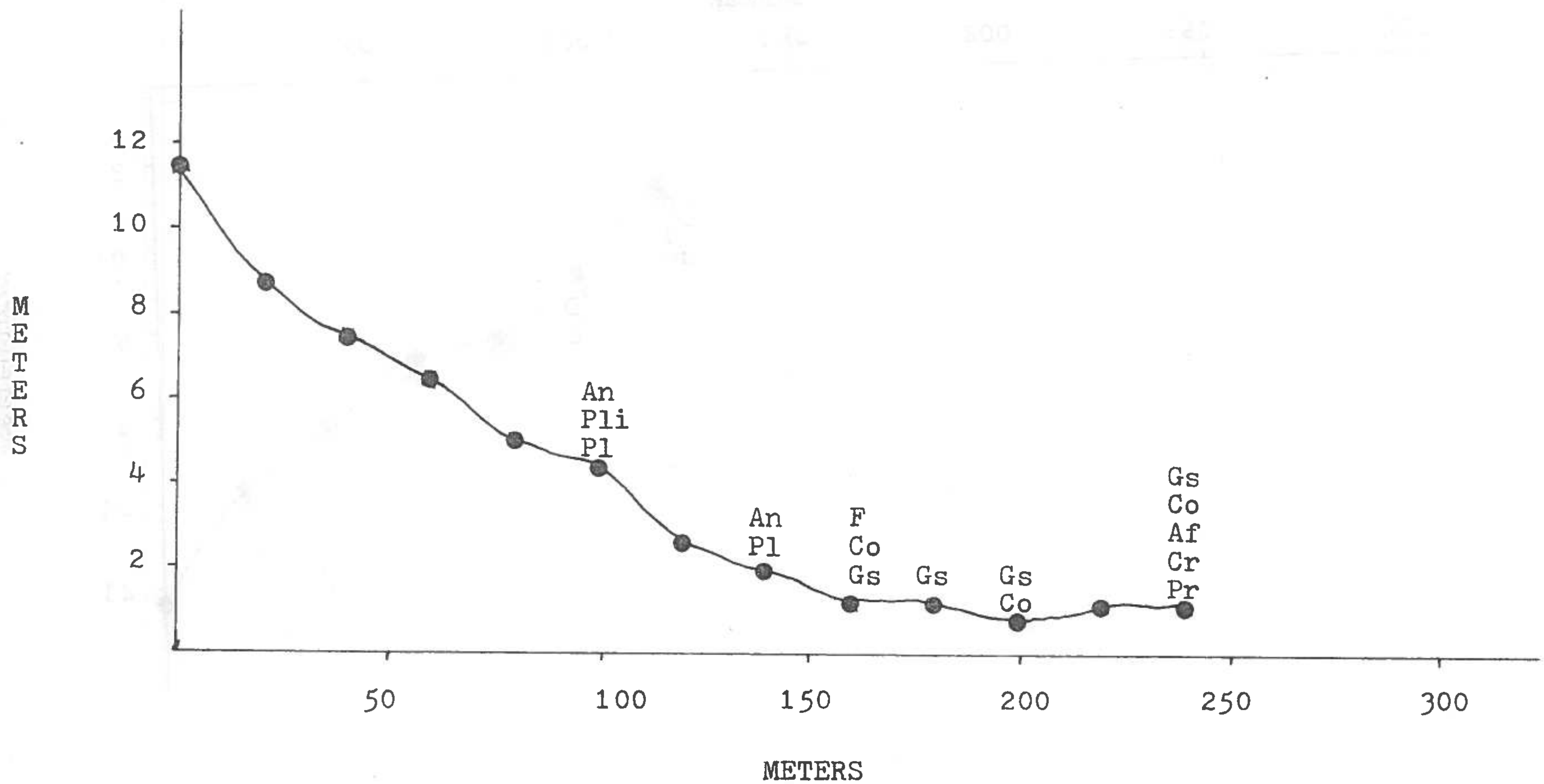


Figure 4: Transect J

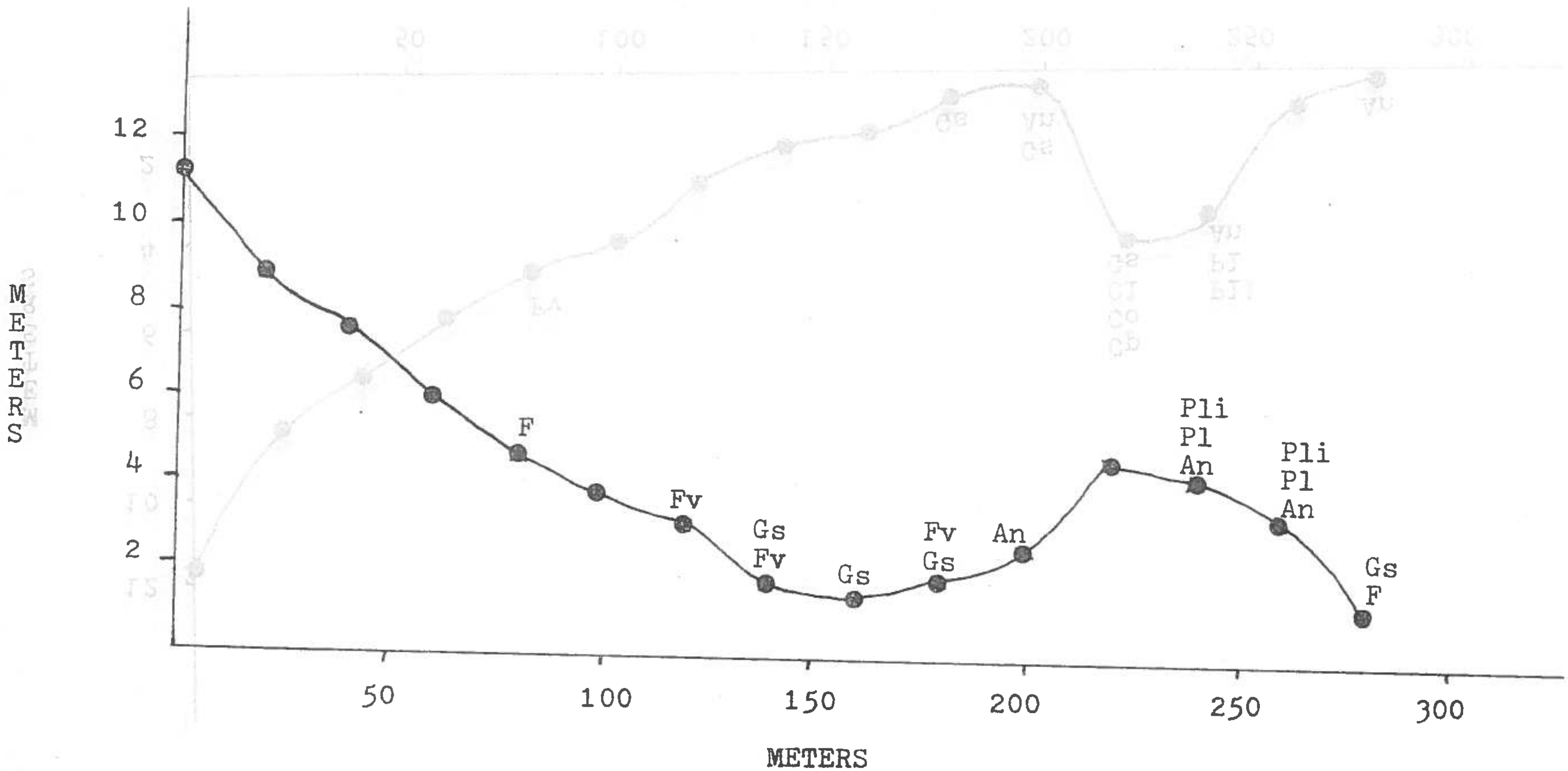
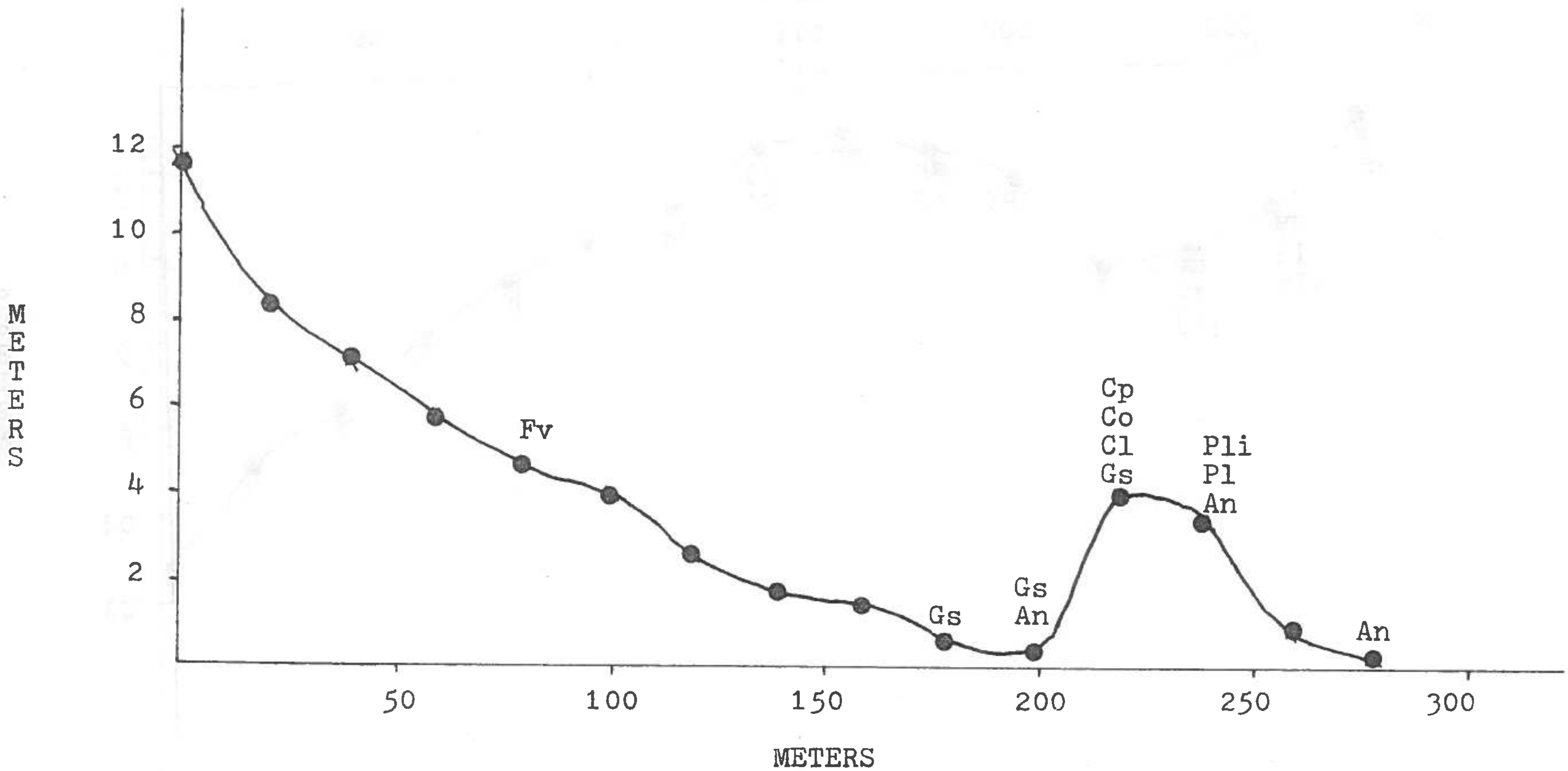


Figure 5: Transect K



SALTMARSH INSECT SURVEY OF 1976

O. Krepinsky

INTRODUCTION

This year the insect survey has concentrated upon gathering data on the populations of leafhoppers and planthoppers (Cicadellidae and Delphacidae) of Wolfville Marsh, although occasional random samples were taken of other fauna at the Wolfville and Kingsport sites to supplement the general collection. A preliminary analysis of Otitid fly populations was done as well.

STUDY ZONES AND METHODS

The site referred to as "Wolfville Marsh", a relatively small, rather elevated segment of the band of marshland occurring along the Wolfville dykes by the (mouth of the) Cornwallis River, was chosen primarily for its ease of access. Its total area is under 0.5 km and it is significally inundated only by tides exceeding 7.3 m above M.S.L. Five zones were established in the summer of 1977 representing the most prominant vegetation patterns; the system was adhered to throughout this season.

The zonation is as follows:

W1 Zone: Areas immediately adjacent to the river basin. The sparse cover of Salt Marsh Cordgrass (_Spartina alterniflora_

Lois.) evident at the beginning of the summer season develops into a dense growth reaching up to 1.5 m in height by the beginning of August. This zone is subject to the longest periods of inundation.

W2 Zone: Somewhat elevated from zone W1; an area of S. alterniflora, which never reaches the profusion found at W1.

W3 Zone: S. alterniflora patches on the main plateau of the marsh.

W4 Zone: Areas of Salt Meadow Cordgrass (Spartina patens (Ait.)Muhl.). Closely conforms to the description by Denno (1977).

W5 Zone: A cluster of islands of elevated ground whose peaks are above the highest tide mark. This is the most heterogenous zone, with the vegetation including some typically dry-land species such as one very young oak (Quercus sp.). The sampling was done mostly along the highest water mark where the vegetation included Salicornia europaea L., Solidago canadensis L., Solidago sempervirens L., Limonium nashii Small, Suaeda maritima (L.)Dumort, Plantego juncoides Lam., Anaphalis sp., Spartina foliosa Trin., Dancus carota L., Sonchus sp., and, very prominently, an Agropyron sp.

During a sample period, each of the zones were sweep-sampled five times daily at approximately three-hour intervals (Starting at 8 a.m.). Sample periods were about 1.5 weeks apart, corresponding to the occurrence of days when the point of highest tide was reached between 10 a.m. and 4 p.m.

A note on terminology: the sampling season spans from June 1978 to (probably) November 1978; 1 sampling period = 2 sample days; 1 sample day = 5 sample runs = 25 samples.

The sweep net is one of the cheapest, easiest and most widely used means of mass collection, though one of the more controversial (Cothran, Summers and Franti, 1975 ; Delong, 1932; Romney, 1945; Menhinick, 1963). The main difficulties appear to lie in maintaining uniformity of method and eliminating the effects of environmental variation in catch assessment. Wind and temperature have been shown to be the two most important variables affecting leafhopper sweep sampling (Cherry, Word and Ruesink, 1977; Romney, 1945), although, besides other environmental conditions, even sex, species, and kind of food plant may be of importance (Cherry et al,1977; Stern, 1973). The planned sampling program attempted to utilize this variability of the sweep technique in the study of leafhopper activity, by comparing sweep catches with the absolute populations known to occur at a given site during the relevant sample period. The environmental variables monitored were time of day, vegetation, temperature, light intensity, and wind velocity; light was measured in footcandles by a General Electric Type 213 pocket light meter and also in relative terms by the built-in meter of a Minolta SRT202 camera, and the wind by the displacement of a vertically suspended windvane along a protractor scale. (The scale shall later be calibrated and the readings converted to km/h). A standard 38cm - diameter sweepnet was used for the sweeps, with ten swings taken at each site during each sample run. A swing encompassed an arc of approximately 135° which was carried through on a "one-two" count; the swing was done against the wind when the latter was appreciably strong. Only the upper one-fourth to one-third of the vegetation height was swept: this bypassed less active individuals, reduced the amount of trash collected, and also insured a more uniform technique throughout (the thatchy nature of S. patens frustrates deeper sweeping). At times rather wet vegetation had to be sampled (in the mornings after inundation) which posed some nuisance and degraded the quality of the specimens; no samples were run in strong rain. An occasional sample was missed due to tide or weather: sometimes it was taken a day or two later.

The specimens were shaken from the net into glass jars (sometimes residue had to be picked out with an aspirator) which were stored in a freezer chest at about -17°C to be sortedand processed later after being crudely sorted and transferred into small vials. Certain thrips (Thysanoptera), microhymenoptera, spiders, mites and others managed to revive after up to three days in the freezer: thus samples were best sorted after up to four days or later.

Specimens are being dry-mounted where possible and used to expand the collection.

The decision against more intensive sampling was mainly influenced by the small areas sampled from: it avoided any possibility of oversampling at any time and reduced trampling of the vegetation. In W1 zone, a few "paths" were used more than once at least in part, but the substrate was noted to deteriorate rapidly and a normal vegetation pattern never restored itself: it appeared better to penetrate the zone at new places each time.

Initially the sampling method called for the use of a vacuum sampler to establish a close estimate of the absolute populations: a suction trap appears to be the only relatively convenient and uniform apparatus for doing so, especially where quite active insects are concerned (Fuchs and Harding, 1976; Stern, 1973; Dietrick, Schlinger and Van der Bosch, 1959). Unfortunately the D-Vac machine obtained broke down and repairs were not finished in time to allow for its use. Also, the initial sampling delay caused a lack of early data (the first sample runs were on June 2); hopefully at least a partial compensation shall come in continuing the sampling well into the fall. It is perhaps unfortunate that only relative population data will be gathered: these should however, be well sufficient to point out important population trends.

RESULTS AND DISCUSSION

To the writing of this report, almost 300 samples have been taken and transferred in vials into cold storage. Over 60% have had all the Homoptera extracted, sorted and counted (all nymphs are also considered in this study). The species categories are still tentative only; since no experienced taxonomist is at hand, no species have been identified yet. Representative samples will be submitted to Ottawa. An estimate of the species distribution can be made.

Delphacidae	5 species (including brachypterous forms)
Cicadellidae	8 species
Cercopidae	2 species
Membracidae	1 species
Cixiidae	1 species

The most commonly occurring are Delphacidae, 2 species, and Cicadellidae, 3 species.

These shall be subject to multivariate analysis, possibly towards a partial fulfillment of the requirements for the degree of BSc. Honours.

Of the Delphacids, one species appears to be restricted to the lower horizons of the S. patens, and the samples are probably very biased. The numbers of brachypterous forms are likewise expected to show bias since these individuals were observed to occur most plentifully in an area which was not sampled as a separate zone; a small pale patch of high-lying S. patens.

Most of the rare Cicadellidae were captured in zone W5 and are not characteristic of marsh fauna; their numbers are too low for analysis. An attempt will will be made at grouping the instars of the nymphs of the common species; special care was paid to the tiny early instars to ensure no significant underestimation of the population sampled.

Very few Cercopid nymphs were taken, supporting the observation that they occur at quite low levels of vegetation. The adults, though not common, may be considered for analysis. The Cixiidae and Membracidae will be omitted; the former are widespread but infrequent, the latter are found mainly on Solidago sp. and the samples give no accurate indication of the populations present.

The diversity of Homoptera in zone W5 is doubtless enhanced by the variety in plant species. Denno (1977) found more homopteran species in S. patens than in S. alterniflora, and this study will likely show the same; also, throughout the early summer, zone W4 often showed the highest numerical counts.

Marples (1966) indicated the importance of spider predation, and (in agreement with Denno's work), zone W4 was observed to maintain the highest population of lycosid spiders, some of which were seen taking homopteran prey; they probably lower potential leafhopper numbers considerably.

Apart from the Homoptera, insects appearing suitable for population analysis include flies of the famalies Ephydridae, Chloropidae, Dolichopodidae, Otitidae, Sciomyzidae, and possibly Tipulidae. Although tabanids were very common this season (both Chrysops sp. and Tabanus sp.), their fast flight caused low numbers to be captured. Fly populations may be examined depending on time and resources.

A brief but revealing preliminary analysis has been carried out on the two species of rather prominant flies, in the family Otitidae, present abundantly throughout the marsh: the results are presented in the three graphs attached. Detailed analysis has not yet yet been attempted, but the results included here already show undeniable trends which tempt to further work.

Taking advantantage of the large number of samples, averaging was used extensively to reduce weather bias and eliminate the effect of any missed samples.

Seasonally, the populations of both species (labelled Otid and Otil) peaked around June 20: this coincides closely with the spring tides. Until some information is obtained on the habits and life cycles of these flies, no explanations shall be offered for the trends observed, though a few calculated guesses cannot be resisted. Some species of Otitids are stem borers: if these species are included, the observed peak of adult numbers would allow oviposition at a time when the vegetation is undergoing a period of rapid growth and proliferation. If however, these species are detrivores, at higher levels of the marsh, the adult stage could be the most sensible way of surviving the floodings. The first theory appears more reasonable by intuition: it is also supported by Cameron's (1972) find that herbivore populations in Spartina foliosa peak during spring months.

Most otitids were taken in zone W5, in the mornings and evenings, and both species appear alike in adult habits and distributions. The importance of larval habitat to adult distribution, such as was noted by Simpson (1976) in Ephydridae, may also pertain to Otitids. A large catch, apparently, is not necessarily correlated with activity: the most active period may occur at the height of day with the populations widely dispersed.

CONCLUSIONS

Sufficient data on the relative populations of at least five species of Homoptera has been gathered to allow for multivariate analysis: the variables of time, vegetation (type and biomass), tidal cover, light intensity, wind intensity, and temperature will be considered. Additionally, populations of certain fly species may be assessed by the Shannon-Weaver Index (Cameron, 1972). As a by-product of the sampling technique abundant material has been accumulated for the expansion of the general collection. A surprising number of Microhymenoptera has been taken: these will be sent to the Biosystematics Research Institute in Ottawa for identification, along with specimens of other taxonomic groups.

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FIGURES

Figure 1: Plot of total average population per site throughout the sampling season. Given values are averages of catch over the 2-day sampling periods.

● - Otids

○ - Otils

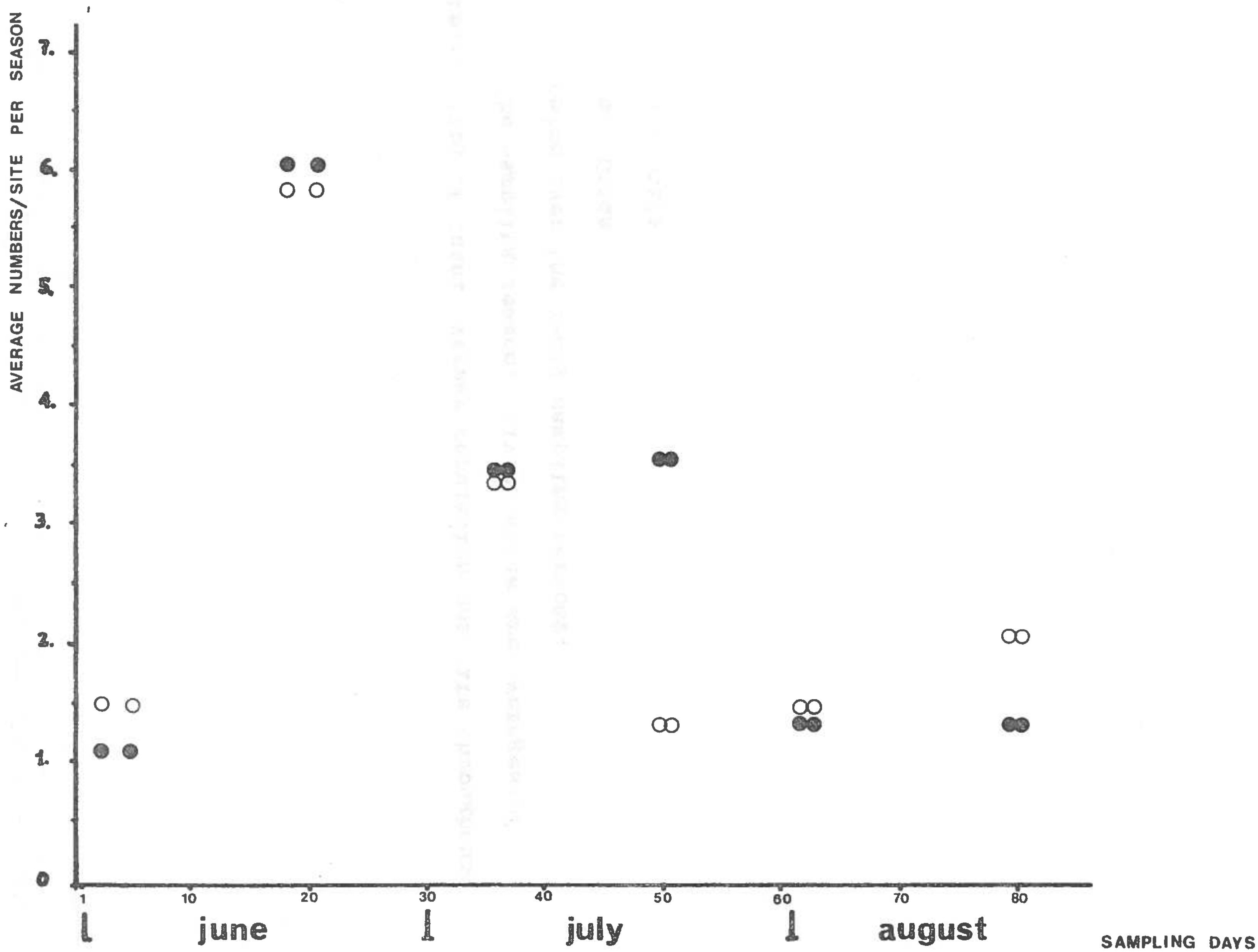

AVERAGE NUMBERS/SITE PER SEASON
7.
6.
5.
4.
3.
2.
1.
0
1
10
20
30
40
50
60
70
80
june
july
august
SAMPLING DAYS

Figure 2: Seasonal population totals in each of the five zones.

● - Otids

○ - Otils

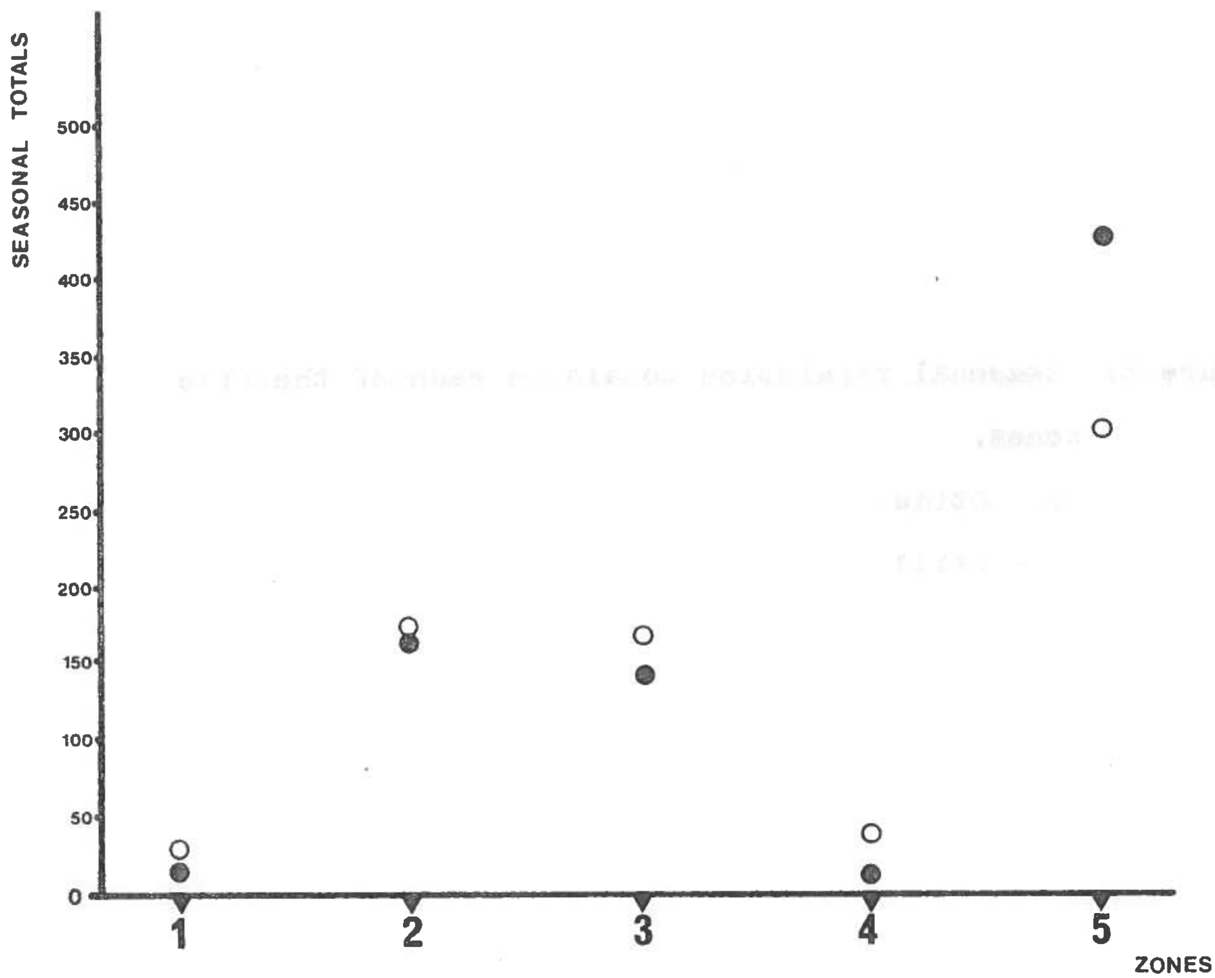
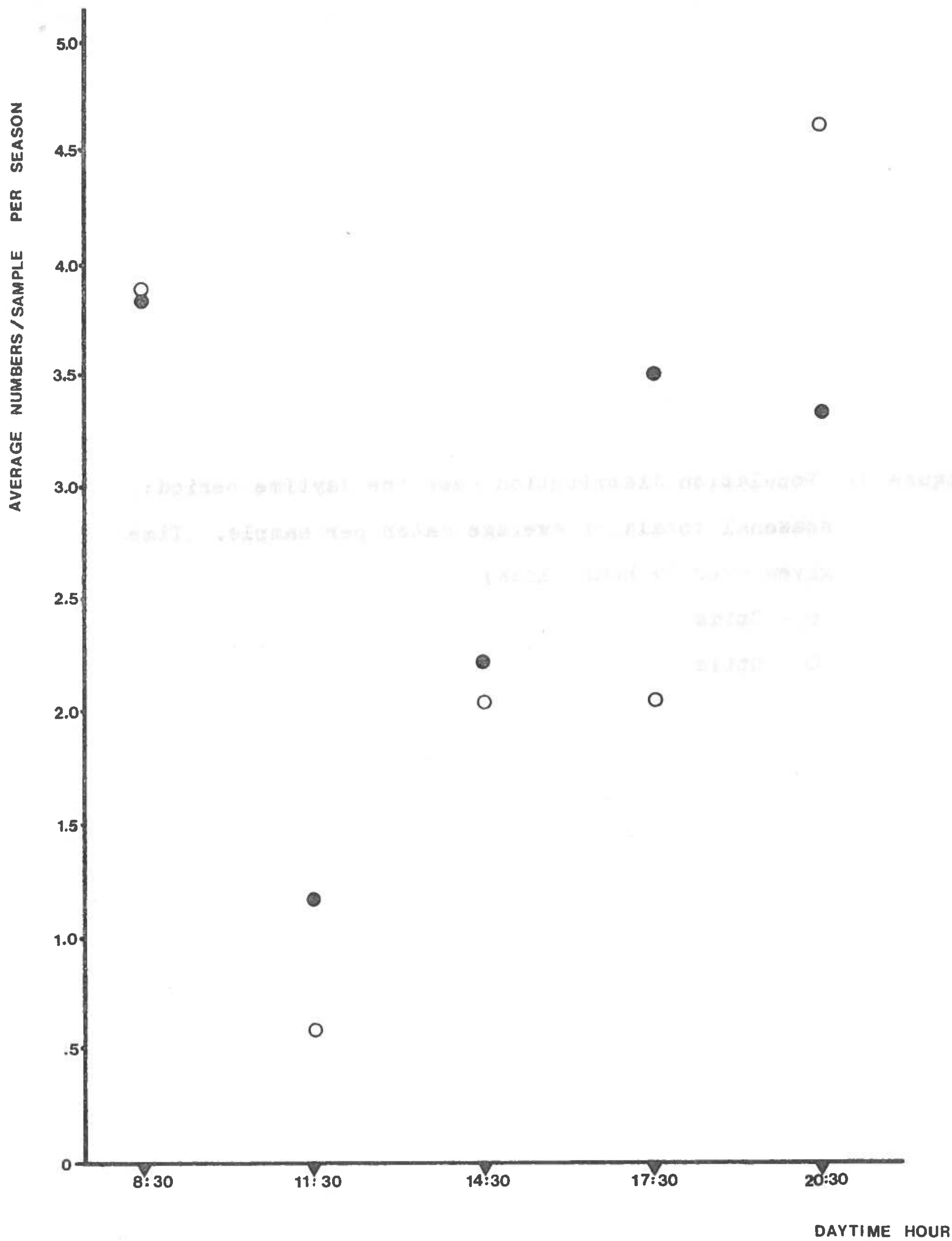

SEASONAL TOTALS
500
450
400
350
300
250
200
150
100
50
0
1
2
3
4
5
ZONES

Figure 3: Population distribution over the daytime period: seasonal totals of average catch per sample. (Time given over 24 hour clock).

⊕ - Otids

O - Otils


5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
AVERAGE NUMBERS / SAMPLE PER SEASON
8:30
11:30
14:30
17:30
20:30
DAYTIME HOUR

APPENDIX I

APPENDIX I

PARTIAL FAMILIES LIST OF SALTMARSH COLLECTION HOLDONGS

Only insects identified to date to family or beyond are included. The list arrangement follows Borror & DeLong (1964).

+ - regular visitors

* - commonest and/or most diverse families

! - accidental vagrants, or very rara

Subclass PTERYGOTA

Order: Ephemeroptera

Superfamily: Leptophlebioidea Family: Leptophlebiidae !

Odonata

Suborder: Anisoptera

Aeshnoidea	Aeshnidae +
	Gomphidae !
Libelluloidea	Libellulidae +
Zygoptera	Coenagrionidae

Orthoptera

Caelifera

Acridoidea	Acrididae
Ensifera	Tettigoniidae
	Gryllidae

Hemiptera

Hydrocorizae	Corixidae *
Amphibicorizae	Gerridae !
	Saldidae *

Hemiptera con't.

Geocorizae		Miridae *
		Reduviidae
		Lygaeidae !
		Pentataomidae
Homoptera		
Auchenorrhyncha		
	Cicadoidea	Membracidae
		Cercopidae
		Cicadellidae *
	Fulgoroidea	Delphacidae
		Cixiidae
Sternorrhyncha		
	Psylloidea	Psyllidae
	Aphidoidea	Aphididae
Coleoptera		
Adephaga		Cicindelidae
		Carabidae *
		Haliplidae !
		Dytiscidae !
Polyphaga		
	Hydrophiloidea	Hydrophilidae *
	Staphylinoidea	Staphylinidae
		Pselaphidae
	Scarabaeoidea	Scarabaeidae !

Polyphaga con't.

Dryopoidea	Heteroceridae
Elateroidea	Elateridae
Cantharoidea	Cantharidae +
Chrysomeloidea	Chrysomelidae
Curculionoidea	Curculionidae

Trichoptera

	Hydropsychidae !

Lepidoptera

Frenatae

Pyralidoidea	Pyralidae *
Geometroidea	Geometridae
Papilionoidea	Papilionidae +
	Satyridae

Diptera

Nematocera

Tipuloidea	Tipulidae *
Culicoidea	Culicidae *
	Ceratopogonidae *
	Chironomidae *
	Simuliidae
Bibionoidea	Bibionidae !
Mycetophiloidea	Sciaridae
	Scatopsidae

Diptera con't.

Brachycera

Tabanoidea Stratiomyidae

Tabanidae *

Empidoidea Empididae

Dolichopodidae *

Cyclorrhapha

Lonchopteroidea Lonchopteridae

Syrphoidea Pipunculidae

Syrphidae

Nothyboidea Psilidae

Tephritoidea Otitidae *

Tephritidae !

Sciomyzoidea Sciomyzidae *

Milichioidea Sphaeroceridae

Drosophiloidea Ephydridae *

Chloropoidea Chloropidae *

Muscoidea Anthomyiidae

Muscidae

Oestroidea Tachinidae

Hymenoptera

Symphyta

Tenthredinoidea Tenthredinidae !

Apocrita

Ichneumonoidea Braconidae

Ichneumonidae *

Apocrita con't.

Chalcidoidea	Eulophidae	
	Encyrtidae	
	Eurytomidae	
Scolioidea	Formicidae *	
Apoidea	Apidae	

INTERTIDAL MACROBENTHOS OF SIX PERMANENT TRANSECTS IN THE WESTERN MINAS BASIN:

I. DOMINANT POLYCHAETA AND MOLLUSCA

E.P. McCurdy

INTRODUCTION

The purpose of this study was to identify and to monitor the changes in intertidal invertebrate populations in the Minas Basin during the period May to August, 1978. Major taxa collected included polychaetes, pelecypods, and the amphipod Corophium volutator. The growth rate of the latter was also investigated. These organisms are a major food source for the hundreds of thousands of shorebirds using the Minas Basin as a stop-over during fall migration.

This study is basically a continuation of one initiated last summer. Data of this sort, especially over several seasons, is essential in determining longterm faunal variations that may be brought about by sudden environmental changes.

Transects sampled this year were those set up last year; the six sites were at Avonport, Evangeline Beach, Starrs Point, Kingsport, Blomidon Park, and Scot's Bay. A brief description of each transect follows.

Scot's Bay - This transect begins in the sandy area below the large pebbles of the high intertidal area and is 900 m long, with 7 stations 150 m apart. The substrate of fine sand is similar for all stations.

Blomidon - This transect is 600 m, composed of 7 stations 100 m apart, running from the sandy upper beach through a muddy area, to the lower intertidal zone. The remainder of substrate is composed of silt and sandstone-shale fragments, which compose a layer 10-15 cm thick over the bedrock.

Kingsport - This transect is 500 m, with stations 100 m apart. The substrate types here, such as sand, silt-clay, silty sand and muddy rocks are represented by the six stations, which run from the wharf to the low intertidal area.

Starrs Point - This transect is composed of 9 stations, 150 m apart, and is 1200 m in length. The substrate for all stations is similar, and is made up of silt over a clay layer.

Evangeline - This is the longest transect, 1650 m. Its 12 stations, 150 m apart, extend from the sandy upper beach, through various mixtures of silt and clay, to the sandy area of the lower intertidal zone.

Avonport - This transect is 900 m, with stations 150 m apart. Stations 1 and 7 are located in sandy substrate, while 2 through 6 are situated in substrate of silt and clay.

MATERIALS AND METHODS

Triplicate samples were taken at each station once a month, May through August, 1978, using two different sized samplers, and sieved in the field, using two different sized mesh. One sample, 15cm X 15cm X 20cm, was sieved through a #20 sieve (Tyler CSA) while two samples, 10cm X 10cm X 10cm were sieved through a #40 sieve (Tyler CSA). Sieve contents were bottled in a 5% formalin solution. The organisms were later sorted in the laboratory and stored in 70% ethanol. These invertebrates, mainly polychaetes, pelecypods, and gastropods, were identified to species and enumerated.

RESULTS

All species collected and their densities per meter squared for May, June and July along each of the transects are listed in Tables 1 to 6 inclusive.

Polychaetes comprise an important group of intertidal organisms in the Minas Basin. The more numerous species included Heteromastus filiformis, Chaetozone setosa, Eteone longa, Nephtys caeca, and Spiophanes bombyx. Macoma balthica was the most common Pelecypod, although this group was less important than Polychaetea or Corophium volutator. A brief discussion of the above species follows.

Heteromastus filiformis

This species appears to be the most widely distributed polychaete in the Minas Basin, occurring wherever the substrate is muddy. Highest numbers of Heteromastus were found at Starrs Point and Evangeline, while none were collected at Scot's Bay, no doubt because of lack of suitable substrate.

Numbers of Heteromastus remained generally constant throughout May, June and July, except for a slight increase in June and July at Kingsport. Last year in the same area this species exhibited an overall increase during the summer (Fuller and Trevors, 1977) and Watling (1975) reported a general summer increase in numbers of Heteromastus with random fluctuations. H. filiformis is an opportunistic species in that it rapidly expands its numbers to fill a gap left by the decline in numbers of other species (Buchanon and Warwick, 1975) causing random fluctuations noted by several researchers (Watling, 1975; Gratto, 1977; McCurdy, 1977).

It would appear that there exists an inverse relationship between H. filiformis and the amphipod Corophium volutator, with high numbers of one reflecting low numbers of the other at the same station, as suggested by Gratto (1977).

Chaetozone setosa

Little is known of this species in the Minas Basin. High numbers occur in very muddy substrates, notably along Starrs Point and rather high intertidally at Evangeline, Kingsport, and Avonport. Several samples with over 500 specimens (i.e. 50,000 per m^2) have been collected in these areas and samples with 150 to 200 Chaetozone are common. A small polychaete usually only retained in the #40 sieve, Chaetozone setosa was incorrectly identified as Tharyx sp. in Fuller and Trevors (1977). Large populations appear to occur in conjunction with high numbers of Heteromastus filiformis and, to a lesser degree, Streblospio benedicti. No trend in seasonal distribution could be determined.

Eteone longa

Eteone longa is the most abundant errant polychaete in the Minas Basin. It is found in various types of substrate at various heights intertidally all over the Basin but occurs most frequently in muddy sand low intertidally. This concurs with Pettibone (1963) who reported that E. longa is found at low water in mud flats, muddy sand, sand and gravel, but may occur rather high intertidally.

Along all transects numbers of E. longa greatly increased in July. This is likely due to larval settlement and subsequent growth from May spawning (Pettibone, 1963). This species was more abundant this year than last along the same transects (Fuller and Trevors, 1977).

Nephtys caeca

Nephtys caeca occurred most abundantly at Scot's Bay in fine sand, but specimens were collected in a wide variety of substrates throughout the Basin. Stopford (1951) reported N. caeca to inhabit clean coarse sand near the low tide level in England.

During the summer numbers of N. caeca increased along all transects while numbers of young Nephtyidae (5 to 7 mm) decreased greatly from May to JUly. These young Nephtyidae generally occur in mud or sandy mud and their summer decline in numbers is likely a reflection of an increase in size and their moving to a more suitable sandy habitat, perhaps subtidally.

Spiophanes bombyx

This species appears to be limited in distribution by substrate. Spiophanes is a tube building spionid, and occurs in highest numbers in sandy sediments, often along with Clymenella spp. It occurs at Scot's Bay and the lower Kingsport, Evangeline, and Blomidon stations, but is absent from muddy stations.

This species declined in numbers in July at Evangeline, Scot's Bay, and Kingsport and in June at Blomidon. Last year at the same sites, random fluctuations in numbers were exhibited (Fuller and Trevors, 1977). This may be due to extremely patchy distribution.

Macoma balthica

Macoma balthica was found throughout the Basin, but the highest numbers occurred at Blomidon in a muddy area around station 2. Here, densities of this bivalve increased throughout the summer, while numbers fluctuated at the same spot last year (Fuller and Trevors, 1977). The occurrence of Macoma high intertidally concurs with the findings of Anderson (1972) who reported this species in England in greatest numbers near high tide level.

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TABLES

Table 1

Density of Invertebrates ($\#/m^2$) at Soot's Bay

from May to July, 1978

SPECIES	DENSITY		
	MAY	JUNE	JULY
Nephtys caeca	90	139	97
Spiophanes bombyx	275	191	44
Orbina ornata	10	-	-
Pygospio elegans	-	71	97
Paraonis fulgens	13	71	141
Eteone longa	-	-	26

Table 2

Density of invertebrates (#/m^2) at Blomidon

from May to July, 1978

SPECIES	DENSITY		
	MAY	JUNE	JULY
Heteromastus filiformis	50	181	50
Eteone longa	107	175	680
Eteone heteropoda	3	-	3
Pygospio elegans	20	2870	1420
Nereis virens	67	40	50
Polydora ligni	-	-	27
Nephtys caeca	20	20	40
young Nephtys	60	7	54
Glycera dibranchiata	7	-	3
Paraonis fulgens	17	44	3
Exogone hebes	3	10	7
Spiophanes bombyx	330	44	104
Scolecolepides viridis	-	-	7
Scoloplos armiger	3	-	7
Syllis cornuta	-	-	3
Lumbrineris fragilis	-	-	3
Clyminella torquata	7	-	17
Streblospio benedicti	3	-	-
Spio setosa	3	-	-
Capitella capitata	3	-	-
Peloscolex benedini	7	20	24
Corophium volutator	3	-	3
Macoma balthica	220	326	343
Mya arenaria	13	7	10
Nasarrius obsoletus	-	3	-

Table 3

Density of invertebrates (#/m^2) at Kingsport

from May to July, 1978

SPECIES	DENSITY		
	MAY	JUNE	JULY
Heteromastus filiformis	620	922	984
Chaetozone setosa	675	1460	498
Eteone longa	114	200	710
Eteone heteropoda	-	8	-
Nephtys caeca	16	78	82
young Nephtyidae	125	98	31
Nereis virens	16	-	60
Streblosio benedicti	212	812	370
Pygospio elegans	8	240	125
Glycera dibranchiata	16	40	24
Polydora ligni	8	8	24
Spiophanes bombyx	576	750	275
Scoloplos armiger	-	8	12
Clymenella torquata	130	122	47
Clymenella zonalis	-	16	-
Exogone hebes	63	165	20
Phyllodoce mucosa	70	55	48
Paraonis fulgens	4	-	8
Nematodes	-	75	28
Macoma balthica	4	24	-
Mya arenaria	4	-	4
Gemma gemma	12	-	-
Notoplana sp.	-	4	-

Table 4

Density of invertebrates (#/m^2) at Starrs Point

from May to July, 1978

SPECIES	DENSITY		
	MAY	JUNE	JULY
Heteromastus filiformis	3532	3161	3540
Chaetozone setosa	1205	771	2735
Streblospio benedicti	1111	727	881
Eteone longa	186	141	254
Eteone heteropoda	11	29	55
Eteone lactea	-	8	10
Scoloplos armiger	16	24	-
Scoloplos fragilis	47	78	24
young *Nephtys*	125	44	8
Pygospio elegans	31	10	-
Glycera dibranchiata	8	24	5
Spiophanes bombyx	-	-	8
Polydora ligni	-	-	5
Nasarrius obsoletus	18	42	21
Macoma balthica	3	3	-
Mya arenaria	-	3	-
Gemma gemma	3	-	-
Cerebratulus lacteus	3	5	5

Table 5

Density of invertebrates (#/m^2) at Evangeline

from May to July, 1978

SPECIES	DENSITY		
	MAY	JUNE	JULY
Heteromastus filiformis	1625	1316	2375
Chaetozone setosa	2724	278	3008
Streblospio benedicti	396	570	440
Pygospio elegans	2	598	163
Nephtys caeca	16	30	24
young Nephtyidae	531	122	33
Scoloplos fragilis	228	360	70
Scoloplos armiger	-	6	-
Eteone longa	98	594	2030
Eteone heteropoda	14	10	124
Eteone lactea	-	2	6
Nereis virens	-	-	14
Glycera dibranchiata	39	31	25
Spiophanes bombyx	828	1012	631
Exogone hebes	6	50	4
Clymenella torquata	76	106	61
Nematodes	2	-	-
Cerebratulus lacteus	6	6	6
Nasarrius obsoletus	18	20	51

Table 6

Densities of invertebrates (#/m^2) at Avonport

from May to July, 1978

SPECIES	DENSITY		
	MAY	JUNE	JULY
Heteromastus filiformis	1331	1143	1291
Chaetozone setosa	175	723	538
Streblospio benedicti	94	228	94
Nephtys caeca	20	30	34
young Nephtyidae	280	90	188
Nereis virens	3	3	30
Eteone longa	74	114	696
Eteone heteropoda	7	-	7
Eteone lactea	-	3	-
Glycera dibranchiata	-	-	7
Scoloplos armiger	-	3	-
Scoloplos fragilis	30	20	3
Pygospio elegans	-	598	282
Clymenella torquata	3	-	3
Macoma balthica	17	24	10
Mya arenaria	3	20	3
Nasarrius obsoletus	20	24	-
Cerebratulus lacteus	-	-	7

Figure 1: Map of the southern bight of the Minas Basin showing the sites of the six permanent transects.

1 - Scot's Bay

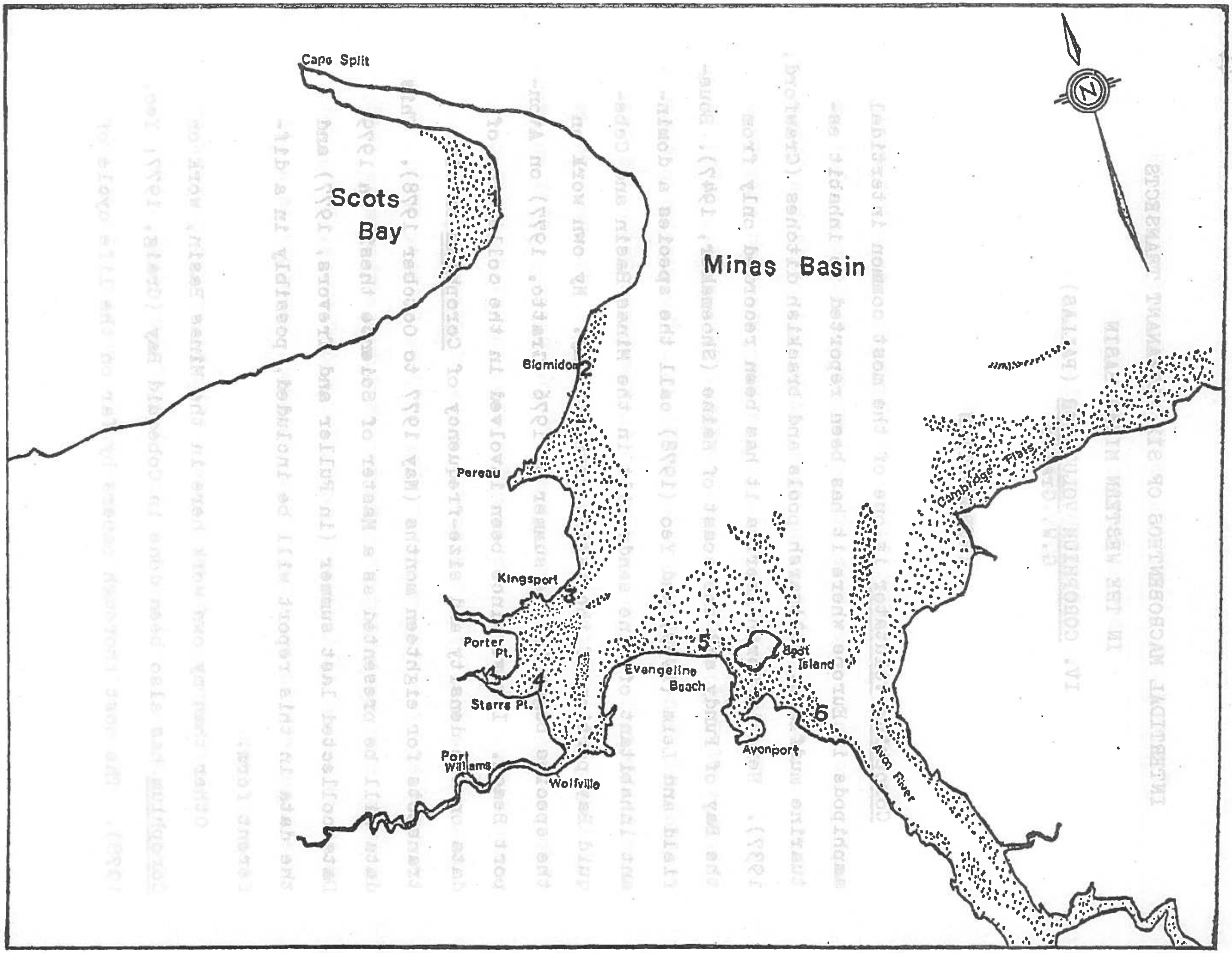
2 - Blomidon

3 - Kingsport

4 - Starrs Point

5 - Evangeline Beach

6 - Avonport


Cape Split
Scots Bay
1
Minas Basin
Blomidon
2
Pereau
Kingsport
3
Porter Pt.
4
Starrs Pt.
Port Williams
Wolfville
Evangeline Beach
5
Boot Island
6
Avonport
Avon River
Cambridge Flats
N

INTERTIDAL MACROBENTHOS OF SIX PERMANANT TRANSECTS IN THE WESTERN MINAS BASIN

IV. COROPHIUM VOLUTATOR (PALLAS)

G.W. Gratto

INTRODUCTION

Corophium volutator is one of the most common intertidal amphipods in Europe where it has been reported to inhabit estuarine mudflats, saltmarsh pools and brackish ditches (Crawford, 1937). Here in North America it has been recorded only from the Bay of Fundy and the coast of Maine (Shoemaker, 1947). Bousfield and Leim (1959) and Yeo (1978) call the species a dominant inhabitant of fine sandy silt in the Minas Basin and Cobequid Bay portion of the basin, respectively. My own work on the species began in the summer of 1976 (Gratto, 1977) on Avonport Beach. I have since been involved in the collection of data on the density and size-frequency of Corophium on six transects for eighteen months (May 1977 to October 1978). This data will be presented as a Master of Science thesis in 1979. Data collected last summer (in Fuller and Trevors, 1977) and the data in this report will be included, possibly in a different form.

Other than my own work here in the Minas Basin, work on Corophium has also been done in Cobequid Bay (Craig, 1977; Yeo, 1978). The most thorough papers by far on the life cycle of the species have been done in England. The best paper was Watkin (1941) in addition to more limited papers by Hart (1930) and McLusky (1968).

MATERIALS AND METHODS

The methods (sample sizes, sieve sizes and techniques used) were the same as those used by McCurdy (see preceeding section of this report) as the Corophium were picked from the same samples used there for polychaetes and molluscs.

Once the Corophium had been separated out they were placed in vials containing 70% ethanol. They were then placed into size classes. The size classes were "large" (8mm), "medium" (3 to 8mm) and "small" (3mm).

RESULTS

Corophium was present at five of the six transects sampled. The species was not found at Scots Bay on any of the three sampling periods this summer. Of the five remaining transects, the density (Table 1) followed the same pattern of a sharp increase from May to June with a lowering of the rate of increase to July on four transects. These were Blomidon, Kingsport, Starrs Point and Evangeline. At the fifth, Avonport, the density rose to a peak in June, dropping back moderately in August.

Table 2 gives the percentage of the three size classes for each beach. Note the similarity of values for May; over ninety-seven percent of the population was composed of the medium and large size classes on all the beaches. In June the percentage of small individuals rose but only at Avonport was it above the percentage of the medium size. The percentage of the medium-sized Corophium again becomes the dominant size-class in July as the large size-class decreases in percentage.

DISCUSSION

The pattern of changing percentages may be used to demonstrate the widely recognized two yearly generations of Corophium (Watkin, 1941; Gratto, 1977; Yeo, 1978). The first generation is that which is hatched in late May and early June. This generation causes the increase in the size of the small size-class in June and, as the young rapidly mature, causes the increasing percentage of medium size Corophium in July. This generation is able to reproduce usually in August. The resulting brood becomes the overwintering (second) generation which develops slowly throughout the winter to produce a new brood the following spring (May, early June). This lack of winter reproduction creates the very large percentage of the medium size Corophium as well as the large sized individuals evident in May.

This year the life cycle of Corophium volutator appears to be two weeks ahead of that found last year. This conclusion is drawn from the percentage data. The percentage of the small size-class is down considerably over last June. This seems to indicate that the peak of small sized Corophium had already passed as of June sampling whereas last year the samples were taken when the new brood was in the small size-class. This year the new brood was collected at a time when a large number of the small sized Corophium had crossed over the dividing line into the lower end of the medium size-class range. This resulted in the decreased percentage of small individuals over last year.

Avonport has the largest population of Corophium of all the transects (densities of up to $73,000/m^2$ were found this summer), and thus should lend itself better to an examination of the longterm dynamics of a population of Chrophium. After examining the data collected over the past three summers, I find that there are three separate patterns of population growth. In 1976 (Gratto, 1977), the population peaked in July, after the first major brood of the summer had appeared. This is the pattern which has been observed in the Cobequid Bay portion of the Minas Basin (Yeo, 1978). He found that despite a subsequent major brood release, high mortality rates reduced the population after late July and early August. In 1977 (Fuller and Trevors, 1977; corrected data in Table 3 of this report), the population did not peak until September, after the release of the second major brood which was larger than the first. This past summer, 1978, the population at Avonport peaked in late June. As the remaining four transects were still rising at this time, it is quite possible that this was a false peak. Samples collected in August and September must be examined to verify this.

This wide range of variability makes it necessary to have a number of years' data before making accurate predictions about the future population changes of such an ecologically important species as Corophium volutator.

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TABLES

Table 1

Densities of size classes of Corophium volutator for the three months studied

Transect	Small < 3mm	Medium 3mm- 8mm	Large > 8mm	Total
May				
Blomidon	0.0	104.1	0.0	104.1
Starrs Point	15.6	747.6	101.7	864.9
Evangeline	6.9	212.7	21.1	240.6
Avonport	3.6	1857.3	609.0	2469.9
June				
Blomidon	151.2	299.1	70.5	520.8
Kingsport	35.1	435.0	7.8	477.9
Starrs Point	363.3	3220.8	188.1	3772.2
Evangeline	506.7	1514.4	147.3	2169.4
Avonport	8648.7	4907.7	1694.1	15250.5
July				
Blomidon	57.0	699.0	137.7	893.7
Kingsport	125.4	690.0	3.9	819.3
Starrs Point	264.0	3814.2	20.9	4099.1
Evangeline	126.0	2400.0	0.0	2526.0
Avonport	2827.2	9217.2	441.9	12486.3

Table 2

Percentages of size classes of Corophium volutator for the three months studied

TRANSECT	SIZE CLASSES SMALL	MEDIUM	LARGE
May			
Blomidon	0.0	100.0	0.0
Starrs Point	1.8	86.4	11.8
Evangeline	2.9	88.4	8.7
Avonport	0.1	75.2	24.7
June			
Blomidon	29.0	57.4	13.5
Kingsport	7.3	91.0	1.6
Starrs Point	9.6	85.4	5.0
Evangeline	23.4	69.8	6.8
Avonport	56.7	32.2	11.1
July			
Blomidon	6.4	78.2	15.4
Kingsport	15.3	84.2	0.5
Starrs Point	6.4	93.0	0.5
Evangeline	5.0	95.0	0.0
Avonport	22.6	73.8	3.5

Table 3

Correction of Table 14 (p. 60)

from Fuller and Trevors (1977)

Densities and size classes of Corophium volutator

for the three months studied

TRANSECT	SIZE CLASSES SMALL	MEDIUM	LARGE	TOTAL
May				
Scot's Bay	0.0	2.1	0.0	2.1
Blomidon	0.0	143.8	4.2	148.6
Kingsport	9.9	189.9	4.9	204.7
Starrs Point	3.3	407.8	46.0	457.1
Evangeline	2.7	209.9	2.7	215.3
Avonport	5.6	1852.1	86.1	1943.8
June				
Blomidon	36.9	124.2	80.6	241.7
Starrs Point	1117.6	691.9	13.1	1822.6
Evangeline	62.0	10.7	2.1	74.8
Avonport	5043.9	1565.2	639.3	7248.4
July				
Blomidon	20.1	275.3	6.7	302.1
Kingsport	3.9	19.6	0.0	23.5
Starrs Point	39.2	919.1	10.4	968.7
Evangeline	6.4	151.7	2.1	160.2
Avonport	2411.7	9571.9	612.8	12596.4

THE INVERTEBRATE FAUNA OF THE INTERTIDAL FLATS FROM CAPE BLOMIDON TO HORTON BLUFF

G.W. Gratto

ABSTRACT

Over nine hundred 10 X 10cm samples were taken on the intertidal flats from Cape Blomidon to Horton Bluff in the southern bight of the Minas Basin, Nova Scotia. Approximately forty kilometers (twenty-five miles) of coastline was surveyed in the eight week period from May 29 to July 25. Of the seventy-six species of invertebrates encountered, thirty-six were polychaetes and twenty-three crustaceans.

Three major types of flats are defined (sand, "firm" mud and "soft" mud) on the basis of substrate zonation. The faunal association of each type is discussed.

When the data for all nine hundred plus samples was combined and averaged a density of slightly over 10,000/m^2 was arrived at. However the density of the samples taken along forty consecutive transects in a "soft" mud area was about 1.7 times that figure.

INTRODUCTION

The objective of this study was to provide data on the distribution of the benthic invertebrates on the intertidal flats of the southern bight of the Minas Basin, Nova Scotia.

Previously, the most extensive study in this area was that of Bousfield and Leim (1959). They reported one hundred ninety-five species of invertebrates. These were collected mainly from dredge samples and shore sampling at scattered sites in the Minas Basin and Channel. The Polychaeta and Hydrozoa in this area were examined in detail by Petersen and Petersen (1976). Craig (1977) reports that only forty-two species of invertebrates were found on the intertidal flats of the eastern end of the Minas Basin (Cobequid Bay).

No studies of this type, or magnitude, have been attempted in this area. In fact, no intertidal study of this nature was found after an extensive search in the literature although there have been similar subtidal studies in the United States (Sanders, 1960; Mauer et al, 1978).

MATERIALS AND METHODS

To achieve the most opportune compromise between completely blanketing the area and remaining within the fourteen week framework of the project, the distance of two hundred meters was chosen as the distance most suited for spacing the samples. To minimize equipment to be hauled over the flats the number of paces required by a given person to walk the two hundred meters was used to calculate the spacing of the samples. As the mud became thicker, the paces became smaller, resulting in a lessening of the two hundred meter intervals and better coverage in areas of deep mud. Along Evangeline Beach (transects 155 to 164) and on the end of Starrs Point (transect 118), three hundred meter intervals were used due to the width of the flat.

The samples were taken using a 10 X 10 X 10cm sampler and sieved through a sieve with openings of 425 (Canadian Standard Sieve size #40). Sieves with openings of this size were used as previous research in other years indicated that they retain even very small invertebrates such as Nematoda and Copepoda. The sample size was required to ensure that all the invertebrates collected could be sorted, identified and counted in the time available. The sorting and collecting procedures are described by McCurdy in section C of this report. Identification of the specimens was done by McCurdy and myself using the best keys available to us (Pettibone, 1952; Gosner, 1971; Bousfield, 1973; Brinkhurst et al, 1976; Linkletter, 1977). Questionable identifications and unknowns are being sent to appropriate specialists for verification.

The transects were sampled on the dates found in Table 1.

Table 1

Sampling dates of all two hundred twenty-one transects

MONTH	DAY	TRANSECTS
May	29	1 - 4
	30	5 - 12
	31	13 - 20
June	1	21 - 28
	5	29 - 36
	7	37 - 44
	8	45 - 51
	12	52 - 57
	13	58 - 67
	14	68 - 77
	15	78 - 85
	26	86 - 93
	27	94 - 102
	28	103 - 111
	29	112 - 121 (≠118)
July	4	128 - 140
	5	122 - 127, 118
	6	165 - 180
	7	141 - 154
	10	155 - 164 (≠161)
	11	181 - 189, 161
	12	190 - 199
	13	200 - 205
	24	206 - 211, 219, 220
	25	212 - 218

ANNOTATED LIST OF SPECIES

This list contains all seventy-six species found in the samples together with a few comments on their respective distributions. The raw data is found in Appendix I.

PLATYHELMINTHES

Turbellaria

Notoplana sp.

The only platyhelminth collected, this species was always found in areas with rocks in the immediate vicinity. Notoplana are commonly seen on the underside of rocks at White Waters and Kingsport.

NEMERTINA

Lineus sp.

This species is also most often associated with rocks and to a lesser extent coarse sand. This accounts for its sparse distribution in the area (only found from Blomidon to Longspell Point).

Cerebratulus sp.

There appeared to be two distinct sizes (species?) in the samples. One was small ($<$3cm) and thin. They appeared to prefer sand and were most commonly found on the sandflats from White Water to Longspell Point and on the upper stations (1 or 2) of scattered transects thereafter. The larger specimens were found only in mud areas. Previous observations have led me to believe that they primarily inhabit the clay layer (Gratto, 1977).

Amphiporus sp.

Found at only seven stations, six of those were along transects 25 to 28.

NEMATODA

unknown species

Due to the small diameter of the specimens, numbers would have undoubtably been greater had a smaller meshed sieve been used. Our results show an increase in the number of occurrences of nematodes on the upper half of transects 53 to 64.

MOLLUSCA

Gastropoda

Polinices heros Say

Collected only twice in the survey, many more were seen at low water, especially at Kingsport and Evangeline Beach. The majority were seen on sand.

Nassarius obsoletus Say

Sparse populations of Nassarius may be found anywhere in mud from White Water to Horton Bluff, even in a silt veneer over sand and bedrock. This species becomes more common between

Longspell Point and Avonport where mud is the most common substrate. The greatest densities occur in areas of soft mud in the Canning and Canard River estuaries and are concentrated along the edge of the marshes. Specimens of the rare white banded form (Abbot, 1974) were seen in the Canard estuary.

This species appears to congregate in localized areas during the winter. Thousands were found in a small pool at the base of the cliff at Starrs Point as the ice thawed this past spring. The population then spread outward from this point during late spring and occupied the remainder of its territory.

Nassarius trivittatus Say

A single specimen was found: at station 1 on a transect on the east side of Starrs Point. This is very unusual as the species is usually observed near low tide on rocks, gravel or in tidepools.

Pelecyopoda

Ensis directus Conrad

More common than is indicated by the two specimens found, the problem of collection of Ensis is that they burrow too deeply to be sampled in a sample 10 cm deep. The greatest observed density of Ensis was along Kingsport in the lower intertidal zone.

Mytilus edulis Linnaeus

This species was found only once, on exposed bedrock with very little silt coating, off Long Island Head. The species is rather uncommon in the Minas Basin (Bousfield and Leim, 1959) as are most filter feeders.

Petricola pholadiformis Lamarck

Only one specimen was collected. This species was commonly seen burrowing in exposed hard clay on the eastern end of Evangeline Beach and on Boot Island. They are also found in large numbers in abandoned holes of the sandstone burrowing clam Zirphaea crispata Linnaeus off Cape Blomidon.

Gemma gemma Totten

Found in scattered localities throughout the area, Gemma appeared to concentrate in the first three samples along a transect (the upper four hundred meters of intertidal zone).

Mya arenaria Linnaeus Figure 1

In contrast to the other most common bivalve Macoma balthica, Mya were found everywhere along the transects from high to low water although they were not found very often. They were more common north of Longspell Point, preferring less turbid waters as they filterfeed.

There are extensive areas of large (4 to 5cm long) Mya especially off Delhaven. These areas did not yield these larger specimens as they lie too deep in the substrate to be collected in a sample only ten centimeters deep. To achieve an accurate estimate of the density of Mya in these patches, larger areas must be excavated deeper.

Macoma balthica Linnaeus   Figure 2

Macoma was found primarily high intertidally and was located in small but dense patches all along the coast. As these patches were very small, less than ten meters wide, and quite rare, very few were taken in the samples as they were so easy to miss with the two hundred meter intervals used. Within these patches the density was usually quite high as is evidenced by the fifty specimens, many of which were very small, found in the first station on transect 161.

The feeding traces of apparently dense colonies were observed along the coast, especially at Starrs Point and Avonport, in the Spartina alterniflora beds. These areas were not sampled.

More Macoma were found after (south) of Longspell Point where mud was the dominant substrate. This is due to the fact that as detritus feeders they are not succeptable to gill clogging as are filterfeeders.

The species is definately more common in Cobequid Bay than in this area, as Yeo (1978) and others from McMaster University describe Macoma as one of the dominant species in that area.

ANNELIDA

Polychaeta

Sigalion arenicola Verrill

This species was found only once, and that was on the large Middle Ground bar. It was collected in an area of sand with very large ripple formations. There was nothing else in the sample.

Cirratulidae

Chaetozone setosa Figure 3

High densities of Chaetozone were very scattered from White Water to Kingsport with the only concentration occurring in the soft mud of the Pereau estuary. These high densities gradually became more numerous south of Kingsport, resulting in the major concentration of this species along the salt marsh south of Kingsport and on Porter Point. The density lowered only slightly as one travelled eastward along Starrs Point and the adjacent mudbar. Starting up Evangeline Beach from transect 128, the density progressed from nonexistance at the first ten transects to a secondary concentration of Chaetozone on the eastern end of the beach and on the western end of Boot Island. Populations in the Guzzle were very sparse. High densities were then found along Oak Island and the western end of Oak Island bar and along the western half of Avonport Beach. In all of the areas from Evangeline eastward, the highest densities are usually found quite close onshore, at stations 2 and 3.

This overall distribution is characteristic of the group of invertebrates found in the southern bight of the Minas Basin which dominate the "soft" mudflats. These species prefer substrates which are almost liquid in nature. This is created by the mixing of the silt and clay layer to form a homogenous ooze. Such substrate is characteristic of that occupying almost all the flats from Kingsport saltmarsh to just south of Starrs Point. "Soft" mud is also found on the upper half of the beach at Evangeline, the Guzzle, and at Avonport. Here the "soft" mud may change to a firmer substrate rather abruptly as one proceeds along a transect.

Phyllodocidae

Phyllodoce mucosa Oersted

This species was usually found at or near the end of transects whether the substrate was mud or sand, though the latter appeared to be preferred. The greatest densities were near Delhaven, Medford and on the middle of Evangeline Beach. Not found on large sections of the study area, the most significant of these absences occurred from transects 82 to 148 where the species is only present on the ends of four transects where sand is found.

Eteone heteropoda Hartman   Figure 4

One of the "soft" mud species, *E. heteropoda* was found only occassionally from White Water to Kingsport. The numbers became greater along Kingsport saltmarsh to Porter Point. From the eastern half of the Porter Point flat to the transect off the end of Starrs Point, E. heteropoda clearly dominates E. longa. Further along, the occurrence of E. heteropoda was clearly related to the patches of soft mud with the greatest populations occurring in the eastern end of Evangeline Beach, on Oak Island, and scattered along Avonport Beach. All of these patches were located on the upper half of the flats.

Eteone longa Fabricius Figure 4

This species was the most widespread errant polychaete found in this area. It occurred on all types of substrate from coarse sand to soft mud although densities were lower at these extremes in substrate types. The best type of substrate appeared to be a dry silty mud with little clay mixed in, such as that preferred by the amphipod Corophium volutator. The areas of greatest density were the end of Porter Point, the middle of Starrs Point, and the midintertidal zone from Long Island Head to the western half of Boot Island and Oak Island - Avonport Beach.

Eteone lactea Ciaparede Figure 4

This species was only confirmed from samples taken on Oak Island and Middle Ground. Because of the closeness in structure of the anal cirri of E. lactea and E. heteropoda, this being used to separate E. longa from E. heteropoda, it is quite possible that more E. lactea were found but not distinguished from the other species.

Syllidae

Syllis gracilis Grube

Of the three locations where Syllis was found, two of these were on or adjacent transects, 25 and 26. All three occurrences were on sand.

Eusyllis blomstrandi Malmgaren

Eusyllis was found on both sand or mud but most commonly on the former. The greatest density of occurrences was on transects 20 to 29.

Exogone dispar Webster

This species was found sparsely throughout the study area on mud and sand.

Exogone hebes Webster & Benedict

This species was identified only from station 10/5. There was also E. dispar in that sample.

Nereidae

Nereis virens Sars

The density of Nereis was very sparse on the first one hundred fifty transects (to the centre of Evangeline Beach).

Thereafter there was a fairly continuous population of the species on the upper half of the transects. This continued all the way to Horton Bluff.

Nephtyidae

young Nephtyidae Figure 5

All of the small specimens (under 1.5 cm) from this family are grouped as it was impossible to key such small specimens to species. In addition to the two species of _Nephtys_ listed below, two other species in the family have been found from this area _Micronephtys_ _minuta_ Theel (Peterson and Peterson, 1973) and _Nephtys_ _incisa_ Malmgren (McCurdy, unpublished data).

The young appear to concentrate more in mud than do the adults who prefer sand (Pettibone, 1963) although nothing was found in the literature on this apparent difference in substrate preference.

Nephtys _bucera_ Ehlers

A single specimen, the only large _Nephtys_ collected on Middle Ground, was identified as this species.

Nephtys _coeca_ Fabricius Figure 5

This species was found mainly on the sandflats throughout the study area although a number were found on firm mud. Sand is described by Pettibone (1963) as the preferred substrate for this species.

Glyceridae

Glycera dibranchiata Ehlers

Although this species is reported to have a preference for soft mud (Klawe and Dickie, 1957), very few were found in the area from Kingsport salt marsh to the north side of Starrs Point where soft mud is the dominant substrate.

The greatest number of occurrences was along Evangeline Beach and the western end of Boot Island. A lesser number were on Oak Island and Avonport Beaches. The majority of these were at the middle of the transects.

Lumbrinereidae

Lumbrinereis fragilis O.F. Miller

Only three specimens of this species were found on Oak Island Bar, another at Avonport and the third on Middle Ground.

Paraonidae

Aricidea suecica Eliason

Aricidea was identified only four times, all of which were on the first twenty-two transects. The stations were all on sand.

Paraonis fulgens Levinsen

Collected primarily from White Water to Longspell Point, the greatest number of occurrences was from Paddy Island to Longspell Point. The species was not found from Kingsport wharf to the end of Starrs Point. Only low densities were found on the remainder of the transects.

Dorvilleidae

Protodorvillea keferesteini McIntosh

Protodorvillea was collected only twelve times, all on the first 37 transects. The greatest concentration occurred on transects 24 through 29.

Orbiniidae

Scoloplos spp.

Both S. fragilis Verrill and S. armiger have been identified in the samples. Differentiation of the two species is difficult as the interramal cirrus present on the anterior abdominal parapodia of S. fragilis does not seem to be present on all the parapodia.

From the material examined in detail the two species seem to prefer different substrates. S. armiger was found most commonly in sand or firm mud. S. fragilis was found mainly in soft mud at the first few stations on a transect. This latter species most probably accounted for the large numbers of Scoloplos which were found at stations 102/1, 110/1, 118/1 and 121/1 as they are said to be gregarious (Pettibone, 1963).

Spionidae

Polydora ligni Webster

Occasionally found in sand, the main substrate preferred was mud. Of the nineteen occurrences only four were north of Longspell Point.

Spio sp.

Single specimens were collected at twelve stations. All but one of these was in sand. Of the twelve occurrences only four were south of Longspell Point.

Scolecolepides viridis Verrill

This species was mainly collected along the banks of rivers (ie. the Cornwallis, Gaspereau and Avon). Very few were found in the middle of the flats. This species is reported by Linkletter (1977) to be typically estuarine.

Streblospio benedicti Webster   Figure 6

After the first Streblospio had been collected along transect 34, the distribution was fairly continuous although the species was usually found at only one or two stations along a transect (most often at stations 3 and 4). South of Longspell Point, Streblospio densities became larger with the greatest densities occurring along the salt-marsh south of Kingsport and the western side of Porter Point. The areas with the next greatest densities were on Starrs Point, along Evangeline

Beach and on the western end of Boot Island. The species was not found on the eastern end of Boot Island.

There were a few dense patches on Oak Island but populations in the area from the Guzzle to Horton Bluff were usually quite sparse.

This overall distribution is indicative of a "soft" mud species, the characteristics of which are described under Chaetozone setosa.

Spiophanes bombyx Claparede Figure 7

This species was the dominant invertebrate along much of the coast from White Water to Longspell Point, where coarse sand or sand with a silt veneer occurred. From White Water to Delhaven it occurred mainly at stations 3 and 4 as the flats further out are comprised mainly of exposed bedrock with very little soft substrate on top. In the vicinity of Delhaven the greatest densities were found lower in the intertidal zone as silt occupied the first few stations. Very few Spiophanes were found in the Pereau estuary. From Paddy Island to Longspell Point the greatest densities were again located mainly at stations 3 and 4 but the dominance of this region was less prevalent than before. The distribution of Spiophanes south of Longspell Point was very patchy, with the species occurring in the rare areas of suitable substrate. Sand, fine sand or coarse silt may be found mainly along the rivers and on the ends of Porter and Starrs Points. Although Figure 7 shows a great number of occurrences on the outer half of Evangeline Beach and on Boot Island, densities were usually quite low, rarely rising above 20 per sample. These low densities also occurred along the outer portion of the flat at Avonport and on the east end of the bar off Oak Island. The low densities in these areas is possibly due to lack of a truely suitable substrate as the sand areas on the outer edges of these flats have a tendency to silt up gradually during the spring and summer months, thus excluding the species at a time when it is best able to establish itself.

<u>Pygospio</u> <u>elegans</u> Claparede   Figure 8

The density of <u>Pygospio</u> showed no definate trend in along-transect preference although the exceptionally high densities were found at the last or second last station on a transect. An example of this was station 60/5 where the density was 220 per sample.

<u>Pygospio</u> was a very widespread species, occurring in substrates ranging from coarse sand to silt and silty clay. Its occurrence on the latter was very limited; from Porter Point to Long Island Head on the west end of Evangeline Beach the species was rarely found although densities got higher on the end of Starrs Point.

Opheliidae

<u>Ophelia</u> <u>limacina</u> Rathke

The greatest number of occurrences were on transects 18 through 27. Found only on sand in the upper half of the intertidal zone, most occurred at stations 2 and 3.

Capitellidae
Heteromastus filiformis Claparede Figure 9

Clearly the most numerous and most widely distributed polychaete in the southern bight of the Minas Basin, Heteromastus is rivalled only by Chaetozone setosa and Eteone longa; Chaetozone because it occurred at densities much greater than Heteromastus but was less widespread and Eteone because it is almost as widespread but occurred at lower densities.

The occurrence of Heteromastus from White Water to Delhaven was quite sparse as silt and mud substrates were very limited. In the mud of the Pereau estuary it was found in many of the samples but in low numbers. The species was not found for a short distance south of Paddy Island as sand was once again the dominant substrate. As mud slowly began to dominate along Medford the density became greater all the way along Kingsport to transect 93. Along Porter Point and Starrs Point the densities were at their greatest, being above 100 per sample on thirty-two occasions. There were also fairly dense populations occurring in the upper intertidal zone along Evangeline Beach (mainly on the eastern end) and the western end of Boot Island. The population became less dense along Oak Island and Avonport Beaches and was also located in the soft mud belt high intertidally.

Although found on both firm and soft mud, Heteromastus reached its greatest densities in soft mud.

This survey confirms the hypothesis first stated by myself (Gratto, 1977) concerning an inverse relationship between Heteromastus and the amphipod Corophium volutator. At that time I stated that high densities of one of these species in a area results in low densities of the other. This pattern was followed in all the samples this summer. I also stated then that this was due to competition; most probably, competition for food and space with the species best suited for the particular substrate becoming dominant as the two species prefer different substrates. The sample which came closest to high densities for both species was 84/1 where 120 Corophium (slightly above average) and 104 Heteromastus (high) were present.

Notomastus sp.

Only one specimen of this species was found (station 62/1) and that minus its tail, making identification difficult.

Maldanidae

Clymenella spp.

Both C. torquata Leidy and C. zonalis Verrill were identified in the samples with the former appearing to be more common. Identification is difficult as the specimens break up when being sieved.

The population of Clymenella was very sparse and was located on groups of a few transects in a row.

The preferred substrate was sand or sand with a silt veneer. This accounts for its occurrence at or near the end of transects on mudflats as they turn sandy just before low water.

Oweniidae ?

Two specimens were collected which appear to be from this family. Both were collected on sand.

Sabellidae

Fabricia sabella Ehrenberg

This species was found at only four stations. There was no particular type of substrate in which all of these occurred.

Ampharetidae

Asabellides oculata Webster

Two were collected at station 134/2 on mud on the bank of the Cornwallis River.

Terebellidae

Amphitrite cirrata Muller

Found only in sand, this species was most common on transects 21 to 27.

polychaete ?

Unknown genus and family, found only once (station 38/6).

The specimen was pale green, with no parapodial rami and a long pointed prostomium with no appendages on it.

Oligochaeta

Unknown species

This species was most numerous in the sand throughout the intertidal area but most commonly at station 1. More numerous north of Longspell Point, the species was very sparse afterwards.

Peloscolex benedini Vedkem

Found only between White Water and Kingsport, Peloscolex was most common just north of Medford (transects 51 to 56).

ARTHROPODA

Insecta

Diptera

Chironomidae

Chironomid larvae were found in samples scattered throughout the area but were most common from Delhaven to Kingsport. They were primarily found in the upper half of the intertidal zone but were also occasionally found almost at low water.

A single pupa was found in a sample also containing larvae.

Crustacea

Copepoda

Harpacticoidea

Copepods were collected occasionally in many samples on sand. Dense populations were found in damp sand at station 1 on two transects at Medford. These were in the order of thousands in each of the two samples (about 5 ml of copepods in each sample).

Cumacea

<u>Oxyurostylis</u> <u>smithi</u> Calman

During this study, the greatest concentration was along the middle of the beach at Evangeline. Lesser concentrations occurred on the flats immediately east of Paddy Island, on the eastern end of Boot Island and at Oak Island.

There is a definate preference for coarse substrates: sand and gravel. The emphasis is on sand as most of the occurrences were on sand on the lower half of the transects. Due to the relative scarcity of the species there were very large gaps where <u>Oxyurostylis</u> was not found even on sand. This scarcity may be due to seasonal variation in numbers as the species usually builds up its population in the lower intertidal zone to a peak in October and November as it moves up into the intertidal area from subtidally. This was observed last autumn at Kingsport.

Eudorella truncatala Bate

There were only four occurrences of Eudorella, all on low intertidal sand.

Tanaidacea

Leptognatha coeca Harger

This species was found only at three locations during this study; at White Water, Delhaven and Avonport. All were found low intertidally in sand.

Isopoda

Chiridotea coeca Say

Five of the six occurrences of this species were high intertidal on sand. The only one not fitting into this pattern was a gravid female with young about to be released, which was found at the end of a transect off Blomidon.

Chiridotea tuftsi Stimpson

In sharp contrast to the high intertidal distribution of C. coeca, that of C. tuftsi was found to be low intertidal. All five of those found were at or near the ends of transects. The only common denominator between the two species was their preference for sand.

Idotea spp.

Both I. balthica Pallas and I. phosphorea Harger were collected. The adults of both of these species are most commonly found on the brown alga <u>Ascophyllum nodosum</u> on rocky shores. Those collected in this survey were all juveniles and were found at the bases of the green alga <u>Enteromorpha intestinalis</u> where the plants were attached to small pebbles in the gravel on Middle Ground.

<u>Edotea montosa</u> Stimpson

This species, though collected only occassionally, was always found low intertidally on sand or gravel. This species is most common subtidally, therefore it is quite probable that those collected here represent only the upper limit of a more extensive population extending subtidally.

<u>Jaera marina</u> Fabricius

Only three specimens were found, all from areas where rocks and gravel occurred. This species is very common on rocks in this area.

Amphipoda

<u>Gammarus oceanicus</u> Segerstrale

No definite substrate preference was observed in the six occurrences of <u>G. oceanicus</u>. Usually concidered to be the dominant intertidal and shallow-water species of <u>Gammarus</u> of mainly rocky shores (Bousfield, 1973), it appears to be more widespread on the sand and mud of this area than the soft substrate benthic <u>G. lawrencianus</u>.

Gammarus lawrencianus Bousfield

There were only two occurrences of this species, one on the flat at Kingsport and the other in the Guzzle. I have previously encountered this species at White Waters (sand), Kingsport (mud) and Avonport (mud). Bousfield (1973) lists the species as a very common, essentially benthic amphipod of sand and sandy mud bottoms.

Gammarus mucronatus Say

This species was found in only one sample, on the bank of the Gaspereau River adjacent to an area of salt marsh. As the species is reported to be a very common, dominant species in many saltmarsh pools (Bousfield, 1973), it is likely that these had overflowed from nearby marsh pools.

Ampelisca vadorum Mills

Represented by only one occurrence in this survey (Avonport), this species has also been found at White Water and Kingsport but not until after the middle of June. As samples were taken at White Water at the end of May, it is not surprising that the species was either not present or was in numbers too few to be consistently collected with the size of sample taken. The species has always been collected on low intertidal sand, which according to Bousfield (1973) is the preferred substrate.

<u>Psammonyx nobilis</u> Stimpson

This species was collected at only one station in this survey, low intertidally on Evangeline Beach. I have previously found this species occassionally at White Water and commonly at Scots Bay. All of these occurred in sand.

The distribution of this species is described by Bousfield (1973) as preferring medium to medium-coarse sand preferably in areas of cold water. This would explain its presence at White Water and Scots Bay, which are definitely areas of cold water but the occurrence of a single specimen on Evangeline Beach could possibly be explained as having been transported across the Basin by the tides.

<u>Corophium volutator</u> Pallas Figure 10

By far the most abundant crustacean found in this area of the Minas Basin, <u>C. volutator</u> occurred in densities of up to 420 per sample.

The density of <u>Corophium</u> was sparse or nonexistant in the sand from White Water to Delhaven, but as the silt built up in the vicinity of the Pereau estuary, the density increased to a level which was very high for the time of year at which they were collected. Further work in this area in August and September might have revealed densities higher than previously recorded.

As the substrate became coarser, from the east side of the Pereau estuary to Kingsport, the density of <u>C. volutator</u> became lower. These low densities also prevailed in the soft mud from Kingsport to the transect off the end of Starrs Point.

From the end of Starrs Point to the eastern edge of the adjacent bar, the mud becomes firm. This type of mud, previously encountered in the Pereau estuary and the very end of Porter Point, moves inshore to occupy most of the intertidal area. This resulted in higher densities of C. volutator, which continued to the eastern limit of the study area wherever this type of mud was found.

The greatest overall densities were found in the area from the Guzzle to Horton Bluff. The bulk of the population in this area was in the mid intertidal zone until transect 214 and beyond where the greatest densities occurred at stations 1 and 2. This was due to the presence of rocks and bedrock low intertidally.

Although the highest densities were in this area, it must be remembered that these samples were taken near the end of July when the population had had time to increase. From previous years' data it is very possible that the densities found at Pereau, which were only slightly lower than those on Oak Island and Avonport Beaches, would have at least doubled by August.

Corophium bonelli M.-E.

Only two specimens of this species were found during this survey. They were located in the Enteromorpha-gravel substrate on Middle Ground where the Idotea were also found. This species is very common in late summer in the sand at the base of macrophytic algae on the sandstone terraces off Cape Blomidon.

Corophium tuberculatum ? Shoemaker

A single male, possibly of this species, was found in the same area of Middle Ground as C. bonelli.

Caprella linearis Linnaeus

A single specimen was collected. It was found in the same area of Middle Ground mentioned above.

Aeginina longicornis Kroyer

A female with six young was found in the area of Middle Ground mentioned above.

Mysidacea

Mysis stenolepis S.I. Smith

Two specimens were collected in a sample on a high bank along the Canard River. As the species is usually found along the edge of the tide in the water, these specimens were probably left stranded on the bank by the receeding tide. This species has also been found previously at Kingsport while another mysid, Neomysis americana S.I. Smith was found at Scots Bay and Avonport. These were collected in the past two years.

Decapoda

Crangon septemspinosa Say

Very few Crangon were collected relative to the number which were actually on the flats. The reason for this is that the majority are found in tidepools and intertidal streams while only a few are left on the surface of the flats, in which they then bury themselves as the tide receeds.

Pagurus longicarpus Say

Although only one specimen was collected in the samples, Pagurus are very common in tidepools and streams on all the intertidal flats in this area. Two species of Pagurus have been identified in the Minas Basin, P. longicarpus and P. acadianus Benedict (Bousfield and Leim, 1959). P. longicarpus was reported by Craig (1977) to be a major invertebrate of sand habitats in the Cobequid Bay portion of the Minas Basin.

Of the seventy-six species listed above, forty-five are not found in the list of Bousfield and Leim (1959). Of these, twenty-one of the polychaetes are listed in Petersen and Petersen (1976). Eight other assorted species have been reported by Fuller and Trevors (1977), and Gratto (1977). The remaining sixteen species are new reports for this area. This breakdown may be found in Appendix II.

DISCUSSION

As was demonstrated in the annotated list of species, the distribution of many species is controlled by substrate preferences. Although the structure of the intertidal flats varies considerably throughout the study area only three basic types of flats emerged. This resulted in a minimum number of species groupings.

The first type of intertidal flat is the sandflat. This type was present from White Water to Delhaven (except for isolated mud patches along streams), from Paddy Island to Kingsport wharf and on the eastern half of Boot Island. In these areas sand was found from high to low water. There may also be areas of exposed bedrock or rocks scattered throughout. The species occurring solely on or having a definite preference for sand comprise almost half of the seventy-six species collected this summer. This high diversity is especially striking when compared with the number of species on other substrates. These sandflats are characterized by having a low density, high diversity community dominated by Spiophanes bombyx and Pygospio elegans.

As the sand occurred from high to low water, there existed a division between the species occupying the two areas (high and low sand). Chiridotea coeca and the unknown species of oligochaete occurred on sand in the upper part of the intertidal zone. Other species, such as Chiridotea tuftsi, Edotea montosa and Clymenella spp. are found on sand near low water. The occurrence of some of these latter species is an indication of species whose primary habitat is on subtidal sand but who have spread out to occupy the substrate intertidally.

Sandflats are usually adjoined by "firm" mudflats which are separated from the sandflats by a transitional area in which silt starts as a narrow band about two hundred meters down from high water and gradually expands to create the mudflat. "Firm" mudflats consist of a layer of brown silt, of varying thickness, overlying a base of hard clay, which may be brown or grey. This is the most common type of mudflat in this area.

"Firm" mudflats may be found in the Pereau estuary, for a brief distance south of the Kingsport wharf, on Starrs Point Bar and on Oak Island Beach and Bar east to Horton Bluff. Smaller "firm" mudflats exist in sheltered coves in sandflat areas, such as Medford.

This type of intertidal flat is characterized by a narrow band of "soft" mud in which the silt and clay layers are mixed together. Most of the beach is composed of layered silt and hard clay. Below this is a band of sand down to low water. Exposed bedrock and rocks also occur on "firm" mudflats but less frequently than on sandflats. This appears to be the near-equivalent of the intertidal flats of the Cobequid Bay portion of the Minas Basin described as a typical mudflat by Risk, Craig and Yeo (in Daborn, 1977). "Firm" mudflats are dominated by the amphipod Corophium volutator which we have found to occur in densities up to 78,000/m^2. The most widespread polychaetes are Eteone longa and Pygospio elegans although the latter occurred at densities much lower than when in sand. The number of species present remains very high on "firm" mudflats due to the number of substrate types present. Most of the "soft" mud species are present but not in the numbers present on "soft" mud dominated flats (the third type of intertidal flat). The number of sand species present is greatly reduced as only low intertidal sand is present.

The "soft" mudflats in this area are found primarily on both sides of the Canning and Canard Rivers, in other words from Kingsport saltmarsh to the tip of Starrs Point. They differ from "firm" mudflats in several ways. Exposed bedrock and rocks are almost nonexistant. The "soft" mud does not gradually change to "firm" mud and then to sand unless the flat is extremely wide. This condition is found on the end of Porter and Starrs Points. The "soft" mudflats in this area are also characterized by a great number of deep-channelled streams which subdivide the area. The softest mud is associated with the banks of these streams and is recognizable by the green film of diatoms which coat the mud by mid-summer. Soft mudflats usually have an upper zone of the saltmarsh grass Spartina alterniflora instead of sand.

In "soft" mud the number of species present drops considerably, especially in areas of very soft mud. Despite the low diversity, these flats harbour the greatest densities found anywhere in the study area.

The density of invertebrates in the primary "soft" mudflat area (transects 78 to 118) was $17{,}000/m^2$ which is about 1.7 times the density of the invertebrates on all 221 transects. This increased density may be related to the amount of detritus deposited by the tide dropping its sediment load in the sheltered area and by the three rivers that flow into the area. Both of these densities compare favourably with those found in the literature for studies of this magnitude (mainly subtidal) and are among the greatest values listed by Mauer et al (1978) for these previous studies.

"Soft" mudflats in this area are dominated by the polychaete worms Heteromastus filiformis and Chaetozone setosa. Streblospio benedicti also forms a major portion of the fauna of "soft" mudflats. It is not uncommon for samples from this type of flat to have only these three species plus one or two of Eteone heteropoda, Corophium volutator (low numbers), young Nephytidae and a very limited number of other species. Four or five species per sample is in sharp contrast to nine or ten species which is not uncommon in a sand sample.

An oddity which was quickly noticed when the identification of the samples was taking place was the occurrence of an unusually large number of species in transects 20 to 30 inclusive. In addition to the more common sand species, many rarer species were either found only along these transects or were concentrated there. This brought the total to thirty species on those transects. This total is made even more remarkable by the complete absence of such common species as Macoma, Mya, Heteromastus, Chaetozone, Streblospio and Chrophium volutator. As no major visible differences could be observed along this section of sandflat that would separate it from adjacent sections, I feel that a more intensive study is necessary to discover the secret of the area.

Yeo (1978) speculated that rarer fauna appeared more commonly as one moved west in the Minas Basin, into the southern bight where this study was undertaken. This could explain the relatively few species (forty-two) found by extensive sampling over a number of years in Cobequid Bay as compared to the number of species encountered in this eight week study (seventy-six).

This study has gone a long way in determing the distributions of the various invertebrate species as they exist today. This will hopefully facilitate future studies of a similar nature which will be able to document longterm trends in changing distributions.

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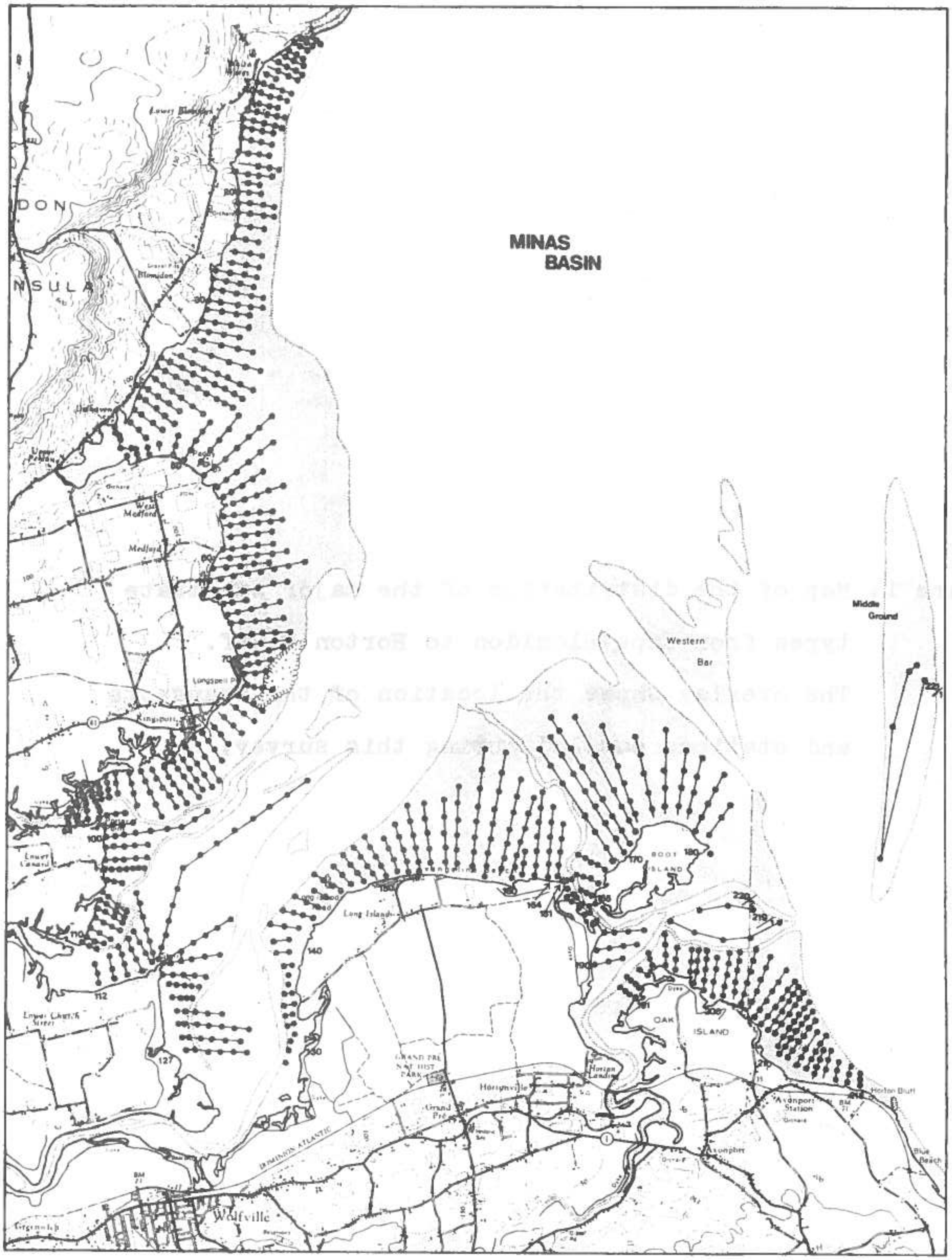
FIGURES

Figure 1: Map of the distribution of the major substrate types from Cape Blomidon to Horton Bluff. The overlay shows the location of the transects and stations sampled during this survey.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BASIN
Middle
Ground
Western
Bar
BOOT
ISLAND
OAK
ISLAND
Long Island
Blomidon
Lower Blomidon
Kingsport
Medford
West
Medford
Lower
Canard
Lower Church
Street
GRAND PRE
NAT HIST
PARK
Grand
Pré
Hortonville
Horton
Landing
Avonport
Station
Avonport
Horton Bluff
Blue
Beach
Wolfville
DOMINION ATLANTIC

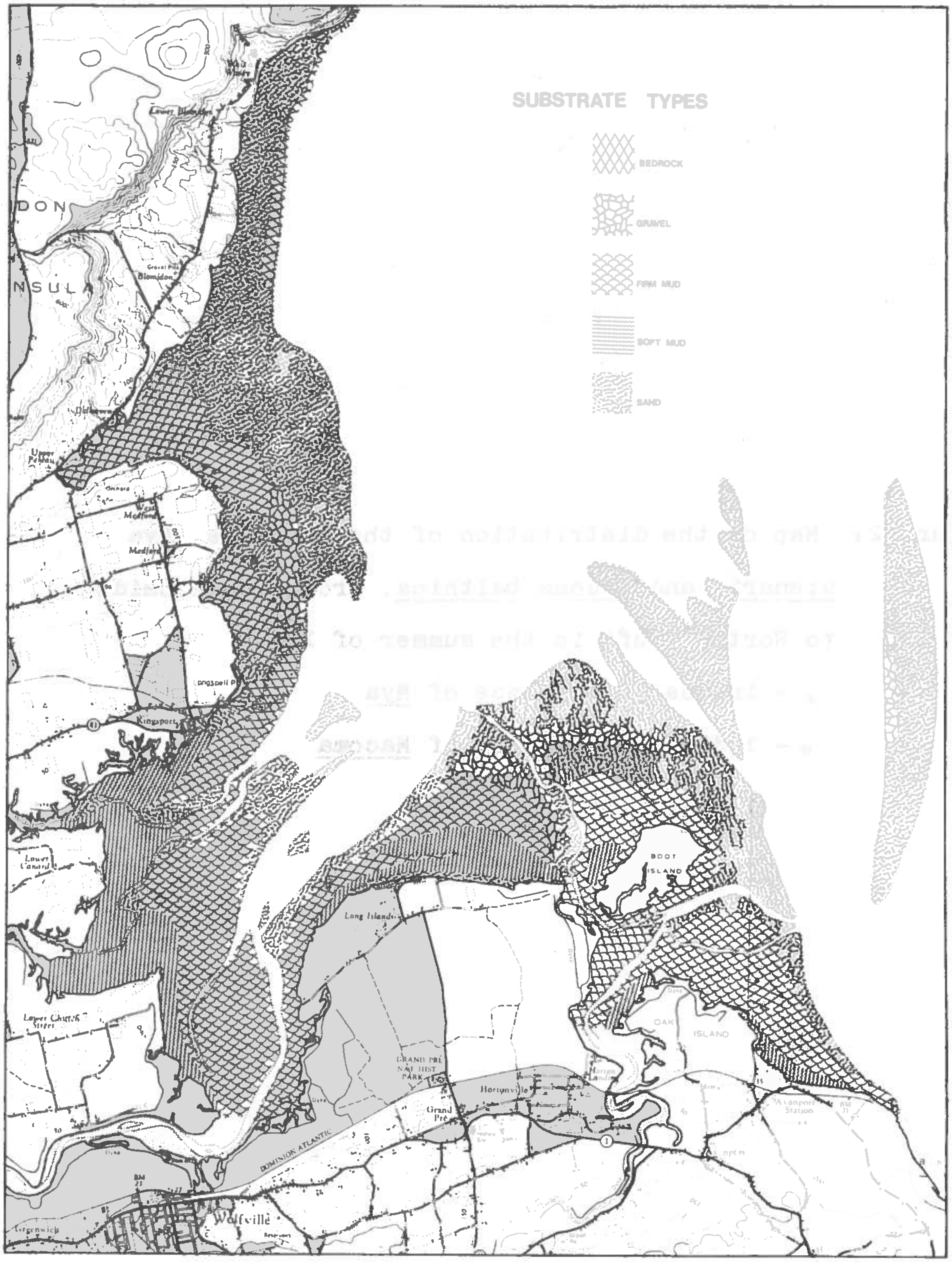
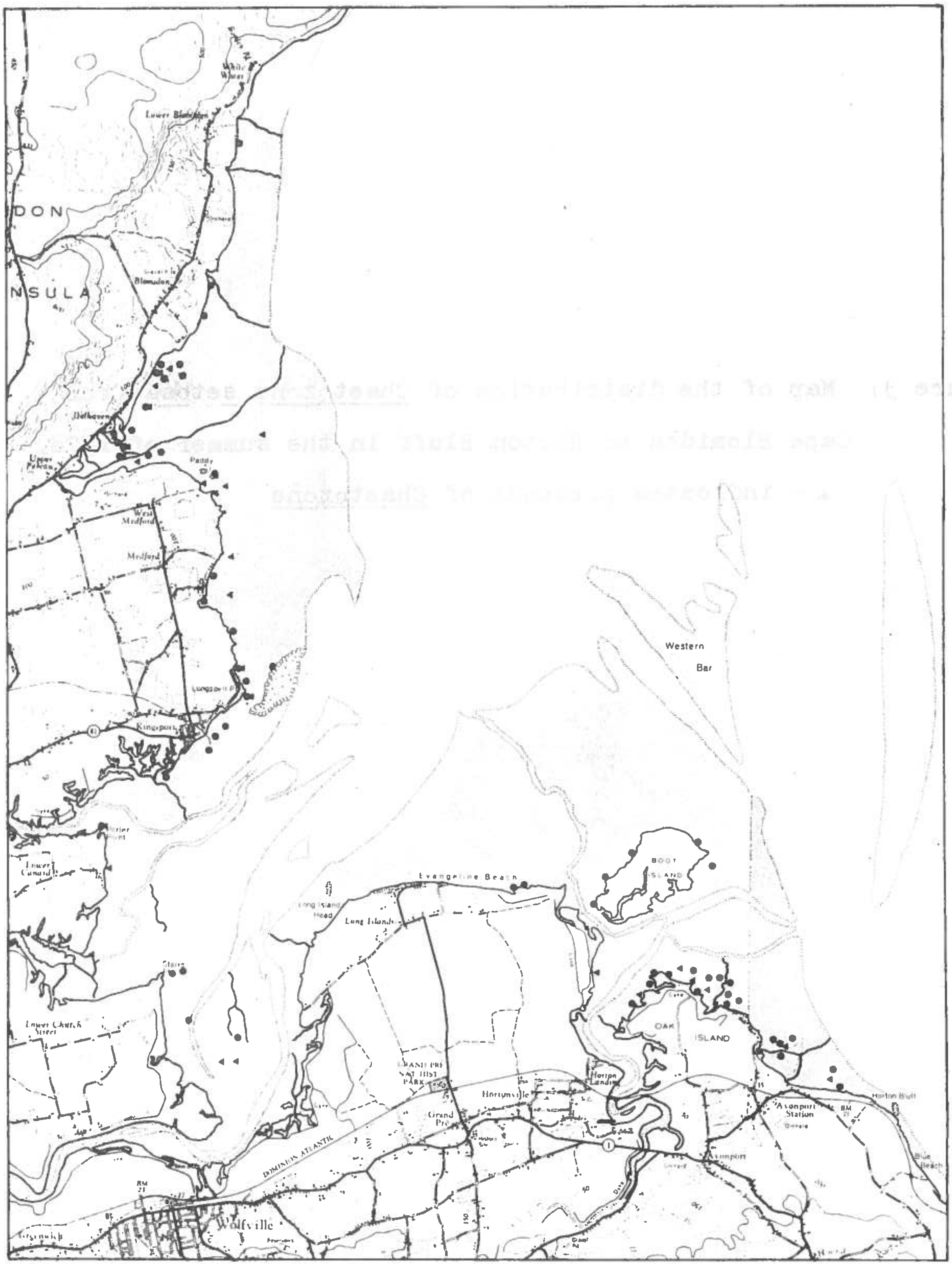

SUBSTRATE TYPES
BEDROCK
GRAVEL
FIRM MUD
SOFT MUD
SAND
DON
NSULA
Lower Blomidon
Blomidon
Medford
Kingsport
Lower Canard
Lower Church Street
Long Island
BOOT ISLAND
OAK ISLAND
GRAND PRE NAT HIST PARK
Hortonville
Grand Pré
DOMINION ATLANTIC
Avonport Station
Wolfville
Greenwich

Figure 2: Map of the distribution of the bivalves, Mya arenaria and Macoma balthica, from Cape Blomidon to Horton Bluff in the summer of 1978.

▲ - indicates presence of Mya

● - indicates presence of Macoma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White Water
Blomidon
Delhaven
Upper Pereau
West Medford
Medford
Kingsport
Lower Canard
Lower Church Street
Evangeline Beach
Long Island Head
Long Island
Western Bar
BOOT ISLAND
OAK ISLAND
Horton Landing
Hortonville
GRAND PRE NAT HIST PARK
Grand Pré
Avonport Station
Avonport
Horton Bluff
Blue Beach
DOMINION ATLANTIC
Wolfville
Greenwich

Figure 3: Map of the distribution of Chaetozone setosa from Cape Blomidon to Horton Bluff in the summer of 1978.

▲ - indicates presence of Chaetozone

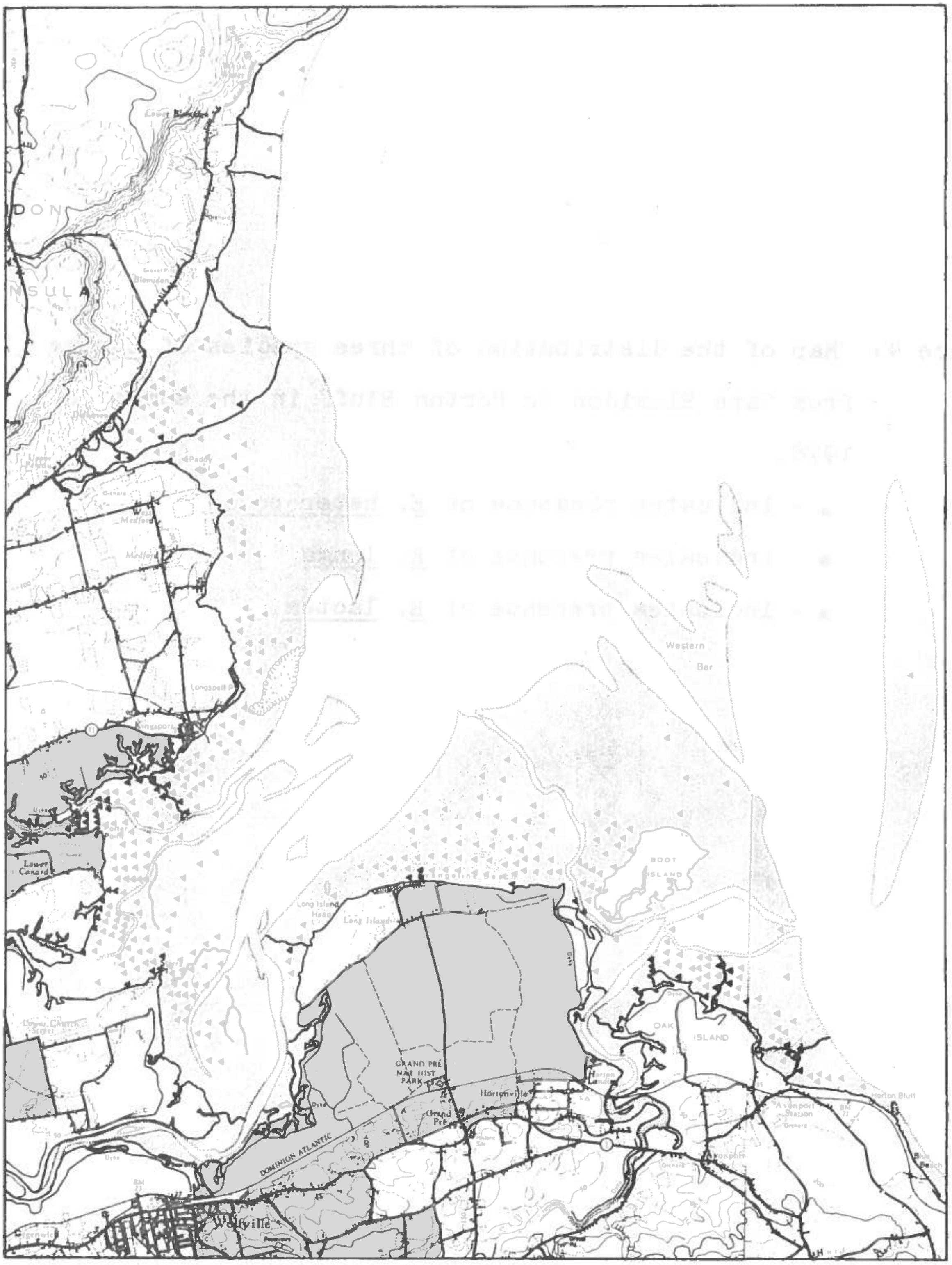

Lower Blomidon
DON
NSULA
Medford
Kingsport
Lower Canard
Long Island Head
Long Island
Western Bar
BOOT ISLAND
OAK ISLAND
GRAND PRÉ NAT HIST PARK
Grand Pré
Hortonville
Horton Landing
Horton Bluff
Avonport Station
Avonport
DOMINION ATLANTIC
Wolfville

Figure 4: Map of the distribution of three species of *Eteone* from Cape Blomidon to Horton Bluff in the summer of 1978.

▲ - indicates presence of *E. heteropoda*

● - indicates presence of *E. longa*

■ - indicates presence of *E. lactea*

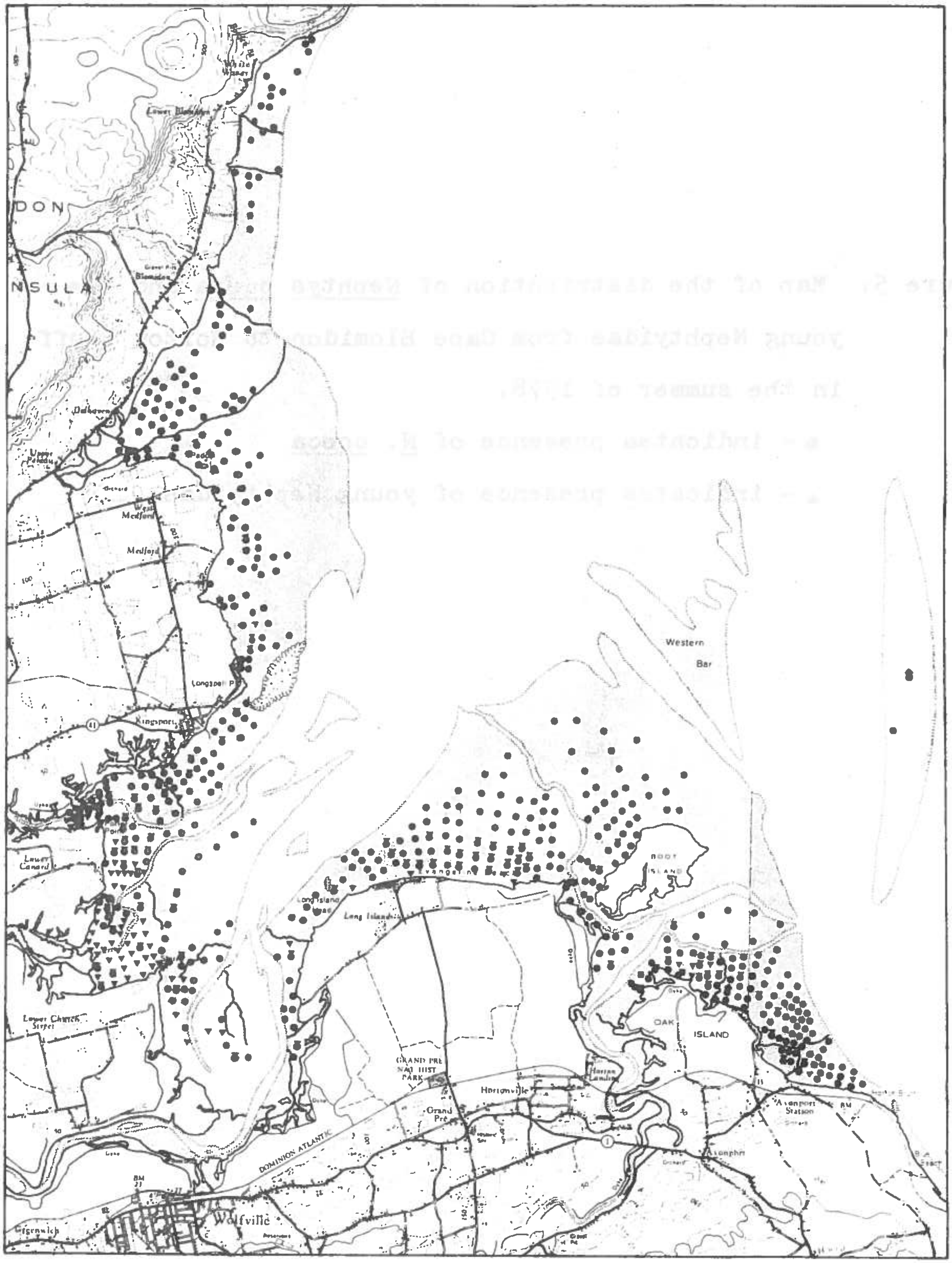
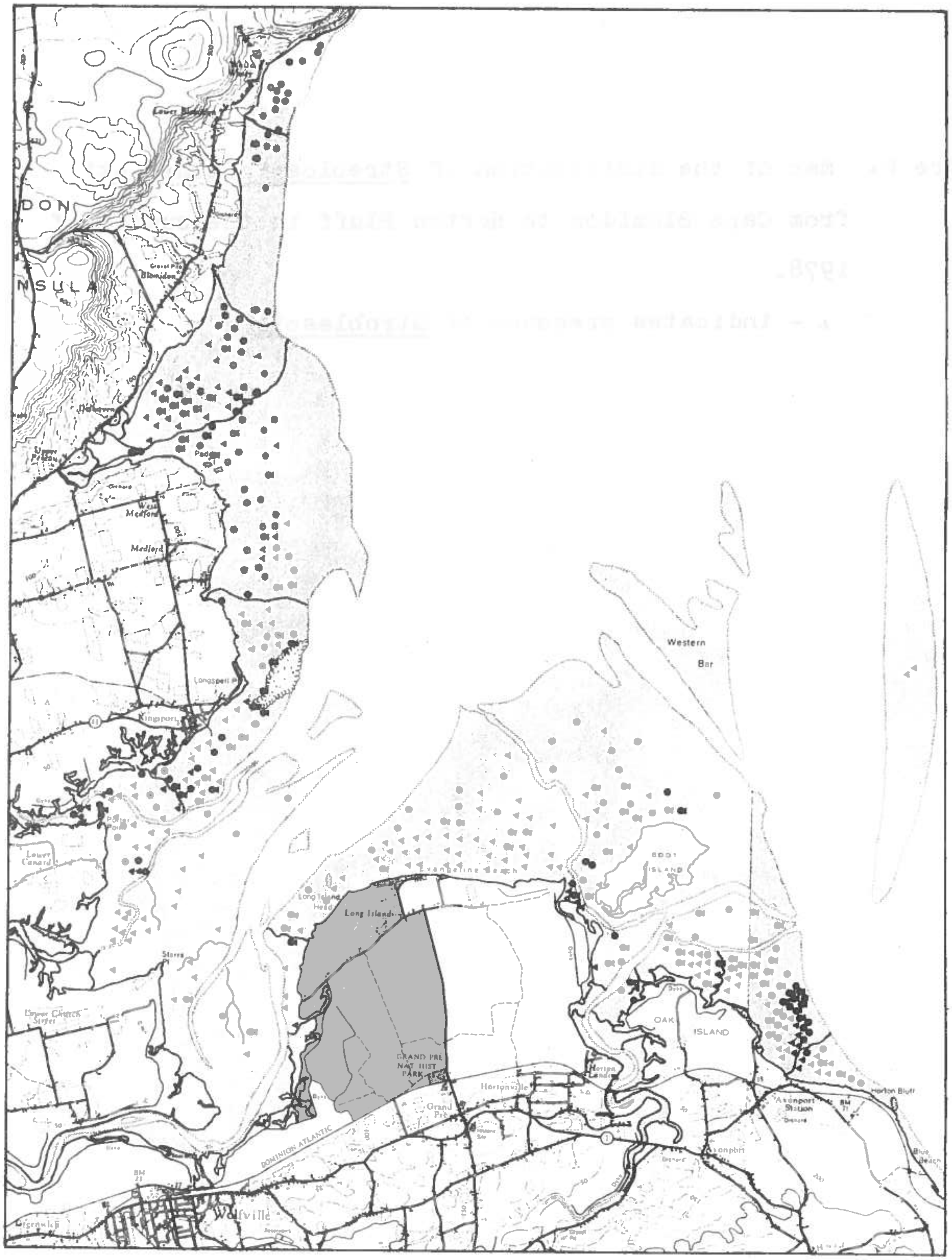

DON
NSULA
Lower Blomidon
Blomidon
Medford
Kingsport
Lower Canard
Long Island
Western Bar
BOOT ISLAND
OAK ISLAND
GRAND PRE NAT HIST PARK
Grand Pre
Hortonville
DOMINION ATLANTIC
Wolfville

Figure 5: Map of the distribution of *Nephtys coeca* and the young Nephtyidae from Cape Blomidon to Horton Bluff in the summer of 1978.

● - indicates presence of *N. coeca*

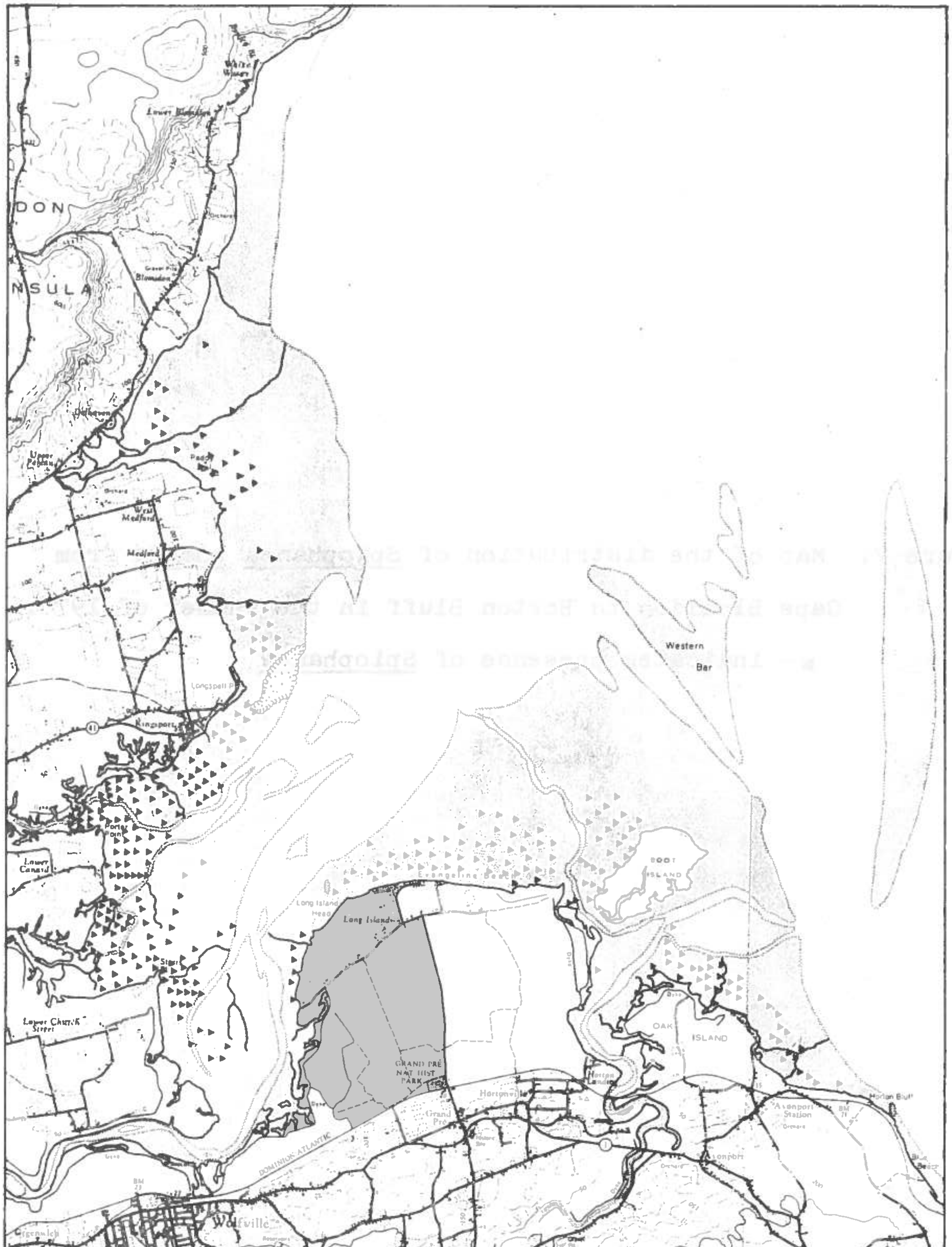
▲ - indicates presence of young Nephtyidae



Lower Blomidon
Blomidon
Medford
West Medford
Longspell Pt
Kingsport
Lower Canard
Starrs Pt
Upper Church Street
Western Bar
BOOT ISLAND
Evangeline Beach
Long Island Head
Long Island
OAK ISLAND
GRAND PRE NAT HIST PARK
Hortonville
Grand Pre
Avonport Station
Avonport
Horton Bluff
Blue Beach
DOMINION ATLANTIC
Wolfville

Figure 6: Map of the distribution of *Streblospio benedicti* from Cape Blomidon to Horton Bluff in the summer of 1978.

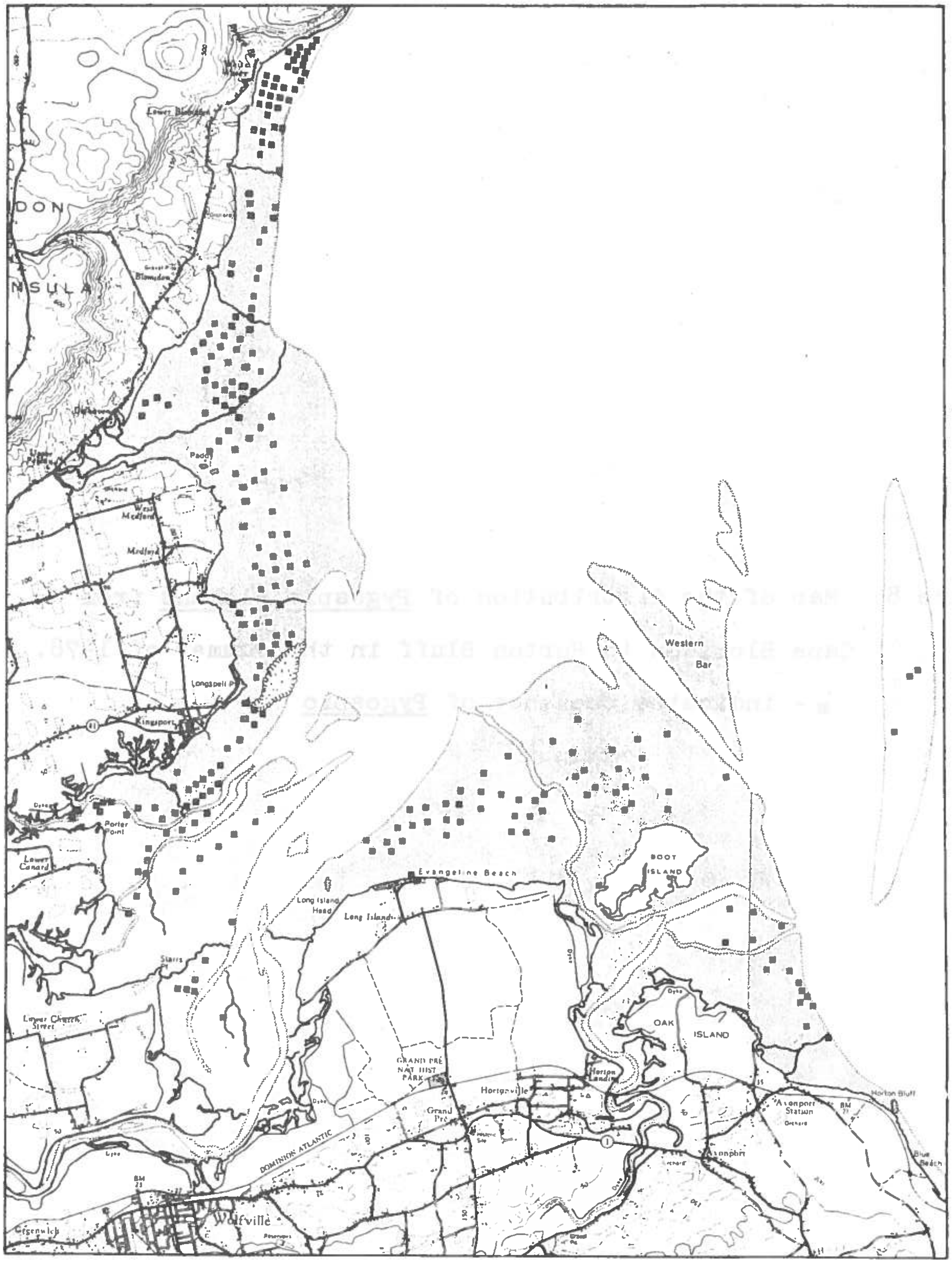
▲ - indicates presence of *Stroblespio*



Lower Blomidon
White Waters
DON
NSULA
Blomidon
Delhaven
Upper Pereau
West Medford
Medford
Western Bar
Longspell Pt
Kingsport
Porter Point
Lower Canard
Long Island Head
Long Island
Evangeline Beach
BOOT ISLAND
Starr
Lower Church Street
GRAND PRÉ NAT HIST PARK
Hortonville
Horton Landing
OAK ISLAND
Horton Bluff
Avonport Station
Avonport
DOMINION ATLANTIC
Wolfville
Greenwich

Figure 7: Map of the distribution of _Spiophanes bombyx_ from Cape Blomidon to Horton Bluff in the summer of 1978.

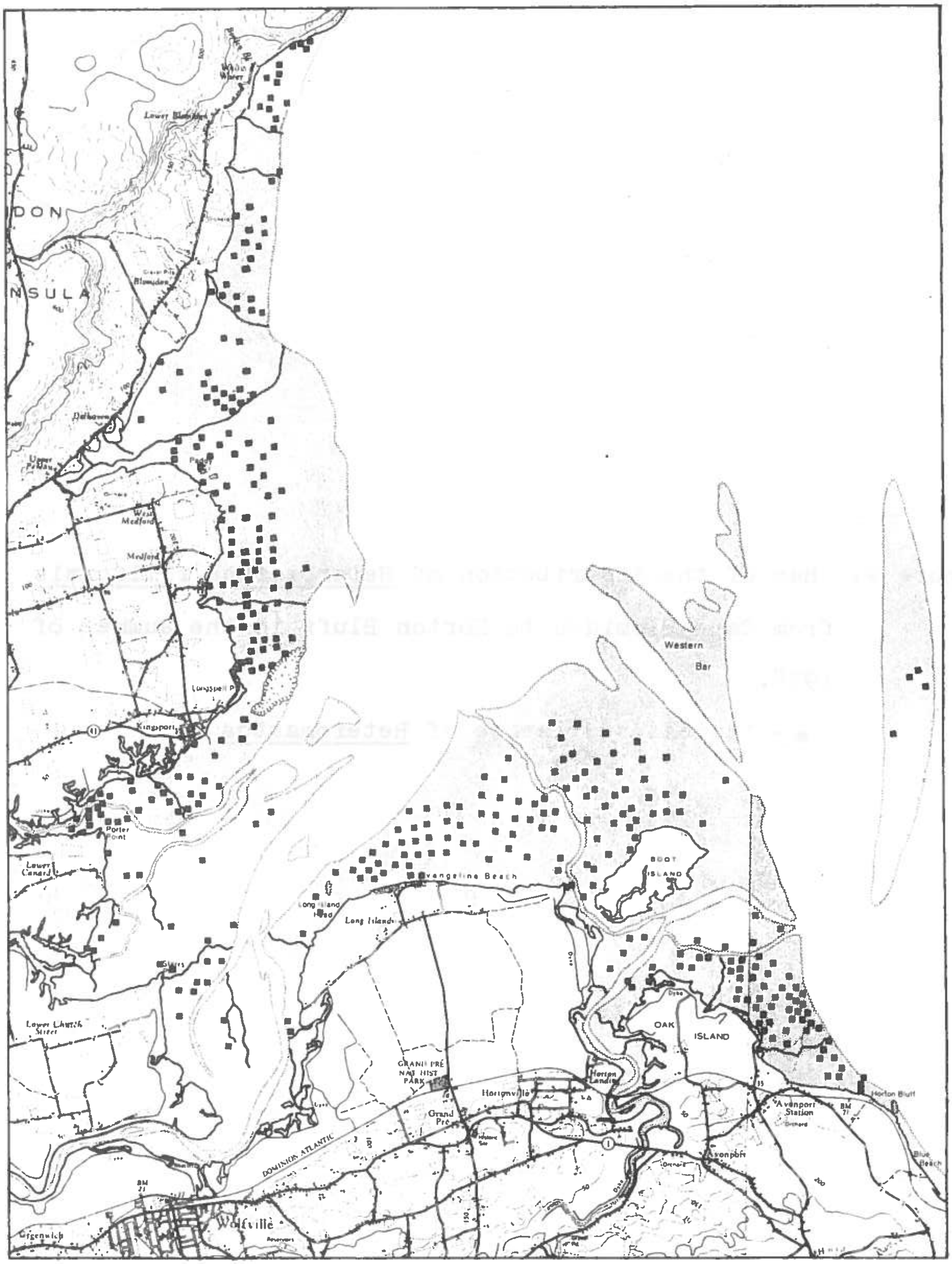
■ - indicates presence of _Spiophanes_



DON
NSULA
Blomidon
West Medford
Medford
Longspell Pt
Kingsport
Porter Point
Lower Canard
Starrs
Lower Church Street
Long Island Head
Long Island
Evangeline Beach
Western Bar
BOOT ISLAND
OAK ISLAND
GRAND PRÉ NAT HIST PARK
Hortonville
Horton Landing
Grand Pré
DOMINION ATLANTIC
Wolfville
Greenwich
Avonport Station
Avonport
Horton Bluff
Blue Beach

Figure 8: Map of the distribution of <u>Pygospio elegans</u> from Cape Blomidon to Horton Bluff in the summer of 1978.

■ - indicates presence of <u>Pygospio</u>



DON
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Lower Blomidon
Blomidon
Dalhousie
Upper Pelham
West Medford
Medford
Longspell Pt
Kingsport
Porter Point
Lower Canard
Sisters
Lower Church Street
Western Bar
BOOT ISLAND
Evangeline Beach
Long Island Head
Long Island
OAK ISLAND
Dyke
GRAND PRÉ NAT HIST PARK
Grand Pré
Hortonville
Horton Landing
Avonport Station
Avonport
Horton Bluff
Blue Beach
DOMINION ATLANTIC
Wolfville
Greenwich

Figure 9: Map of the distribution of *Heteromastus filiformis* from Cape Blomidon to Horton Bluff in the summer of 1978.

■ - indicates presence of *Heteromastus*

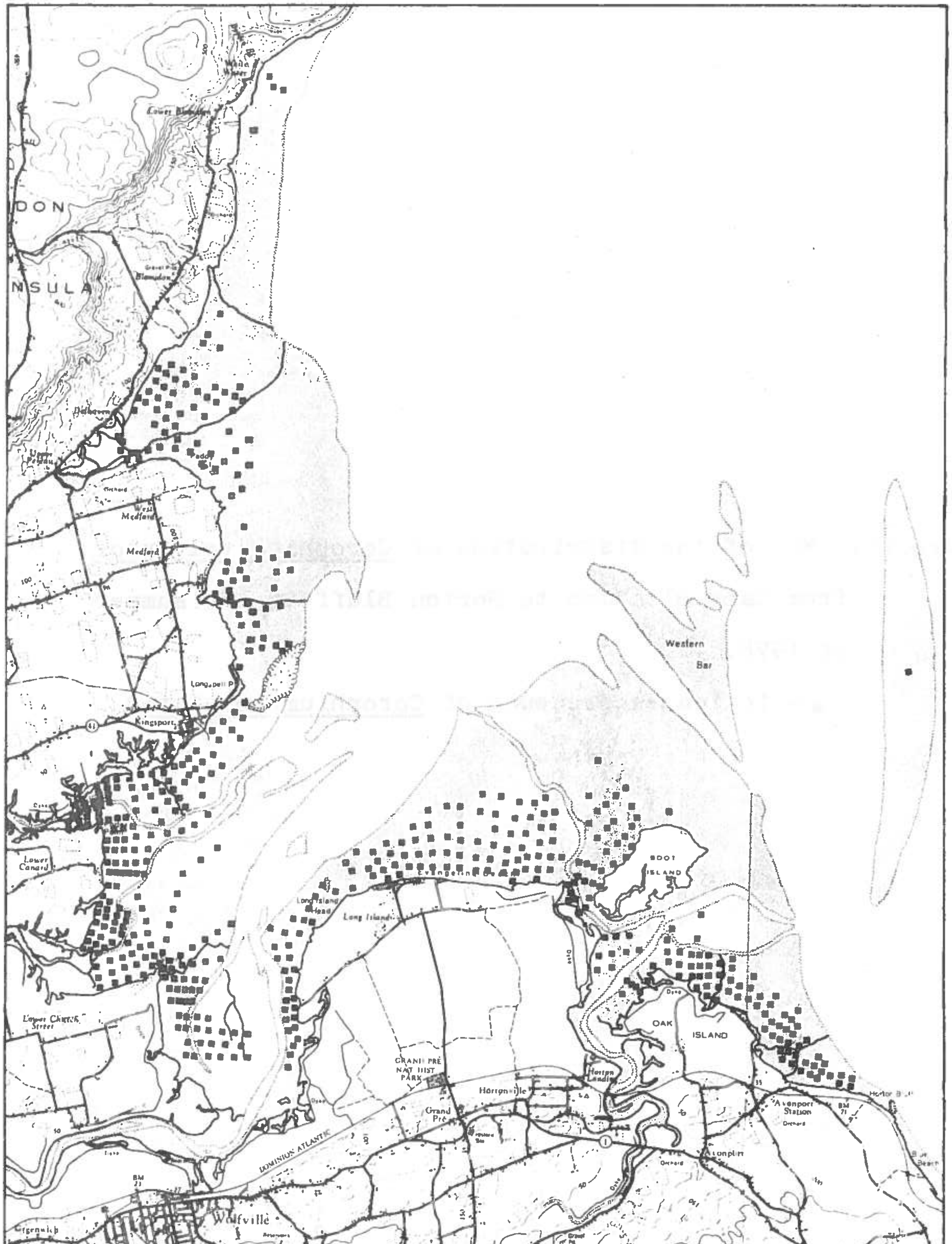
DON
NSULA
Delhaven
West Medford
Medford
Kingsport
Lower Canard
Long Island Head
Long Island
Western Bar
BOOT ISLAND
OAK ISLAND
GRAND PRÉ NAT HIST PARK
Hortonville
Horton Landing
Grand Pré
Avonport Station
Avonport
DOMINION ATLANTIC
Wolfville
Greenwich

Figure 10: Map of the distribution of <u>Corophium volutator</u> from Cape Blomidon to Horton Bluff in the summer of 1978.

● - indicates presence of <u>Corophium volutator</u>

DON
NSULA
Lower Blomidon
White Waters
Blomidon
Upper Pereau
West Medford
Medford
Longspell Pt
Kingsport
Lower Canard
Lower Church Street
Western Bar
Evangeline Beach
Long Island Head
Long Island
BOOT ISLAND
OAK ISLAND
GRAND PRE NAT HIST PARK
Grand Pre
Hortonville
Horton Landing
Avonport Station
Avonport
Horton Bluff
Blue Beach
DOMINION ATLANTIC
Wolfville
Greenwich

APPENDIX I

APPENDIX I

This is the raw data for the seventy-six species found in the annotated list. Explanation of the format used: for example 100/1 8

The 100/1 means that the sample was the first one taken along transect 100. The 8 is the number of individuals of that species in the sample. This number, when multiplied by one hundred gives the density of that species as number per meter squared.

PLATYHELMINTHES

<u>Notoplana</u> sp.

39/5	1	50/3	1	54/3	1	62/6	1
101/2	1						

NEMERTINA

<u>Lineus</u> sp.

28/1	5	30/2	1	36/5	1	38/3	2
39/4	1	39/5	1	48/4	1	55/5	1
72/3	2						

<u>Cerebratulus</u> sp. (small) medium or large

2/1	(2)	4/4	(1)	9/1	(1)	9/5	(1)
12/5	1	17/3	(1)	17/4	(3)	21/2	(2)
24/1	(1)	25/2	(1)	27/3	(6)	28/4	(3)

Cerebratulus sp. con't.

29/1	(1)	25/2	(1)	30/1	(1)	30/3	(1)
33/3	(1)	34/3	1	36/4	(1)	37/1	(2)
40/2	1	41/4	1	50/3	1	50/4	(1)
51/4	1	54/1	(4)	56/1	(1)	57/4	(3)
67/1	(2)	71/3	(1)	72/1	(1)	73/1	2
80/1	1	86/1	(1)	86/2	(3)	88/3	1
89/3	1	91/2	1	93/2	1	97/2	1
97/3	1	99/2	1	100/5	1	100/6	(1)
101/2	(1)	101/4	1	105/1	1(1)	105/2	1
106/2	1	108/2	1	109/2	2	110/3	1
111/1	1	112/1	(5)	115/1	(4)	117/4	1
117/6	1	118/3	2	121/1	1	121/4	1
122/4	1	126/3	1	140/1	(1)	146/1	(2)
147/1	(1)	148/3	1	148/3	1	150/1	(6)
152/1	1	152/3	(1)	153/2	(1)	153/3	1
154/3	1	156/2	1	157/4	1	159/3	1
159/5	1	160/2	1	162/2	1	163/4	1
167/1	(4)	170/3	(1)	174/5	1	183/2	1
200/2	1	209/8	1	210/3	1	213/2	2
213/6	(1)	214/4	1	217/3	1		

Amphiporus sp.

10/3	1	25/3	1	26/3	3	26/4	1
27/2	1	28/1	3	28/2	2		

NEMATODA

unknown species

2/3	1	5/4	1	13/4	1	14/3	1
18/2	1	19/3	4	20/1	1	23/2	1
24/3	1	25/2	1	25/3	1	26/2	2
26/3	1	28/1	31	28/2	2	30/1	1
37/4	1	37/6	2	37/8	1	43/2	2
44/6	1	45/2	1	46/1	1	53/1	4
54/1	3	55/2	2	56/4	1	57/2	16
57/5	1	58/2	8	58/5	1	62/1	21
62/3	33	63/1	1	64/7	5	67/4	3
70/3	3	71/2	5	76/3	12	76/4	8
148/1	6	176/4	1	181/2	1		

MOLLUSCA

Gastropoda

<u>Polinices</u> <u>heros</u>

42/2	1	178/4	1

<u>Nassarius</u> <u>obsoletus</u>

79/2	5	42/2	6	112/2	6	112/3	1
114/2	1	118/1	4	120/1	1	121/1	3
121/2	1	122/1	2	123/1	3	148/2	5
148/3	2	149/3	1	150/2	2	166/2	2
168/1	2	168/3	1	174/2	3	198/1	1
209/2	1	209/6	1	210/2	1	210/4	2

Nassarius trivittatus

125/1	1

Pelecypoda

Ensis directus

51/6	1	70/6	1

Mytilus edulis

146/3	5

Petricola pholadiformis

67/5	1

Gemma gemma

37/3	1	42/2	3	44/4	27	44/5	6
49/3	2	57/2	2	58/2	6	60/2	4
61/1	3	61/2	3	62/1	1	64/2	4
72/1	2	72/2	3	75/2	1	78/3	1
83/3	1	89/2	3	190/1	1	194/2	1
197/1	7	199/3	1	200/1	2	201/1	1

Mya arenaria

37/2	5	38/1+	3	39/2	8	41/2	1
44/2	1	44/4	1	44/5	1	46/2	1
52/1	1	52/6	2	53/1	1	53/2	1
59/2	1	63/3	2	70/1	1	73/1	1

Mya arenaria con't.

97/1	6	102/1	2	111/2	1	127/4	1
127/5	1	190/1	1	192/1	1	196/2	1
197/1	4	199/2	1	200/1	1	209/3	1
215/2	1						

Macoma balthica

15/1	1	28/1	1	31/1	1	36/2	2
37/1	1	37/3	1	38/1+	11	38/2	3
41/2	1	43/2	1	44/1	1	44/3	2
44/4	14	44/5	1	47/2	2	48/2	1
52/2	1	61/1	5	63/1	3	67/1	3
70/1	3	71/4	1	72/1	2	73/1	2
76/2	2	77/2	1	78/2	4	83/1	1
97/1	2	120/2	1	120/3	1	124/2	1
125/6	2	160/1	2	161/1	50	166/1	2
168/1	1	171/1	1	178/1	1	180/2	1
191/2	4	193/1	2	194/1	1	195/1	17
197/2	1	198/1	21	199/3	1	201/1	6
201/2	1	201/3	1	202/2	1	207/2	1
208/2	1	209/2	2	209/4	1	215/3	1
216/1	1						

ANNELIDA

Polychaeta

Sigalion arenicola

221/2	1

Chaetozone setosa

5/4	1	9/4	1	15/4	12	32/3	1
33/2	51	34/2	8	37/9	2	38/2	1
38/3	1	38/4	11	38/7	2	39/2	80
39/3	39	39/4	4	39/6	1	39/7	1
40/2	236	40/3	1	40/4	88	41/1	1
41/2	7	41/3	227	41/4	51	41/5	1
42/1	6	42/3	10	42/4	125	43/2	1
43/3	7	44/5	92	44/6	1	48/2	2
49/1	1	50/2	5	50/4	13	51/2	58
51/3	42	51/5	10	52/2	16	52/3	20
52/4	17	52/5	2	53/3	6	49/2	115
53/4	7	54/2	215	54/3	22	55/3	1
55/4	2	56/2	1	57/3	2	57/6	1
58/3	3	59/2	2	59/3	28	65/3	1
66/2	94	66/3	15	66/4	3	67/2	40
68/2	28	68/3	4	68/4	4	68/5	1
59/4	2	69/2	39	69/3	3	70/3	1
82/1	1	82/2	47	82/3	53	82/4	4
82/5	5	83/2	83	83/3	53	83/4	27
83/5	13	84/1	68	84/2	22	84/3	43
84/4	1	84/5	6	85/1	7	85/2	34
85/3	113	85/4	39	85/5	28	86/1	11
86/2	249	86/3	258	86/4	237	87/2	132
87/3	284	88/3	12	88/4	294	88/5	12
89/2	1	89/3	198	92/1	5	92/2	45
93/2	10	94/2	103	95/1	16	95/2	485
96/1	1	96/2	101	96/3	30	97/2	22

Chaetozone setosa con't.

97/3	8	97/4	5	98/2	167	98/3	43
98/4	1	99/3	41	99/4	70	100/3	20
100/4	52	100/5	141	100/6	4	100/7	1
101/2	76	101/3	83	101/4	92	101/5	19
102/2	85	102/4	4	102/3	193	103/5	19
103/3	9	103/4	42	103/4	184	103/6	47
103/7	35	104/1	1	104/2	58	104/3	186
105/1	17	105/2	17	105/3	49	105/4	72
106/1	3	106/2	4	106/3	6	106/4	96
107/1	16	107/2	71	107/3	98	107/4	198
108/1	2	108/2	2	108/3	114	108/4	30
109/3	173	110/3	2	111/1	5	112/2	2
114/1	3	114/3	39	114/2	1	114/4	4
115/2	17	115/3	9	115/4	31	116/1	5
116/2	15	116/3	8	116/4	78	117/2	40
117/3	46	117/4	178	117/5	120	117/6	67
117/7	14	118/1	16	118/2	8	118/3	18
118/4	11	118/5	22	118/6	228	118/7	220
118/8	107	118/9	2	119/2	3	119/3	22
119/4	8	119/5	12	119/6	37	120/2	22
120/3	6	120/4	32	120/5	6	120/6	2
121/2	9	121/3	7	121/4	88	121/5	4
122/1	17	122/2	7	122/3	305	122/4	22
123/1	1	123/3	53	124/1	1	124/2	1
124/4	1	124/5	42	125/3	3	125/4	1

<u>Chaetozone</u> <u>setosa</u> con't.

127/3	11	127/4	3	139/1	1	140/1	2
141/6	6	142/1	7	143/2	2	146/2	4
148/7	20	149/4	8	150/2	3	150/3	75
151/2	10	151/3	85	152/1	1	152/2	27
152/3	73	153/1	2	153/2	68	153/3	67
153/4	8	153/5	2	153/6	3	154/2	5
154/3	36	154/5	3	154/6	2	155/2	48
155/3	66	155/4	12	155/6	13	156/2	36
156/3	28	156/4	32	156/5	12	157/2	8
157/3	196	157/4	52	157/6	82	157/7	2
157/8	1	158/2	211	158/3	214	158/4	189
158/5	71	158/6	7	158/7	3	158/8	1
158/9	2	159/2	20	159/3	256	159/4	22
159/5	19	159/6	9	160/1	3	160/3	584
160/2	432	160/4	249	160/5	9	160/6	1
160/7	1	161/2	229	161/3	215	162/2	139
162/3	1	162/4	14	162/6	1	163/2	201
163/3	6	163/5	3	164/2	8	166/2	17
167/1	68	167/2	65	167/3	106	168/2	99
168/3	277	168/4	43	168/5	85	169/1	48
169/2	53	169/3	59	170/2	39	170/3	36
170/4	3	171/1	2	171/2	219	171/3	85
172/2	137	175/6	1	176/2	1	176/4	2
178/5	1	183/2	5	185/2	1	188/2	1
190/1	2	192/1	1	192/2	1	194/1	15

<u>Chaetozone setosa</u> con't.

194/2	103	194/3	4	195/2	27	195/3	36
195/4	27	196/1	24	196/2	15	196/3	47
197/2	10	198/2	46	198/3	109	198/4	2
199/1	2	199/2	10	199/3	62	199/4	186
199/5	17	200/1	2	200/2	54	200/3	41
200/4	3	201/2	273	201/3	95	201/4	1
202/2	32	202/3	83	202/4	1	202/5	1
203/2	5	204/3	1	205/6	1	206/3	11
207/2	32	207/3	4	208/2	1	208/3	74
208/4	1	209/3	22	210/2	57	210/3	21
211/3	21	211/4	44	212/2	8	213/2	115
214/1+	4	214/2	1	215/2	5	216/2	1
218/2	1	219/1	1	219/5	3	220/4	1
221/4	4						

<u>Phyllodoce mucosa</u>

2/3	1	4/3	1	5/4	1	9/5	1
10/4	2	15/4	1	23/3	1	30/4	1
31/3	1	31/4	1	32/4	1	33/4	1
34/4	2	35/4	2	35/5	2	35/6	2
36/6	1	38/9	1	51/4	1	52/5	1
52/7	1	53/6	1	55/6	1	57/5	1
58/4	1	64/5	5	66/5	3	67/4	1
68/5	1	73/4	1	75/4	1	77/4	2
79/5	1	81/5	2	100/8	1	100/9	17

Phyllodoce mucosa con't.

103/7	1	118/9	1	118/12	1	119/7	1
148/7	1	149/5	2	150/5	1	152/5	2
153/6	2	154/6	6	156/7	7	158/9	2
169/6	2	175/6	2	218/2	1	219/1	1
219/2	3	220/2	2	220/3	2		

Eteone heteropoda

22/2	1	50/3	1	51/3	1	58/3	1
67/3	1	68/2	1	69/2	2	70+/1	1
75/2	2	77/3	1	80/2	3	81/3	1
83/4	2	84/2	2	84/3	1	85/4	2
86/3	1	86/4	3	88/4	3	89/3	2
91/1	5	92/1	6	92/2	1	93/2	3
94/1	1	94/2	4	95/1	7	95/2	3
96/2	3	96/3	1	97/1	1	97/2	4
97/3	1	98/4	1	99/3	1	100/2	5
100/3	8	100/5	2	101/2	2	101/3	6
101/4	1	101/5	2	102/2	2	102/3	10
102/4	1	103/3	5	103/4	5	103/5	16
103/6	2	103/7	5	104/2	5	104/3	7
105/1	1	106/2	5	106/3	2	106/4	1
107/1	4	107/2	4	107/4	6	108/1	7
108/3	10	108/4	3	109/1	7	109/3	21
110/1	2	110/2	3	110/3	7	111/2	3
111/3	5	112/1	5	112/2	9	112/3	10

Eteone heteropoda con't.

113/1	5	113/2	9	113/3	5	114/1	2
114/2	1	114/3	4	114/4	4	115/1	15
115/2	1	115/3	16	115/4	12	116/1	4
116/2	4	116/3	1	116/4	2	117/2	8
117/3	4	117/4	5	117/5	6	117/6	1
118/1	5	118/5	1	118/6	1	119/3	1
120/1	3	121/2	2	121/3	3	122/2	1
124/1	1	125/4	1	125/5	2	126/2	1
127/5	1	131/1	2	140/1	1	141/1	8
146/2	1	147/1	1	151/3	2	151/4	1
152/1	1	152/2	4	153/2	3	154/2	1
154/4	3	155/3	5	156/3	8	157/2	2
157/4	4	158/2	6	158/3	8	158/4	2
159/2	3	159/3	12	159/4	7	160/1	2
160/2	4	160/3	6	160/4	4	161/2	7
161/3	7	168/2	1	192/1	1	194/1	2
195/2	2	196/2	2	197/1	1	197/2	1
198/2	1	198/3	2	199/2	4	199/3	4
199/4	1	199/5	1	200/3	3	202/4	1
204/3	1	206/4	2	207/2	5	210/2	3
212/2	3	213/2	1	217/2	16	219/5	1

Eteone longa

1/2	2	2/2	1	3/3	1	6/4	1
8/2	2	9/3	4	9/4	1	10/3	3
11/2	3	11/3	2	13/2	1	13/4	1

<u>Eteone</u> <u>longa</u> con't.

14/3	5	15/2	1	17/5	1	18/1	1
18/2	1	18/3	2	19/2	1	21/2	4
23/2	1	29/1	1	29/2	1	30/2	6
30/4	1	31/2	3	32/2	2	32/3	3
32/4	4	33/3	2	34/3	2	35/2	1
36/8	1	37/2	1	37/3	3	37/4	1
37/8	2	37/9	1	38/3	4	38/4	8
38/5	1	38/8	3	38/9	3	39/2	9
39/3	6	39/5	2	39/6	2	39/7	3
40/2	5	40/3	6	40/4	5	40/5	1
41/2	3	41/3	5	41/4	6	41/5	4
42/1	1	42/2	5	42/3	5	42/4	12
43/3	4	44/4	3	44/5	2	44/6	4
44/7	1	45/2	5	46/2	6	47/1	1
47/2	1	49/1	2	49/2	18	49/3	7
50/2	3	50/3	7	50/4	4	51/2	11
51/3	8	51/4	3	51/5	2	52/2	5
52/3	10	52/4	10	53/1	2	53/3	4
53/4	7	53/5	11(10vs)	54/2	11	54/3	9
55/3	5	55/4	6(5vs)	55/5	4(vs)	56/2	4
57/2	5	57/3	14	58/3	8	58/4	5
59/3	14	59/4	9	60/2	1	60/4	2(vs)
60/5	3(2vs)	60/6	12(vs)	61/3	2	61/4	5(vs)
62/5	2	62/6	5(3vs)	64/2	2	64/3	1
62/1	1	64/4	1	65/1	1	65/2	1

Eteone longa con't.

66/3	7	66/4	5(1vs)	67/2	22	67/3	1
67/4	1	68/2	2	68/3	13	68/5	1(vs)
69/2	7	69/3	3	69/4	4	70/2	1
70/3	2	70+/1	4	71/2	2	74/2	26
75/2	6	75/3	14	75/4	1	76/2	6
76/3	5	76/4	1	77/2	5	77/3	5(1vs)
78/3	7	78/4	4	79/2	8	79/3	8
79/4	4	79/5	4	80/2	2	80/3	5
80/4	1	80/5	1	81/3	10	82/1	2
82/2	10	82/3	10	82/4	11	82/5	1
83/1	1	83/2	2	83/3	4	83/4	2
84/1	5	84/2	10	84/3	9(4vs)	84/4	6
84/5	2(s)	85/1	5	85/2	5	85/3	4
85/4	4	85/5	24	86/2	4(s)	86/3	3
86/4	9	87/1	2	88/2	1	88/3	1
88/4	5	88/5	20	89/2	1	89/4	27
90/2	1	91/2	1	92/2	1	93/1	4
93/2	14	94/1	1	95/2	9	96/3	7
97/1	1	97/3	6	97/4	4	98/2	4
98/3	3	98/4	15(14s)	99/3	6	99/4	3
100/3	3	100/4	5	100/5	10	100/6	15
100/7	68(67s)	100/8	11(s)	101/2	4(3s)	101/3	4
101/4	7	101/5	20	102/1	1	102/3	3
102/5	5	103/6	2	105/2	3	105/3	1
105/4	2	106/1	3	106/2	1	106/4	3

<u>Eteone</u> <u>longa</u> con't.

107/2	1	108/3	1	112/3	1	113/2	1
116/3	1	117/6	1	117/7	29	118/2	1
118/3	1	118/4	6	118/5	5	118/6	5
118/7	25	118/8	24	118/9	82	118/10	84
118/11	84	119/2	2	119/3	4	119/4	5
119/6	8	119/7	11	120/3	1	120/4	3
120/5	14	120/6	7	121/4	5	122/1	1
122/2	2	122/3	11	122/4	7	123/1	1
123/3	15	124/5	2	125/2	2	126/5	1
127/5	1	127/6	1	130/1	3	131/1	2
133/1	1	134/2	3	135/1	3	135/2	1
136/1	1	138/1	2	140/1	2	140/2	1
143/2	1	143/3	1	144/2	6	144/3	1
145/3	12	146/2	9	147/2	1	148/3	9
148/4	3	149/2	2	149/3	5(4s)	149/4	26
149/5	1	150/2	10	150/3	6	150/4	4
151/2	3	151/3	7	151/4	26	152/2	6
152/3	9	152/4	32	153/2	1	153/3	5
153/4	14	153/5	84	154/2	3	154/3	7
154/4	26	154/5	45	154/6	7	155/2	1
155/3	8	155/4	20	155/5	11	155/6	76
156/2	3	156/3	4	156/4	13	156/5	24
156/6	35	156/7	4	157/2	3	157/3	4
157/4	8	157/6	29	157/7	53	157/8	57
158/2	2	158/3	5	158/4	6	158/5	32

Eteone longa con't.

158/6	37	158/7	82	158/8	34	158/9	46
159/3	8	159/4	3	159/5	30	159/6	47
159/7	69	160/2	3	160/3	2	160/4	4
160/5	16	160/6	27	160/7	23	161/2	2
161/3	5	162/1	1	162/2	5	162/4	18
162/5	25	162/6	58	162/7	3	163/2	5
163/3	2	163/4	18	163/5	58	163/6	3
164/2	13	164/3	1	166/2	4	166/3	1
167/1	2	167/2	12	167/3	12	168/2	6
168/3	1	168/4	12	168/5	11	169/1	5
169/2	4	169/3	10	169/4	4	170/1	1
170/2	4	170/3	5	170/4	9	170/5	4
171/1	5	171/2	9	171/3	13	171/4	7
171/5	16	171/6	1	171/7	8	171/9	1
172/2	13	172/1	4	172/3	27	172/4	27
172/8	17	173/2	3	173/3	15	173/4	29
173/5	42	173/6	25	173/7	8	174/3	35
174/4	68	174/6	1	175/2	34	175/3	26
176/2	4	176/4	1	181/1	2	181/2	1
181/3	1	183/1	1	185/1	1	186/2	2
187/1	1	188/1	1	188/2	1	188/3	1
189/1	2	189/2	4	189/3	5	190/1	4
192/1	5	192/2	3	192/3	3	193/1	1
194/1	1	194/2	1	195/1	1	195/2	2
195/3	7	195/4	10	196/1	2	196/3	27

Eteone **longa** con't.

197/3	4	198/2	4	198/3	10	198/4	1
199/1	1	199/2	3	199/3	2	199/4	10
199/5	25	200/1	3	200/2	5	200/3	8
200/4	17	201/1	1	201/2	5	201/3	19
201/4	46	201/5	38	202/2	7	202/3	15
202/4	24	202/5	114	202/6	25	203/1	1
203/2	13	203/3	24	203/4	16	203/5	59
203/6	51	204/3	43	204/4	19	204/5	55
204/6	28	204/7	5	205/3	28	205/4	6
205/5	28	205/7	9	205/6	30	206/2	14
206/3	21	206/4	10	206/5	6	206/6	51
206/7	36	207/2	13	207/4	3	207/5	18
207/6	30	208/2	3	208/3	4	208/4	1
208/5	6	208/6	9	209/2	2	209/3	6
209/4	8	209/5	5	209/6	28	210/2	2
210/3	4	210/4	9	210/5	22	210/6	30
210/7	21	211/2	6	211/3	2	211/4	9
211/5	10	211/6	25	212/2	2	212/3	8
212/4	7	213/3	9	213/4	15	213/5	37
213/6	2	214/1	4	214/2	13	215/2	14
215/3	3	216/1	8	216/2	14	216/3	30
217/1	7	217/3	2	218/2	27	219/1	1
219/2	6	219/3	112	219/4	44	219/5	5
220/2	16	220/3	19	220/4	6	221/3	9
221/4	33						

Eteone lactea

193/2	1	196/1	1	221/4	1

Syllis gracilis

9/5	1	25/2	2	26/4	2

Eusyllis blomstrandi

7/5	1	9/5	4	12/4	1	16/4	7
20/3	5	21/3	10	22/1	1	22/3	1
23/2	5	24/3	2	25/4	1	26/3	3
27/4	10	28/1	1	28/3	1	28/4	1
29/5	1	36/5	2	43/4	5	62/8	3
71/3	3	73/4	1	164/3	1	213/6	1
214/4	1	220/2	1	221/4	7		

Exogone dispar

4/3	1	6/3	1	7/4	1	10/5	4
14/3	1	20/3	2	30/2	1	30/4	1
30/5	1	31/2	1	32/3	2	32/4	3
33/3	1	34/2	4	34/3	1	35/3	2
35/5	1	36/4	4	36/5	2	36/6	3
37/4	1	37/5	1	37/7	1	38/3	1
38/7	1	38/8	2	38/9	3	39/2	1
39/5	5	39/6	1	39/7	2	40/3	1
41/3	1	41/4	1	41/5	1	42/1	1
44/7	1	46/1	1	50/3	2	51/4	1

Exogone dispar con't.

53/5	1	53/6	1	54/2	1	56/2	1
56/3	7	56/5	2	57/5	4	58/4	3
60/5	4	64/5	1	64/7	4	66/5	3
67/5	1	68/4	1	68/5	1	69/5	4
70/6	11	72/3	1	73/3	1	74/3	2
75/4	2	76/4	5	79/4	1	80/4	4
80/5	2	81/3	1	82/5	2	83/4	5
84/2	1	88/5	1	100/6	1	100/7	1
101/5	3	103/7	1	145/3	1	148/7	1
153/5	1	154/6	1	155/4	1	156/6	1
158/6	1	160/5	1	160/7	1	162/6	10
163/5	3	169/6	1	171/1	1	171/5	1
171/6	1	172/3	2	173/3	3	173/5	2
173/7	1	174/6	3	175/2	1	178/5	1
205/4	1	205/6	1				

Exogone hebes

10/5	2

Nereis virens

5/2	2	8/2	1	14/4	1	21/4	1
29/5	1	37/1	1	37/2	8	38/1+	6
44/2	1	53/2	2	54/1	1	61/1	1
69/1	1	86/2	1	86/3	1	89/1	1
92/1	1	97/1	1	117/4	3	118/6	2

Nereis virens con't.

141/1	1	150/3	1	152/3	1	154/3	1
155/4	1	158/2	1	158/3	1	158/4	1
159/4	1	161/2	1	161/3	1	162/1	1
163/2	1	166/2	1	167/2	4	167/3	5
167/4	1	168/2	2	168/3	6	168/4	5
168/5	3	169/1	1	170/3	1	170/4	1
171/2	8	171/3	2	171/4	3	172/2	7
172/3	3	173/5	1	173/7	1	175/2	1
175/6	1	176/2	1	176/5	1	177/4	1
178/2	1	181/3	3	183/1	1	184/1	1
187/2	1	192/1	4	192/2	3	193/1	1
194/2	3	195/3	2	196/3	1	197/3	2
198/2	5	198/3	1	199/3	2	199/4	2
201/3	2	201/2	3	201/5	2	202/2	1
202/3	6	203/5	1	207/3	1	208/3	1
209/4	2	210/2	1	211/2	1	211/3	2
211/6	1	212/2	2	213/2	1	213/4	1
213/5	2	214/1+	1	216/1	1	219/4	1
220/3	1						

young Nephtyidae

34/2	1	34/3	2	34/5	2	35/3	3
37/3	1	37/4	1	37/6	3	37/7	2
37/8	11	37/9	11	38/3	2	38/6	6
38/8	1	38/9	13	39/2	1	39/4	2

young Nephtyidae con;t.

39/5	6	39/6	1	39/7	8	40/2	5
40/3	5	40/4	4	40/5	15	41/3	5
41/4	22	41/5	1	42/2	1	42/3	8
43/3	6	44/6	1	49/2	6	49/3	2
50/4	7	51/3	3	51/4	4	51/5	2
53/6	1	54/5	5	57/6	2	58/4	1
58/5	1	59/4	5	60/4	2	60/5	7
64/6	8	64/7	1	66/2	1	66/4	1
67/2	3	67/3	2	67/4	1	68/4	1
69/2	7	69/4	1	69/5	5	70/6	4
71/4	1	73/3	2	74/3	3	74/4	3
75/2	6	76/2	5	76/4	7	77/4	1
79/2	7	79/4	7	79/5	1	80/2	2
80/4	1	80/5	2	81/3	6	81/4	14
81/5	5	82/3	13	82/5	15	83/4	10
83/5	27	84/1	2	84/3	3	84/5	22
85/5	5	86/3	7	86/4	13	87/3	2
88/4	4	89/3	1	95/1	3	95/2	3
96/3	3	97/3	7	98/3	1	99/4	5
100/5	1	100/6	1	101/4	4	101/5	7
102/5	2	103/4	1	103/6	5	105/4	1
106/3	1	106/4	1	108/3	9	108/4	2
109/3	2	113/2	1	115/4	1	116/4	1
117/4	3	117/5	3	118/5	8	118/6	9
118/7	5	118/8	3	119/6	1	120/4	1

young Nephtyidae con't.

121/4	1	123/1	1	123/3	3	125/7	1
127/6	1	133/1	8	135/2	1	136/2	2
139/2	1	141/1	1	142/2	5	142/2	5
143/3	1	146/2	3	147/2	1	150/3	5
150/4	1	151/3	8	151/4	3	152/2	11
152/3	7	152/4	4	153/2	1	153/3	5
153/4	1	154/5	4	154/6	2	155/2	6
155/3	11	155/4	6	155/5	1	156/2	2
156/3	32	156/4	17	156/5	5	157/4	1
157/6	2	157/7	1	158/2	4	158/3	1
158/4	2	158/9	1	159/2	1	159/3	7
159/4	1	159/5	2	159/6	1	159/7	1
160/4	4	160/5	1	160/6	1	161/2	5
161/3	4	163/2	1	163/3	1	163/5	2
164/2	4	166/2	1	167/3	9	169/2	1
169/4	13	170/3	2	170/4	1	170/5	2
171/1	1	171/5	1	172/3	1	173/2	14
173/4	1	173/7	1	174/3	2	175/2	1
176/2	3	182/1	1	183/1	1	183/2	22
184/2	1	185/2	2	187/2	1	189/3	4
190/1	1	190/2	1	192/2	5	192/3	3
195/3	2	195/4	13	196/2	1	196/3	19
197/2	6	197/3	3	198/2	2	198/3	8
198/4	2	199/2	6	199/3	6	199/4	5
200/2	1	200/3	17	200/4	12	201/2	2

young Nephtyidae con't.

201/3	8	201/4	8	201/5	4	202/3	13
202/4	11	202/5	7	203/4	9	203/5	4
203/6	2	204/3	3	204/4	2	204/5	3
204/6	1	205/4	3	205/6	3	206/3	8
206/4	2	206/5	2	206/6	2	207/2	13
207/6	2	207/7	1	208/3	1	208/4	1
208/5	1	208/6	1	209/2	1	209/5	3
209/6	3	210/2	7	210/3	16	210/4	2
210/5	4	211/3	2	211/4	4	212/2	13
212/3	8	213/3	1	213/4	1	214/2	7
214/3	2	215/2	2	215/3	1	216/2	3
219/1	3	219/2	2	219/5	25	220/2	2
220/4	7	221/3	2	221/4	2	221/5	4

<u>Nephtys bucera</u>

221/1	1

<u>Nephtys coeca</u>

1/3	1	2/3	1	4/3	2	5/2	1
8/3	1	9/2	1	9/3	6	9/4	4
10/3	4	10/4	1	11/3	2	12/2	1
13/4	1	14/3	1	15/2	1	15/3	1
15/4	3	16/2	1	19/3	1	30/2	1
30/4	1	30/5	1	31/2	4	31/2	4
32/2	5	32/3	5	33/2	6	33/4	3

Nephtys coeca con't.

34/3	3	34/4	1	35/4	3	35/6	1
36/7	1	36/8	1	37/8	1	37/9	1
38/4	2	38/5	5	38/6	1	38/9	1
39/3	3	39/4	2	39/5	1	40/3	2
40/4	1	41/3	1	44/6	1	44/7	1
40/5	1	49/2	1	49/3	2	50/3	1
50/4	1	50/5	2	51/3	2	51/5	1
51/6	2	52/3	1	52/4	1	52/6	3
52/7	1	53/5	4	54/3	1	54/5	1
55/3	1	55/4	1	56/5	2	57/2	1
57/4	1	57/5	1	58/4	5	59/3	1
59/5	1	60/6	1	61/3	2	61/4	1
62/5	1	62/7	1	64/2	1	64/4	1
64/6	1	64/7	1	67/2	1	68/3	2
68/4	2	68/5	1	69/3	1	69/5	1
71/3	1	71/4	1	73/3	1	74/3	1
74/4	2	75/4	1	76/4	1	77/3	1
77/4	1	78/3	1	80/3	1	80/4	1
80/5	2	82/4	2	82/5	1	83/1	1
83/2	4	83/4	1	83/5	2	85/1	2
85/3	1	85/4	3	88/3	1	92/2	1
93/2	1	97/2	1	97/3	1	97/4	3
99/3	1	100/2	2	100/9	1	102/3	1
102/4	2	103/7	2	118/10	1	118/13	1
123/3	1	124/5	1	125/7	3	139/2	1

Nephtys coeca con't.

141/1	1	142/2	2	143/3	1	145/2	1
145/4	1	150/3	1	150/5	1	152/5	2
153/6	2	155/5	2	156/5	1	156/7	1
158/6	1	158/8	1	159/4	1	159/5	1
160/5	1	166/2	1	167/3	1	168/3	1
168/4	1	169/2	1	169/3	1	169/7	1
156/6	1	170/8	1	171/4	2	171/5	1
172/3	2	172/8	2	173/2	2	173/3	3
173/4	3	173/5	3	173/6	2	174/2	2
174/6	1	175/2	1	175/3	1	176/2	2
178/4	1	181/3	1	183/2	1	199/5	2
200/4	1	201/4	1	201/5	2	202/5	3
203/4	1	203/5	1	204/4	1	204/5	2
204/6	5	204/7	2	205/5	3	205/6	4
205/7	3	206/3	1	206/4	1	206/5	2
206/6	2	206/7	1	207/2	1	207/3	3
207/4	3	207/5	3	207/6	1	207/7	2
208/2	1	208/5	2	208/6	1	208/7	1
209/6	1	210/7	1	210/6	1	211/5	2
211/6	3	212/4	1	213/5	1	214/3	1
216/2	1	217/2	1	218/2	1	219/1	1
219/2	3	219/4	3	220/2	2	220/3	4
220/4	2						

Glycera dibranchiata

11/2	1	13/4	1	22/4	1	30/4	1
31/2	1	35/5	1	35/6	1	38/3	1
52/2	1	62/5	1	66/4	1	69/2	1
70/4	1	75/3	1	76/4	1	78/4	1
85/1	2	89/3	1	98/2	1	100/3	1
100/5	1	101/3	1	102/5	1	103/7	1
105/2	1	106/4	1	107/3	1	112/2	1
117/7	1	118/2	1	118/4	1	118/6	1
118/7	1	120/4	1	122/3	1	122/4	1
126/3	1	126/5	1	127/4	1	141/2	1
148/3	1	149/2	1	150/2	1	152/3	1
154/4	2	155/5	1	156/2	1	156/5	1
156/6	1	156/7	1	157/2	1	157/6	1
158/6	1	159/5	2	162/5	1	162/6	1
162/7	1	167/3	1	167/4	1	168/3	1
169/2	1	169/3	1	169/4	1	169/7	1
170/2	2	170/4	1	170/5	1	171/1	1
171/4	1	171/5	1	171/7	2	172/2	2
172/4	2	174/2	1	174/3	1	188/2	1
189/4	1	191/3	1	191/4	2	195/3	1
196/3	1	197/2	1	198/3	2	203/2	1
204/3	1	204/4	1	206/3	1	213/3	1
220/2	1	220/3	1				

Lumbrinereis fragilis

215/4	1	218/2	1	221/4	1

Aricidea suecica

10/5	2	14/4	1	16/4	1	17/5	1
22/4	1						

Paraonis fulgens

8/3	3	10/5	1	14/2	1	16/4	1
17/4	1	19/2	1	19/3	2	20/3	4
26/4	3	27/4	1	30/4	1	35/6	1
36/4	10	36/5	1	37/3	5	42/2	5
43/4	12	44/7	2	50/5	3	57/2	1
58/3	2	60/2	2	60/3	6	60/4	1
61/3	1	61/4	8	62/4	2	64/2	2
68/5	1	69/5	1	70/4	7	70/5	9
70⁺/1	1	70/4	7	78/3	2	120/2	1
121/5	182	127/3	1	143/3	2	143/4	4
170/6	1	170/8	1	174/5	1	175/3	1
176/4	1	176/5	1	188/3	1	205/7	2
215/4	5	221/4	25				

Protodorvillea kefersteini

5/4	2	7/5	1	10/4	3	14/3	1
24/3	3	25/3	2	27/2	2	27/3	3
28/3	6	29/4	1	36/4	3	37/8	1

Scoloplos spp.

9/5	3	12/5	1	13/5	3	17/5	1
20/3	9	31/1	1	39/3	14	40/2	7
42/3	3	42/4	1	49/2	4	52/2	1
53/1	1	53/3	1	53/4	1	54/2	1
58/4	1	71/1	1	72/1	1	74/2	1
75/2	1	76/2	1	79/2	4	81/3	2
82/1	2	84/1	2	84/5	4	87/3	2
89/2	1	94/1	3	94/2	1	95/1	3
95/2	1	96/1	2	96/2	1	97/2	4
98/2	1	100/2	1	100/3	1	100/6	1
101/2	2	101/3	1	102/1	27	102/2	2
102/3	1	103/2	1	104/2	4	104/3	3
103/3	1	105/1	5	106/1	8	107/1	7
108/1	7	108/3	1	109/1	3	110/1	16
112/2	1	112/3	1	113/2	1	114/2	3
115/3	2	116/1	8	116/2	1	116/3	1
117/2	4	117/3	2	117/4	1	117/6	1
118/1	14	118/4	1	119/7	1	120/1	7
121/1	73	121/2	2	122/1	2	122/2	15
122/4	1	123/4	1	124/1	1	131/1	1
134/1	1	138/1	1	140/1	4	140/2	2
154/5	2	156/4	1	156/7	1	157/3	1
157/4	1	157/6	1	158/3	2	158/5	2
158/7	1	159/2	7	159/3	3	159/5	2
160/2	2	160/3	6	160/4	1	160/5	2

Scoloplos spp. con't.

173/6	1	174/6	1	183/2	1	184/2	1
187/1	3	188/1	1	190/1	2	192/1	1
194/1	6	194/2	1	196/1	3	196/3	1
198/4	1	199/1	1	201/2	1	202/3	3
204/7	1	209/2	1	209/6	1	211/2	3
211/4	2	213/2	2	214/1+	2	215/2	2
216/1	4	217/3	1	221/5	1		

Polydora ligni

17/5	1	19/3	6	32/3	1	33/2	1
75/4	2	83/3	2	102/4	3	116/2	1
154/5	2	156/4	1	161/2	1	161/3	1
162/3	1	174/2	1	175/5	2	181/3	1
201/2	1	202/6	1	206/3	1		

Spio sp.

3/2	1	4/3	1	9/4	1	32/2	1
36/6	1	53/3	1	62/7	1	64/7	1
77/4	1	86/4	1	98/2	1	178/5	1

Scolecolepides viridis

134/2	5	135/2	6	136/2	1	140/2	1
156/2	1	173/3	1	188/4	1	189/4	102
191/3	48	191/4	8	192/4	2	195/4	2
205/2	1	206/3	1	209/8	1	210/7	1
217/2	1	218/3	4				

Streblospio benedicti

34/2	5	38/3	1	38/9	1	39/2	25
39/3	27	40/2	44	41/3	45	41/4	2
42/3	26	42/4	8	43/3	4	44/5	4
49/2	21	50/3	8	50/4	8	51/2	26
51/3	25	52/2	5	52/3	4	52/4	12
53/3	1	53/4	5	54/2	16	54/3	4
54/4	2	59/3	21	59/4	14	60/5	3
64/2	1	65/3	12	66/2	52	66/3	22
66/4	12	67/2	134	67/3	9	67/4	15
68/2	128	68/3	61	68/4	5	69/2	16
69/3	13	69/4	9	70/5	1	74/2	11
74/3	5	75/2	51	75/3	7	76/2	29
76/3	2	76/4	13	77/2	19	77/3	31
77/4	1	78/4	4	79/2	16	79/3	32
79/4	9	79/5	11	80/2	78	80/3	24
80/4	2	80/5	1	81/3	42	81/4	23
81/5	8	82/1	4	82/2	65	82/3	15
82/4	42	82/5	33	84/1	33	84/2	266
84/3	46	84/4	12	84/5	1	85/1	59
85/2	80	85/3	25	85/4	74	85/5	14
86/1	13	86/2	23	86/3	54	86/4	103
87/1	8	87/2	17	87/3	14	88/2	18
88/3	17	88/4	6	88/5	40	89/2	5
89/3	24	89/4	258	91/1	15	91/2	16
92/1	29	92/2	15	93/1	5	93/2	91

<u>Streblospio</u> <u>benedicti</u> con't.

94/1	2	94/2	6	95/1	13	95/2	2
96/1	4	96/2	51	96/3	124	97/2	14
97/3	56	97/4	13	98/2	107	98/3	4
98/4	34	99/3	41	99/4	2	100/2	30
100/3	20	100/4	29	100/5	49	100/6	66
101/2	12	101/3	36	101/4	8	101/5	16
102/1	2	102/2	21	102/3	24	102/5	11
103/2	1	103/3	13	103/4	11	103/5	4
103/6	3	103/7	10	104/2	7	104/3	46
105/1	4	105/2	14	105/4	6	106/1	1
106/2	8	106/3	12	106/4	3	107/1	15
107/2	14	107/3	19	107/4	38	108/1	24
108/2	11	108/3	11	109/1	11	109/3	10
110/1	17	111/1	9	111/2	35	111/3	7
112/1	2	112/2	5	112/3	22	113/1	4
113/2	9	113/3	2	114/1	4	114/3	13
114/4	22	115/2	12	115/3	8	115/4	4
116/1	7	116/2	16	117/2	21	117/3	22
117/4	7	117/5	23	117/6	29	117/7	96
118/3	15	118/4	24	118/5	25	118/6	13
118/7	38	118/8	4	119/2	19	119/3	23
119/4	37	119/7	10	119/7	1	120/1	5
120/2	22	120/3	22	120/4	33	121/1	11
121/2	11	121/3	26	121/4	18	122/1	23
122/2	11	122/3	36	122/4	7	122/5	3

Streblospio benedicti con't.

123/1	3	123/2	3	123/3	48	124/1	3
125/3	8	125/4	3	126/2	9	126/5	2
127/3	9	127/4	7	136/1	9	138/1	1
139/1	1	140/1	7	141/1	10	142/1	13
146/2	24	147/2	1	148/3	58	149/2	4
149/3	36	150/2	3	150/3	100	150/5	1
151/2	15	151/3	26	152/2	88	152/3	103
153/2	14	153/3	45	153/4	25	154/2	19
154/3	38	154/4	32	155/2	23	155/3	27
155/4	1	156/2	4	156/4	16	156/3	3
156/5	8	157/3	18	157/4	19	157/6	33
158/2	27	158/3	14	158/4	49	158/5	70
158/6	19	159/2	7	159/3	9	159/4	12
159/5	18	159/6	5	160/1	2	160/2	22
160/4	22	160/5	33	161/2	16	161/3	20
162/1	1	162/2	10	162/4	30	162/5	9
163/2	7	163/3	2	163/4	5	166/2	7
167/1	9	167/2	106	167/3	97	168/2	37
168/3	23	168/4	56	168/5	45	169/1	22
169/2	24	169/3	22	169/4	1	170/1	6
170/2	40	170/3	37	170/4	38	170/5	1
171/1	11	171/2	95	171/3	57	171/4	18
172/2	33	172/3	27	172/4	9	173/2	8
183/1	4	183/2	1	190/1	1	192/1	9
194/1	3	194/2	5	195/2	5	195/3	19

Streblospio benedicti con't.

195/4	4	196/1	7	196/2	14	196/3	38
197/2	16	198/2	22	198/3	16	199/2	7
199/3	42	199/4	51	199/5	1	200/1	2
200/2	6	200/3	21	200/4	4	201/2	53
201/3	27	202/2	7	202/3	47	202/4	1
204/3	4	205/3	5	206/3	11	207/2	44
207/3	3	208/2	2	208/3	18	210/2	8
210/3	6	211/3	5	211/4	4	212/2	13
213/2	7	214/1+	9	216/1	1	219/5	2

Spiophanes bombyx

1/3	4	2/3	30	3/2	5	3/3	45
4/2	1	4/3	67	4/4	1	5/3	26
5/4	33	6/3	12	6/4	12	6/5	1
7/5	1	8/2	3	8/3	14	9/2	3
9/3	20	9/4	25	9/5	21	10/2	1
10/3	45	10/4	14	10/5	12	11/2	14
11/3	7	11/4	2	12/3	1	13/4	10
13/5	2	14/2	3	14/3	4	15/3	48
15/4	37	16/3	22	17/5	1	20/2	6
21/2	11	21/4	1	22/2	82	22/4	3
23/3	1	24/3	2	26/2	7	26/4	1
27/2	1	27/4	2	29/4	16	30/4	15
31/3	51	31/4	11	32/2	2	32/3	28
32/4	9	33/2	13	33/3	4	33/4	21

<u>Spiophanes</u> <u>bombyx</u> con't.

34/2	2	34/3	1	34/4	12	34/5	1
35/2	20	35/3	9	35/4	41	35/5	72
35/6	6	36/4	36	36/6	31	36/7	16
36/8	59	37/5	11	37/6	2	37/7	8
37/8	3	37/9	4	38/7	1	38/8	24
38/9	16	39/7	8	40/3	29	41/2	1
42/2	1	51/3	7	51/4	24	51/5	9
51/6	132	52/4	8	52/5	45	52/6	7
52/7	55	53/3	1	53/6	4	54/3	4
54/4	4	54/5	1	55/3	10	55/6	8
56/5	3	57/3	13	58/5	2	59/4	102
59/5	35	60/5	1	60/6	27	61/4	1
62/5	2	62/6	3	62/7	43	62/8	4
64/5	45	64/6	43	65/2	1	66/2	1
66/3	1	66/4	34	66/5	46	67/2	11
67/3	52	67/4	44	68/2	3	68/4	25
69/5	22	69/3	2	69/4	26	69/5	20
70/5	59	71/3	1	72/3	1	74/2	1
74/3	14	74/4	58	75/3	3	75/4	1
76/4	20	77/4	56	78/4	11	79/4	1
79/5	8	80/4	2	80/5	25	81/4	15
81/5	30	83/2	2	83/4	3	83/5	16
84/3	13	84/5	1	85/4	2	85/5	21
86/4	1	88/5	75	89/4	17	92/2	1
93/2	1	97/3	3	97/4	19	98/4	89

<u>Spiophanes</u> <u>bombyx</u> con't.

100/6	38	100/7	29	100/8	44	100/9	58
101/5	14	102/5	7	103/6	3	103/7	14
105/4	1	117/7	39	118/6	9	118/7	68
118/8	42	118/9	5	118/10	7	118/11	21
118/12	1	119/7	16	120/5	5	121/4	2
122/2	1	122/3	2	122/4	3	124/5	2
150/4	40	150/5	51	151/3	3	151/4	17
152/1	5	152/4	4	152/5	6	153/5	9
153/6	12	154/5	4	154/6	9	155/4	5
155/5	2	155/6	21	156/5	1	156/6	1
156/7	20	157/6	3	157/7	13	157/8	24
158/7	4	158/9	2	159/5	2	159/6	31
159/7	20	160/5	3	160/6	15	160/7	18
162/6	4	162/7	1	163/4	3	163/5	4
167/1	2	170/5	4	170/6	8	170/8	14
171/5	13	171/6	1	171/7	3	172/3	2
172/4	10	172/8	10	173/3	8	173/4	3
173/5	22	173/6	10	174/4	8	174/5	1
174/6	8	175/2	5	175/3	4	175/6	2
178/5	1	204/6	15	204/7	31	205/7	20
206/7	5	207/7	3	208/6	12	208/7	4
209/8	1	210/6	2	213/6	1	219/1	9
219/2	33	219/3	15	220/2	34	220/3	5
221/3	62	221/4	145	221/5	48		

Pygospio elegans

1/1	12	2/1	3	2/2	1	3/1	1
6/2	4	7/3	1	8/2	2	8/3	4
10/3	1	10/5	1	11/2	3	11/3	1
12/4	8	13/4	12	17/5	1	18/4	41
21/2	3	22/1	3	22/3	1	23/2	3
23/3	1	24/2	46	24/3	89	25/2	4
25/3	12	26/3	1	28/2	5	29/1	1
29/2	2	29/3	4	29/4	11	30/3	39
30/4	32	30/5	6	33/3	3	33/4	1
35/5	1	36/4	4	36/7	30	36/8	3
37/1	7	37/3	2	37/5	11	37/6	15
37/7	29	37/8	50	37/9	7	38/6	1
38/7	6	38/8	2	38/9	7	39/3	3
42/2	3	49/1	4	49/2	3	49/3	1
50/3	7	50/4	1	51/2	4	51/3	5
51/4	10	51/5	1	52/1	7	52/4	2
52/5	7	52/7	3	53/1	5	53/2	2
53/4	27	53/5	125	53/6	11	54/4	7
54/5	34	55/2	1	55/4	62	55/5	34
56/1	1	56/3	6	56/5	4	57/2	4
57/4	8	58/2	3	58/4	44	58/5	7
59/2	7	59/3	2	59/4	5	59/5	6
60/3	63	60/4	59	60/5	222	61/3	22
61/4	56	62/1	1	62/2	3	62/3	3
62/4	4	62/6	132	62/8	9	64/2	1
64/4	5	64/6	2	64/7	2	65/3	4
66/2	1	66/3	5	66/4	8	66/5	24

<u>**Pygospio elegans**</u> con't.

67/1	1	67/2	2	67/3	12	68/2	3
68/3	14	68/4	9	68/5	2	69/2	3
69/3	1	69/4	3	70/2	11	70/3	8
70/6	45	70^+/1	15	71/2	2	71/3	2
71/4	6	75/3	2	75/4	29	76/4	11
77/3	3	78/3	3	79/1	6	79/5	36
80/4	11	81/3	20	81/5	3	82/2	10
82/4	4	82/5	6	83/5	2	84/2	5
84/3	2	84/4	1	84/5	1	85/3	2
86/1	2	86/2	2	86/4	17	88/3	3
89/2	1	89/4	6	90/1	26	93/2	5
94/1	1	96/1	1	96/2	4	96/3	3
97/3	28	97/4	8	98/2	4	98/3	1
98/4	10	100/7	16	100/1	2	103/4	4
103/6	2	107/3	4	109/2	2	111/1	1
111/2	2	118/1	1	118/4	3	118/8	9
118/11	18	118/12	24	119/5	2	119/7	4
120/2	2	120/5	2	120/6	4	121/5	1
122/2	1	122/4	1	124/1	2	124/5	2
126/5	2	133/2	1	134/2	1	142/2	19
144/2	50	145/3	30	147/3	46	148/2	1
148/3	13	149/2	2	149/3	8	149/4	78
150/2	6	150/3	10	150/4	2	151/2	1
151/4	7	152/1	1	152/2	4	152/3	4
152/4	9	152/5	1	153/1	1	153/3	4

Pygospio elegans con't.

153/4	9	153/5	9	153/6	16	154/3	2
154/4	18	154/5	8	154/6	4	155/3	1
155/4	15	155/5	19	155/6	9	156/5	4
156/6	4	157/4	2	157/6	3	157/7	4
157/8	9	158/3	1	158/5	4	158/6	12
158/7	3	158/8	1	158/9	5	159/4	6
159/5	3	159/6	1	159/7	4	160/6	4
160/7	14	161/3	4	162/5	2	162/6	3
162/7	5	163/5	5	163/6	15	164/2	32
164/3	1	166/3	1	167/2	6	168/3	6
168/4	8	169/2	4	169/3	5	169/4	9
169/6	6	169/7	1	170/5	10	170/6	3
170/7	5	171/1	1	171/3	3	171/4	11
171/5	21	171/6	6	171/7	71	171/8	8
171/9	4	172/1	5	172/2	7	172/3	61
172/7	47	172/6	2	172/8	86	173/2	37
173/3	21	173/4	18	173/5	12	173/6	45
173/7	130	174/2	1	174/3	48	174/4	20
174/5	2	174/6	4	175/2	42	175/3	31
175/5	1	176/2	20	176/3	2	178/2	1
178/5	1	181/2	3	181/3	1	188/3	4
188/4	11	189/3	6	190/2	1	192/3	1
192/4	1	193/2	1	194/2	2	196/2	3
196/3	5	197/2	2	198/4	1	199/4	2
201/4	11	201/5	11	202/2	1	202/3	3

Pygospio elegans con't.

202/4	17	202/5	55	202/6	15	203/2	26
203/4	7	203/5	16	203/6	25	204/3	38
204/4	15	204/5	15	204/6	15	204/7	7
205/2	1	205/3	27	205/4	9	205/5	26
205/6	116	205/7	38	206/2	17	206/3	4
206/6	7	206/7	70	207/2	7	207/5	5
207/6	4	207/7	18	208/3	2	208/4	1
208/5	2	208/6	4	209/3	3	209/6	41
209/7	4	210/6	6	210/7	36	211/7	1
213/4	1	213/5	37	213/6	2	215/2	1
215/4	9	216/2	3	216/3	4	218/1	1
218/2	10	218/3	5	219/1	9	219/2	13
219/3	8	219/4	4	220/2	6	221/1	2
221/3	9	221/4	167	221/5	4		

Ophelia limacina

18/4	2	21/3	2	22/3	4	23/2	1
25/2	8	25/3	1	26/3	1	27/3	2
43/4	3	58/2	63	178/3	2	179/2	2

Heteromastus filiformis

8/2	6	9/3	3	9/4	1	14/2	1
31/2	1	33/2	2	34/2	4	34/3	1
36/7	1	37/2	2	37/4	2	37/6	1
37/7	4	37/8	4	37/8	1	38/1+	3

<u>Heteromastus</u> <u>filiformis</u> con't.

38/2	1	38/3	7	38/4	4	38/5	1
38/6	3	38/7	3	38/9	1	39/2	12
39/3	2	39/4	3	39/6	4	39/7	3
40/2	47	40/3	1	40/4	5	40/5	2
41/1	1	41/2	20	41/3	16	41/4	18
41/5	16	42/1	1	42/3	38	42/4	41
44/3	1	44/4	12	44/5	37	44/6	14
44/7	3	45/2	2	46/2	12	47/2	13
48/2	2	49/2	38	49/3	4	50/2	8
50/3	16	51/2	45	51/3	11	51/5	2
52/2	10	52/3	36	52/4	18	52/5	1
53/3	3	53/4	17	54/2	8	54/3	3
57/3	3	59/3	11	59/4	3	60/2	1
60/3	6	60/4	4	60/5	7	60/6	1
61/2	2	61/3	4	62/2	1	62/3	1
62/4	1	62/6	6	62/7	1	63/2	2
63/3	3	64/2	1	64/3	10	64/6	3
65/2	27	65/3	14	66/2	38	66/3	14
66/4	3	66/5	1	67/2	21	67/3	1
68/2	43	68/3	18	69/2	20	69/3	9
69/4	4	69/5	2	70/6	1	70^+/1	2
74/2	21	75/2	66	75/3	2	76/2	62
76/3	16	76/4	1	77/2	21	77/3	16
78/3	4	78/4	8	79/2	58	79/3	26
79/4	5	80/2	75	80/3	13	80/4	2

<u>**Heteromastus**</u> <u>**filiformis**</u> **con't.**

81/2	1	81/3	2	81/5	2	82/1	13
82/3	3	83/1	14	83/2	8	83/3	30
83/4	7	83/5	2	84/1	104	84/2	76
84/3	29	84/4	30	84/5	8	85/1	104
85/2	100	85/3	63	85/4	37	85/5	16
86/1	54	86/2	78	86/3	126	86/4	54
87/1	47	87/2	28	88/2	91	88/3	73
88/4	74	88/5	41	89/1	1	89/2	21
89/3	86	89/4	16	90/2	14	91/1	62
91/2	16	92/1	65	92/2	90	93/1	85
93/2	39	94/1	7	94/2	160	95/1	65
95/2	141	96/1	19	96/2	111	96/3	43
97/1	7	97/2	72	97/3	56	97/4	11
98/2	115	98/3	125	98/4	1	99/2	27
99/3	98	99/4	87	100/1	1	100/2	50
100/3	99	100/4	112	100/5	124	100/6	72
100/7	11	100/8	3	100/9	1	101/1	1
101/2	77	101/3	128	101/4	75	101/5	11
102/1	6	102/2	131	102/3	169	102/4	145
102/5	12	103/2	27	103/3	36	103/4	62
103/5	62	103/6	112	103/7	19	104/2	84
104/3	71	105/1	35	105/2	125	105/3	76
105/4	92	106/1	60	106/2	65	106/3	80
106/4	107	107/1	37	107/2	111	107/3	109
107/4	119	108/1	32	108/2	73	108/3	121

<u>**Heteromastus**</u> <u>**filiformis**</u> con't.

108/4	95	109/1	40	109/2	45	109/3	132
110/1	31	110/2	78	110/3	125	111/1	169
111/2	66	111/3	151	112/1	51	112/1	53
112/3	107	113/1	61	113/2	55	114/1	39
113/3	53	114/2	22	114/3	91	115/2	65
115/3	61	115/4	89	116/1	38	116/2	89
116/3	89	116/4	114	117/2	136	117/3	63
117/4	137	117/5	142	117/6	164	117/7	14
118/1	34	118/2	14	118/3	43	118/4	56
118/5	129	118/6	86	118/7	36	118/8	16
118/9	19	119/2	21	119/3	65	119/4	84
119/5	25	119/6	53	119/7	8	120/1	71
120/2	69	120/3	43	120/4	37	120/5	60
120/6	4	121/1	60	121/2	83	121/3	67
121/4	97	121/5	6	122/1	38	122/2	44
122/3	54	122/4	34	122/5	6	123/1	32
123/2	57	123/3	60	123/4	1	124/1	42
124/2	41	124/3	52	124/4	2	125/1	3
125/2	98	125/3	49	125/4	56	125/5	44
125/6	22	125/7	11	126/2	78	126/3	49
126/4	14	126/5	42	126/6	6	127/1	1
127/2	43	127/3	89	127/4	63	127/5	23
127/6	4	129/1	1	130/1	20	131/1	32
132/1	2	133/1	11	133/2	1	134/1	23
134/2	1	135/1	45	135/2	11	136/1	78

Heteromastus filiformis con't.

136/2	4	137/1	4	138/1	59	139/1	21
139/2	6	140/1	33	140/2	2	141/1	115
141/2	1	142/1	49	142/2	9	142/3	3
143/1	1	143/2	15	143/3	6	144/3	15
145/3	2	146/2	5	146/3	2	147/2	1
148/3	2	148/4	1	148/7	1	149/2	10
149/3	43	149/5	2	150/1	1	150/2	18
150/3	32	151/1	1	150/4	1	151/2	23
151/3	26	151/4	2	152/2	21	152/3	46
152/4	2	153/2	96	153/3	59	153/4	36
153/5	5	154/2	58	154/3	79	154/4	17
154/5	19	154/6	2	155/2	76	155/3	24
155/4	13	155/6	7	156/2	100	156/3	24
156/4	36	156/5	15	156/6	29	157/2	2
157/3	89	157/4	62	157/6	32	157/7	9
158/2	102	158/3	61	158/4	64	158/5	77
158/6	49	158/7	2	159/2	27	159/3	51
159/4	54	159/5	15	159/6	9	159/7	1
160/1	1	160/2	66	160/3	53	160/4	50
160/5	38	160/6	12	160/7	1	161/2	93
161/3	54	162/1	2	162/2	65	162/3	74
162/4	63	162/5	9	162/6	10	162/7	2
163/2	60	163/3	25	163/4	14	163/5	17
163/6	2	164/2	12	166/2	1	166/3	1
167/1	5	167/2	45	167/3	55	167/4	1

<u>**Heteromastus**</u> <u>**filiformis**</u> con't.

168/2	67	168/3	67	168/4	48	168/5	38
169/1	25	169/3	46	169/2	74	169/4	1
170/1	6	170/2	67	170/3	57	170/4	44
170/5	6	171/1	15	171/2	71	171/3	52
171/4	27	172/1	7	172/2	67	172/3	14
172/4	7	173/2	5	173/4	1	173/6	1
174/2	12	174/3	3	174/4	3	176/2	2
181/2	4	181/3	8	182/2	7	183/1	18
183/2	9	185/1	4	185/2	14	188/1	9
188/2	6	188/3	1	189/1	21	189/2	10
189/3	7	189/4	8	190/1	36	190/2	8
191/1	23	191/4	2	192/1	54	192/2	4
192/3	2	192/4	7	193/2	19	194/1	21
194/2	18	195/2	49	195/3	93	195/4	11
196/1	40	196/2	33	196/3	6	197/1	20
197/2	76	197/3	12	198/1	2	198/2	102
198/3	69	198/4	21	199/1	15	199/2	70
199/3	72	199/4	27	199/5	17	200/1	42
200/2	83	200/3	62	200/4	10	201/2	116
201/3	33	201/4	4	201/5	4	202/2	5
202/3	37	203/2	9	203/3	4	203/4	5
204/3	1	204/4	3	205/3	3	205/4	7
205/5	2	206/2	1	206/3	11	207/2	4
207/3	32	207/4	1	208/2	44	208/3	24
208/4	1	208/5	1	209/2	7	209/3	37

Heteromastus filiformis con't.

209/4	14	209/5	4	210/2	62	210/3	27
211/2	14	211/3	32	211/4	28	211/5	2
212/2	21	212/3	13	213/2	51	213/3	49
213/4	4	214/1+	45	214/2	19	214/3	2
215/2	14	216/1	23	216/2	10	217/1	21
217/2	1	219/4	13	219/5	25	220/4	5

Notomastus sp.

62/1	1

Clymenella spp.

2/3	1	3/3	2	4/3	1	5/4	9
6/3	1	9/3	9	9/4	1	10/3	12
10/4	6	10/5	2	13/4	2	14/2	1
14/3	1	15/4	1	24/3	8	26/4	4
27/4	1	28/4	2	29/4	2	30/4	8
30/5	1	31/2	2	31/3	2	31/4	1
32/3	8	32/4	2	33/4	6	34/4	6
35/2	1	35/3	1	35/4	7	35/6	8
36/4	6	38/8	1	50/3	1	51/4	2
51/6	2	54/4	1	55/5	1	55/6	1
56/5	3	57/4	1	57/5	6	57/6	1
58/4	1	58/5	4	59/5	2	62/8	1
64/5	1	66/4	1	66/5	2	67/3	1
67/4	1	68/2	1	69/4	1	69/5	1

<u>Clymenella</u> spp. con't.

72/3	27	74/2	1	74/3	8	74/4	2
76/4	2	77/4	7	78/4	1	79/4	1
80/5	3	81/4	9	81/5	4	82/3	2
82/4	4	83/4	2	83/5	7	84/3	1
85/4	4	85/5	5	100/6	2	100/8	4
100/9	4	101/5	2	102/5	3	117/7	1
118/7	1	146/4	4	148/7	1	118/11	1
150/4	9	150/5	2	151/4	2	152/4	3
152/5	1	153/5	3	154/6	1	155/5	1
155/6	7	157/6	2	157/7	1	157/8	3
158/6	1	158/7	2	159/7	1	160/5	1
160/6	1	160/7	1	162/5	1	162/6	2
162/7	1	163/5	5	166/3	1	169/7	2
170/8	2	171/5	3	171/6	3	171/7	2
172/3	3	172/4	1	172/8	1	173/3	3
173/4	1	173/5	12	173/6	1	203/6	1
204/4	1	204/5	2	204/6	6	205/4	1
205/5	5	205/6	1	205/7	1	208/6	1
208/7	5	215/4	3	217/3	7	218/3	1
219/3	8	219/4	1	220/2	1		

Oweniidae ?

31/2	1	73/4	1

Fabricia sabella

53/4	3	73/2	2	91/2	10	97/3	1

Asabellides oculata

134/2	2

Amphitrite cirrata

5/4	1	21/3	1	22/3	1	22/4	2
23/2	3	25/3	5	25/4	1	26/2	1
26/3	15	27/2	7	27/3	4	28/1	2
28/3	4	33/4	1	72/3	1	73/3	1
146/3	1	171/6	1	171/7	1		

Polychaete ?

38/6	1

Oligochaeta

unknown species

2/1	2	2/2	4	4/2	1	4/4	1
5/4	3	6/2	17	8/1	2	9/1	1
9/5	3	10/3	2	10/4	3	13/1	1
13/4	23	14/3	2	15/1	2	16/1	3
17/3	7	17/4	3	18/2	1	18/3	11
18/4	2	20/1	16	21/2	1	22/3	3
23/1	19	23/2	46	24/1	1	25/2	55
25/3	6	27/1	1	27/3	6	28/1	1

unknown species con't.

28/3	6	29/3	5	29/4	1	30/3	7
31/2	3	32/1	7	33/1	20	33/3	9
33/4	3	37/1	1	37/5	1	38/2	5
38/3	15	39/4	3	39/5	3	39/6	2
40/5	1	41/4	6	42/1	1	44/1	1
50/2	1	51/5	1	53/1	28	54/1	6
55/2	33	56/1	6	57/2	7	57/4	4
58/2	92	61/1	3	61/4	3	62/2	1
63/1	15	63/2	1	64/2	6	65/1	9
72/3	1	78/1	10	84/4	1	101/1	4
148/1	31	153/1	1	158/1	3	160/1	101
164/1	1	178/3	1	178/4	2	179/2	8
204/3	1						

__Peloscolex__ __benedini__

8/2	58	10/2	2	10/3	3	11/2	1
11/3	1	13/4	5	14/2	2	25/3	1
30/2	1	30/5	3	34/2	1	36/4	1
38/3	1	38/7	1	39/3	1	39/5	1
41/2	9	42/4	3	44/7	6	51/2	3
52/2	28	52/3	9	54/2	9	56/2	2
56/5	1	56/6	1	59/3	1	62/8	1
67/4	1	70/6	1	71/4	1	75/3	1

ARTHROPODA

Insecta

Chironomid larvae (pupae)

9/2	1	11/2	1	15/3	2	18/3	2
21/2	3	22/2	1	38/7	1	38/9	1
39/2	1	40/2	3(1)	41/3	1	52/2	2
53/3	1	54/1	1	54/2	10	58/4	1
59/3	2	67/2	2	68/2	1	68/3	1
74/2	1	75/2	3	77/3	1	78/1	1
87/3	1	86/3	1	116/4	1	159/2	1
169/2	1						

Crustacea

Harpactacoid Copepoda

66/1	∝	68/1	∝

<u>Oxyurostylis</u> <u>smithi</u>

2/3	2	9/4	2	12/1	1	15/3	2
15/4	2	30/5	3	35/5	1	51/4	1
53/6	1	54/4	2	54/5	1	56/5	1
58/4	1	58/5	3	64/6	1	68/4	1
77/4	1	81/4	1	84/5	2	100/5	1
151/3	1	151/4	4	152/2	1	152/4	4
153/5	3	153/6	3	154/4	5	155/4	1
156/5	2	157/2	2	157/5	1	158/5	2
158/8	3	160/3	2	160/5	1	160/7	1

Oxyurostylis smithi con't.

172/8	3	173/6	4	174/4	4	175/3	3
196/3	1	204/7	2	205/6	2	206/7	1
207/7	3						

Eudorella truncatula

10/5	1	54/5	1	84/5	1	183/2	1

Leptognatha coeca

9/5	1	30/5	1	215/4	2

Chiridotea coeca

13/5	1	21/2	1	37/3	1	58/2	2
64/2	1	65/1	1				

Chiridotea tuftsi

5/4	1	36/6	1	56/3	1	57/6	1
84/5	1						

Idotea balthica

gravel on Middle Ground 6

Idotea phosphorea

gravel on Middle Ground 4

Edotea montosa

10/5	1	30/4	1	34/5	3	57/5	1
58/4	1	68/5	1	69/5	1	75/4	1
77/4	1	82/5	2	100/9	1	174/6	1
188/4	1						

Jaera marina

73/2	1	166/3	1	205/7	1

Gammarus oceanicus

78/4	1	80/5	5	133/1	1	134/2	1
146/3	1	187/2	2				

Gammarus lawrencianus

78/4	1	184/2	1

Gammarus mucronatus

189/1	2

Ampelisca vadorum

208/7	1

Psammonyx nobilis

153/6	1

Corophium volutator

4/2	1	7/3	1	8/2	225	9/3	26
9/4	2	11/1	1	11/2	2	12/2	1
13/2	7	14/2	28	14/3	1	30/2	94
31/2	318	32/1	1	32/2	47	33/1	1
33/3	81	34/3	69	37/2	83	37/8	3
38/1+	76	38/2	6	38/3	316	38/4	195
38/5	213	38/6	1	38/8	1	38/9	11
39/2	68	39/4	176	39/5	134	39/6	136
39/7	2	40/2	1	40/3	57	40/4	239
40/5	27	41/2	13	41/3	3	41/4	11
41/5	21	42/2	2	42/4	25	43/3	1
44/1	1	44/3	203	44/4	11	44/5	7
44/6	94	46/1	1	46/2	14	47/2	21
50/2	82	50/3	2	51/2	13	51/3	1
52/2	6	52/3	3	52/4	9	53/4	1
54/2	6	54/3	2	57/3	9	58/4	3
59/3	6	60/3	3	60/5	2	62/5	2
65/3	3	66/4	1	67/2	5	68/2	5
68/3	19	69/3	3	69/4	1	70/2	1
70/3	2	73/2	1	73/3	10	74/2	10
74/3	4	75/3	10	76/3	21	77/3	11
78/3	1	79/5	2	80/2	4	80/3	2
82/1	90	83/1	35	83/3	16	83/4	1
83/5	1	84/1	120	84/4	69	85/1	6
87/1	2	87/2	2	89/1	6	89/4	2

Corophium volutator con't.

195/1	5	195/2	67	195/3	4	195/4	94
196/3	159	197/1	1	197/3	152	198/2	9
198/3	2	198/4	136	199/4	95	199/5	143
200/2	89	200/3	11	200/4	154	201/3	176
201/4	108	201/5	201	202/2	161	202/4	197
202/5	216	202/6	386	203/2	1	203/3	63
203/4	143	203/5	210	203/6	47	204/3	72
204/5	116	204/4	182	205/3	59	205/4	316
205/5	113	205/6	5	206/2	27	206/3	149
206/4	296	206/5	255	206/6	216	207/2	34
207/3	168	207/4	171	207/5	496	207/6	266
207/7	4	208/2	90	208/3	90	208/4	228
208/5	312	208/7	1	209/3	128	209/4	166
209/5	165	209/6	205	209/7	1	209/8	1
210/3	95	210/4	213	210/5	420	210/6	3
210/7	44	211/2	7	211/3	38	211/4	173
211/5	472	211/6	160	212/2	141	212/3	197
212/4	282	213/2	40	213/3	128	213/4	343
213/5	128	213/6	1	214/1+	113	214/2	184
214/3	332	215/2	152	215/3	304	215/4	52
216/1	255	216/2	356	216/3	346	217/1	106
217/2	252	217/3	42	218/1	102	218/2	158
219/1	2	219/2	1	219/3	124	219/4	183
219/5	126	220/2	66	220/3	31	220/4	180

<u>Corophium bonelli</u>

gravel on Middle Ground 2

<u>Corophium tuberculatum</u> ?

gravel on Middle Ground 1

<u>Aeginina longicornis</u>

gravel on Middle Ground 7

<u>Caprella linearis</u>

gravel on Middle Ground 1

<u>Mysis stenolepis</u>

105/3 2

<u>Crangon septemspinoa</u>

78/4	1	102/5	1	118/10	1	120/6	1
152/2	1	155/3	1	155/5	1	156/6	1
168/5	3	169/7	1	170/8	1	172/2	1
173/5	1	174/5	1	174/6	1	210/4	1
211/5	1						

<u>Pagurus longicarpus</u>

158/8 1

APPENDIX II

APPENDIX II

This is a list of the species not found in the list of Bousfield and Leim (1959) but encountered in this study. Different symbols are used to designate the presence of species found on recent unpublished lists:

* first found in Petersen & Petersen (1976), summer & fall, 1970

\+ first found in Gratto (1977), summer & fall, 1976

! first found in Fuller & Trevors (1977), summer, 1977

PLATYHELMINTHES
! Notoplana sp.

NEMERTINA
! Lineus sp.
Amphiporus sp.
\+ Cerebratulus sp.

ANNELIDA
Polychaeta
Sigalion arenicola
* Chaetozone setosa
* Phyllodoce mucosa
* Eteone heteropoda
* Eteone longa
* Eteone lactea
Syllis gracilis
Eusyllis blomstrandi
* Exogone dispar
* Exogone hebes
Nephtys bucera
! Lumbrinereis fragilis
* Glycera dibranchiata
* Aricidea suecica
Paraonis fulgens
Protodorvillea kefersteini
\+ Scoloplos fragilis
* Scoloplos armiger
* Polydora ligni

ANNELIDA
Polychaeta con't.
* Spio sp.
* Scobecolepides virides
* Streblospio benedicti
* Spiophanes bombyx
* Pygospio elegans
\+ Ophelia limacina
* Heteromastus filiformis
Notomastus sp.
* Clymenella zonalis
Oweniidae ?
* Fabricia sabella
* Asabellides oculata
* Amphitrite curata
polychaete ? (unknown fam.)
Oligochaeta
unknown species
! Peloscolex benedini

ARTHROPODA
Insecta
Chironomidae larvae
Crustacea
harpacticoid Copepoda
Leptognathia coeca
! Ampelisca vadorum
Caprella linearis
Aeginina longicornis