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SUBLITTORAL GAMMARIDEAN AMPHIPODS OF SOFT SEDIMENTS IN THE BAY OF FUNDY

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Two benthic sampling designs were used to collect gammaridean amphipods of soft sediments in the Bay of Fundy for taxonomic analysis. The first was a survey consisting of two grab samples at 266 stations spread throughout the Bay to determine geographic distribution. The second involved intensive sampling at two stations to determine seasonal changes in species richness, density, and biomass.

Ninety-nine amphipod species were found. Two species were new to science and 6 are additions to the Canadian Atlantic fauna. Certain amphipods were limited to 1 or 2 of the 3 major surficial sediment types in the Bay, while other species were found on all sediment types. Seasonal sampling over a 2-yr period showed that gammaridean amphipod species richness was less, individual density and biomass were greater, at a shallow estuarine location compared to a deep (80 m) location. Two of the 3 dominant gammarideans at the shallow location were only temporary occupants. The deep location had 6 dominant species which were present throughout the 2-yr sampling period, although changes in subdominant species and densities suggested the occurrence of a perturbing event of unknown nature.

Deux approches furent utilisées pour échantillonner les amphipodes gammarides des sédiments mous de la baie de Fundy afin de les soumettre à une analyse taxonomique. Dans un premier temps, la distribution géographique de ces crustacés fut déterminée à partir de deux échantillons prélevés à la benne a 266 stations couvrant la baie de Fundy. Dans un deuxième temps, les variations saissonnières de la diversité, de la densité et de la biomasse specifiques furent étudiées à partir de deux stations échantillonnées intensivement.

Quatre-vingt-dix-neuf espèces d'amphipodes furent trouvées. Deux de ces espèces sont nouvelles et représentent des additions à la faune atlantique canadienne. Certaines espèces d'amphipodes se limitaient à 1 ou 2 des 3 types principaux de sédiments superficiels de la boie, alors que d'autres espèces furent trouveés dans tous les types de sédiments. L'echantillonnage saisonnier s'echelonnant sur une période de deux ans a montré que la diversité des espèces d'amphipodes gammarides était plus réduite, la densité des individus et la biomasse étaieut plus élelées à une station estuarienne située en eau peu profonde comparée a une station située en eau profonde (80 m). Deux des troix espèces dominantes à la station située en eau peu profonde furent des occupants temporaires. A la station située en eau plus profonde, 6 espèces furent dominantes et elles furent présents pendant les deux années de la période d'echantillonnage. Des changements dans les espèces sous-dominantes et dans les densités ont suggéré qu'un événement perturbateur de nature indéterminé s'est produit à cette station.

Introduction

The taxonomy of Gammaridea (Crustacea, Amphipoda) from the littoral and shallow sublittoral regions of the Bay of Fundy is well known (Bousfield 1973). The taxonomy of sublittoral gammarideans was relatively little known (see Shoemaker 1930, 1931) until recently when systematic sublittoral sampling in the Bay of Fundy was undertaken (Peer *et al*. 1980; Wildish *et al*. 1983). Sampling tor this project at depths to 220 m, revealed species of Gammaridea new to science such as *Haploops fundiensis* (Wildish & Dickinson 1982) and *Melita* n. sp. (Brunel & Dadswell in preparation) and 6 new additions of species to the Canadian Atlantic fauna.

The original purpose of the 1978-79 sampling was to make an estimate of production of all abundant macrofauna in the upper and lower parts of the Bay (see Wildish & Peer 1983). In addition, a shallow and a deep benthic location were studied in detail during 1978-80 to determine the productivity of the most abundant species present. However, only a few species could be treated in detail and gammaridean amphipods were chosen for two reasons. Firstly, marine infaunal amphipods are among the least studied in terms of production estimation (Wildish & Peer 1981) and secondly, these amphipods are important as food for groundfish in the Bay of Fundy (Tyler 1972).

Presented here is an overview of the distributional ecology and taxonomy of the known sublittoral gammarideans in the Bay of Fundy. Included are data from earlier work in some of its estuaries (Wildish 1983), geographic sampling and time-series data obtained from a shallow and deep location in the Bay of Fundy. The taxonomic list has been made as complete as possible by including gammarideans removed from stomachs of bottom feeding fish such as cod, haddock and flounder collected by others at the Biological Station, St. Andrews.

Materials and Methods

Soft-sediment macrofauna were sampled with one of the following grabs: Smith-McIntyre, modified Van Veen or Hunter-Simpson (Hunter & Simpson 1976). Each grab had a sampling surface area of 0.1 m^2 and quantitative samples contained 10-16 L of sediment slurry. Sediment was sieved on deck with running sea water through mesh sizes of 2.5 and 0.8 mm. The 0.8 mm mesh was found to be inefficient in retaining some Gammaridea smaller than 3-4 mm body length. All animals retained on the sieves were preserved in 5% formalin in sea water in tightly sealed plastic buckets.

In the laboratory, Gammaridea were separated from other animals, sorted to species and preserved in 70% ethanol. Bulk weighings were made of the most abundant species; their wet weights are ethanol-preserved weights correct to 0.1 mg.

In the geographical sampling survey, duplicate grab samples were combined giving a total surface area sampled of 0.2 m^2. Positions of the 266 stations sampled are indicated in Fig 1. Only quantitative samples, that is, those containing 10-16 L of sediment were used in the present analysis to determine density and biomass.

Two sampling stations were chosen for detailed seasonal time-series investigations. These were Digdeguash estuary station 32 (1977-1978) and station 82 (1979-1980) off the Wolves Islands in the western mouth of the Bay of Fundy. Seasonal samples consisted of 5-30 individual grabs per sampling date, each of which was sorted separately. Sampling was conducted for 2 years at approximately 2-month intervals.

The general location of the sampling sites is shown in Fig 1. Descriptions of three surficial sediment types by Fader *et al*. (1977) for the lower Bay of Fundy have been used in this paper. La Have clay refers to a net depositional silt/clay sediment, Scotian Shelf drift is a glacial till consisting of poorly sorted sediments of all sizes, and Sambro sand is a sediment undergoing reworking with characteristic fields of sand waves and ripple marks (Fader *et al*. 1977).

Results

Geographic Survey

A summary of the sampling effort and numbers of species found in each region of the Bay of Fundy is shown in Table I.

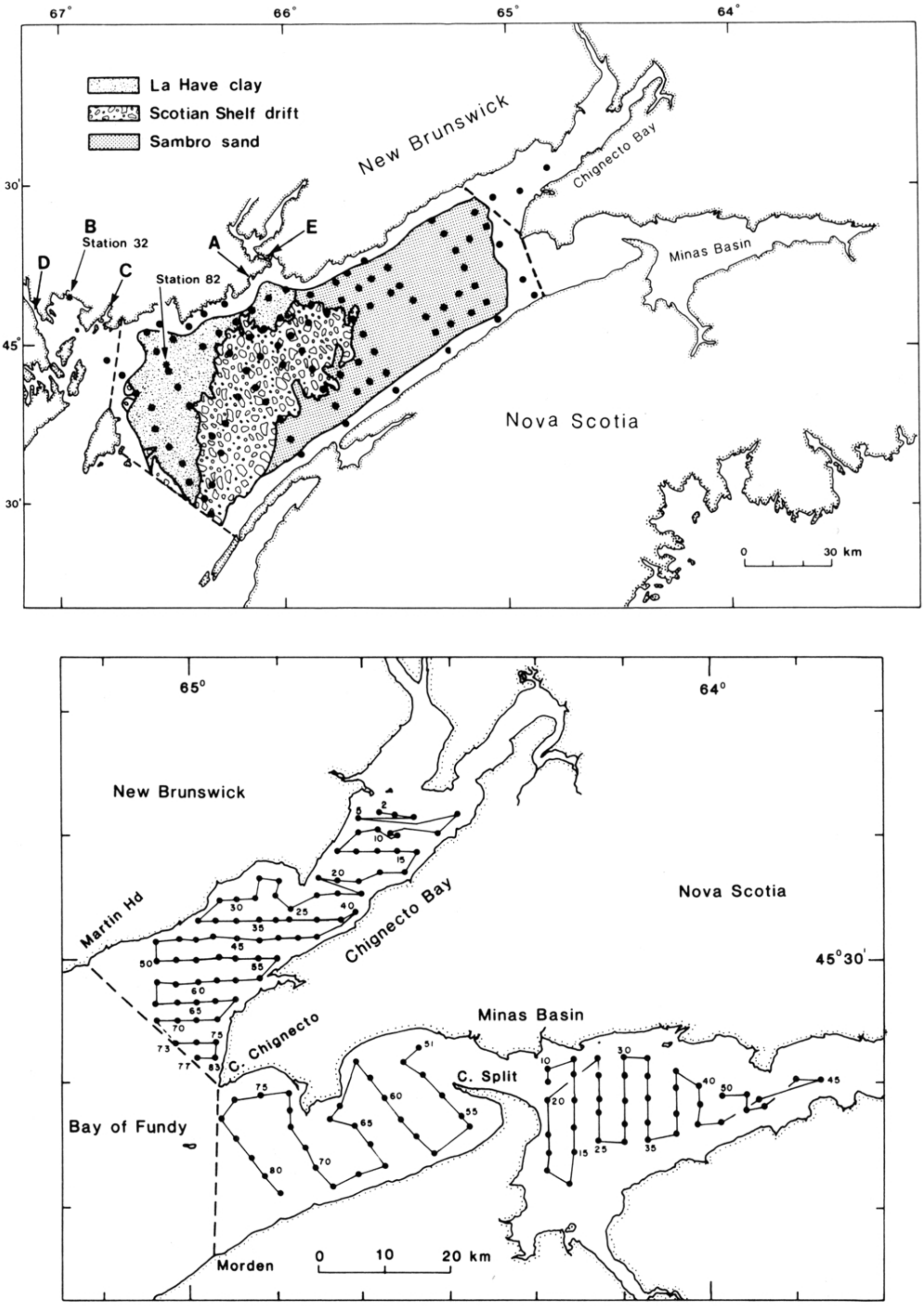

Fig 1 A. Map of the lower Bay of Fundy showing sampling limits at the mouth of the Bay, geographic sampling locations, the two temporal sampling locations by station number, the surficial sediment distribution after Fader *et al*. (1977) and the position of five estuaries designated by letter as in Table II.

B. Map of the upper Bay of Fundy showing sampling limits and sampling locations.

Table I Numbers of individual Gammaridea, sampling effort, and numbers of species in soft sediments of the Bay of Fundy. *0.1 m^2 replicates.

Area	Region	Total number of individuals (N)	Number of quantitative 0.2 m replicates (X)	Total species number (S)	Potential sampling area KM^2	S/X	N/S
Upper Bay	Chignecto Bay	851	37*	24	1099	0.6	35.5
	Minas Basin	297	22*	13	2010	0.6	22.8
Lower Bay	LaHave clay	144	18	18	2186	1.0	8.0
	Scotian Shelf	274	17	17	2251	1.0	16.1
	Sambro sand	115	24	16	4183	0.7	7.2
N.B. estuaries	Musquash	14	9	4	12	0.4	3.5
	Digdeguash	17	1	3	6	3.0	5.7
	L'Etang	1631	4	15	24	3.8	108.7
	St. Croix	12	7	6	16	0.9	2.0
	Saint John Harbour	420	11	2	28	0.2	210.0

Cumulative species/area curves were plotted and representative data are shown in Fig 2, and 3. Of interest is the "species discovery rate," illustrated by these curves, which may be either an arithmetic (Fig 2) or logarithmic (Fig 3) function of area.

Numbers of individuals per species, N/S, are notably high in L'Etang and Saint John Harbour (Table I). In lower L'Etang, organic enrichment caused by pulpmill pollution (Wildish 1982) is the probable reason. Similarly, pollution inclusive of pulpmills and municipal sewage is responsible for organic enrichment in Saint John Harbour. Only *Gammarus oceanicus* mixed with a small proportion of *G. setosus* is present in the Harbour, occurring in large numbers between the interstices of waste wood bark (Wildish 1982).

Average densities of gammarideans based on the total number of stations occupied are shown in Tables II to IV. Densities of species such as *Leptocheirus pinguis* and *G. oceansicus* are high in the estuaries (Table II). Because the grab used

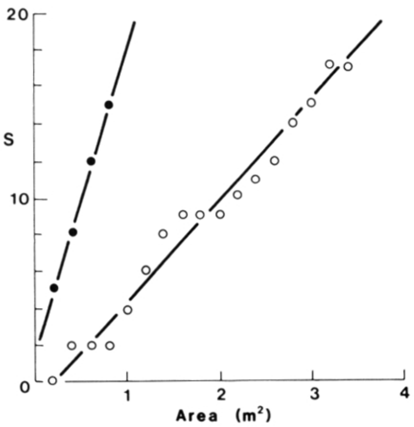

Fig 2 Gammaridean species/area curve for L'Etang Inlet sediments (solid dots) sampled August, 1975 and Scotian Shelf sediment (open dots) within the lower Bay sampled May, 1978.

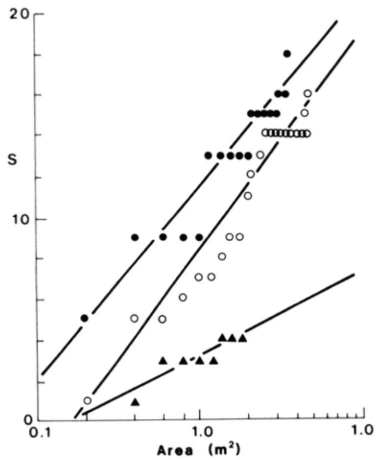

Fig 3 Gammaridean species/area curve for Musquash estuary sampled June, 1973 (solid triangles); La Have clay (solid dots) and Sambro sand sediments (open dots) in the lower Bay sampled May, 1978.

Table II Presence/absence record of Gammaridea in five New Brunswick estuaries. Numbers refer to mean density per m^2 and bracketed figures number of stations averaged.

Taxa	Trophic type	A	B	C	D	E
Ampeliscidae						
Ampelisca abdita	S/D	—	—	93(1)	—	—
A. macrocephalus	S/D	—	—	—	1(1)	—
Phoxocephalidae						
Harpinia propinqua	D	—	—	26(3)	—	—
Melitidae						
Casco bigelowi	D	—	62(1)	—	2(2)	—
Maera danae	D	—	—	3(1)	—	—
Ischyroceridae						
Erichthonius rubricornis	S	—	—	3(1)	—	—
Corophidae						
Corophium volutator		11(4)	—	3(1)	—	—
C. bonelli	*S*	—	—	*20(1)*	—	—
C. crassicorne		—	—	42(2)	—	—
Lysianassidae						
Anonyx liljeborgi	D	—	—	22(2)	—	—
Orchomenella minuta	D	—	—	211(2)	—	—
Oedicerotidae						
Monoculodes edwardsi		—	—	3(1)	—	—
Aoridae						
Leptocheirus pinguis	S/D	6(2)	2(1)	1493(4)	1(3)	—
Unicola irrorata	D	—	—	282(4)	11(1)	—
Pleustidae						
Stenopleustes inermis	D	—	—	3(1)	—	—
Gammaridae						
Gammarus oceanicus		4(2)	—	3(1)	39(1)	588(3)
G. lawrencianus		3(3)	—	—	1(1)	—
G. setosus		—	—	—	—	?
Haustoriidae						
Pontoporeia femorata	D	—	23(1)	—	—	—

Letters: A = Musquash, B = Digdeguash, C = L'Etang, D = St. Croix, and E = Saint John Harbour. Trophic type code, S = suspension feeder, D = deposit feeder.

in this study probably could not quantitatively recover the pieces of wood bark and attached *Gammarus*, the density of *G. oceanicus* in Saint John Harbour (Table II) is probably underestimated. Compared to the lower Bay of Fundy (Table III), estuarine densities of gammarideans are higher. The two commonest species in the Bay of Fundy, judged by the number of stations at which they occur, are *H. fundiensis* and *L. pinguis* (Table IV). Average densities for the former of 42/m^2 and latter of 35/m^2 are less than for the most common estuarine species. Density of upper Bay of Fundy gammarideans was generally lower than those of the lower Bay.

Table III Most abundant Gammaridea in the lower Bay of Fundy showing trophic type, mean density and biomass, and number of stations at which the species was found (N). Species grouped by surficial sediment preference as given by Fader, *et al.* (1977).

Species	Trophic type	No./m^2	g/m^2	N
Sambro sand only				
Anonyx sarsi	D/O	5	0.015	4
Psammonyx nobilis	D	5	0.204	4
Podoceropsis nitida	D	12	0.075	3
Gammaropsis melanops	D	5	0.050	6
Pleusymtes glaber	D	5	0.023	3
Scotian Shelf and LaHave clay				
Byblis gaimardi	S/D	6	0.036	5
Haploops setosa	S/D	78	0.761	8
Haploops fundiensis	S/D	42	0.164	24
Dyopedos monacanthus	S	10	0.065	6
Scotian Shelf and Sambro sand				
Corophium bonelli	S	8	0.072	4
Erichthonius difformis	S	13	0.033	4
Dyopedos porrectus	S	9	0.072	4
Present on all sediment types				
Unciola irrorata	D	17	0.116	16
Unciola leucopis	D	17	0.121	15
Protomedia fasciata	D	17	0.088	7
Phoxocephalus holbolli	D	9	0.055	7
Harpinia propinqua	D	7	0.037	11
Leptocheirus pinquis	S/D	35	0.583	21
Casco bigelowi	D	8	0.171	8
Erichthonius rubricornis	S	10	0.064	5

Trophic type code as in Table II plus O = omnivorous scavenger.

Seasonal Sampling

The physical characteristics of the two intensively sampled stations are given in Table V. Sampling at Station No. 82 indicates that a number of grab replicates must be taken before the species/area curve becomes asymptotic (Fig 4). Thus, stations represented by two grab replicates during geographic sampling are underestimates of the total number of species present.

The most noticeable difference between the shallow estuarine location (Table VI) and the 80 m deep one in the lower Bay of Fundy (Table VII) was the fewer species: only 8 at the former compared to 26 species at the latter, despite comparable sampling efforts. Further analysis of the shallow location (Wildish, 1980a, Table II) indicated that, although *Casco bigelowi* was present on all sampling occasions, the probability of finding it with 15-29 replicates varied from 0.15 to 1.00. The other two dominants, *Leptocheirus pinguis* and *Pontoporeia femorata*, were totally absent for some months, indicating that these species had not permanently established themselves or their life cycles precluded collection (Wildish 1980a). Depopulation probably occurs as a result of wave activity following storms, causing washout of the animals (Wildish & Kristmanson 1980).

Table IV Most abundant Gammaridea in the upper Bay of Fundy showing trophic type, mean density, biomass and number of stations at which the species was found (N). Trophic types as in Table II.

Taxa	Trophic type	Chignecto Bay No./m^2	Chignecto Bay G/m^2	Chignecto Bay N	Minas Basin No./m^2	Minas Basin g/m^2	Minas Basin N
Ampeliscidae							
Haploops fundiensis	S/D	3	0.015	13			
Ampelisca macrocephala	S/D	1	—	1			
Ampelisca vadorum	S/D	1	0.006	7	11	0.016	4
Isaeidae							
Podoceropsis nitida		2	—	1			
Photis pollex	S	1	—	3			
Protomedia fasciata	D	5	0.003	6			
Phoxocephalidae							
Harpinia crenulata	D	1	—	1			
H. propinqua	D	3	0.002	4			
Phoxocephalus holbolli	D	2	0.004	10	7	0.011	5
Melitidae							
Casco bigelowi	D	2	0.084	11			
Melita dentata	D	1	—	2	3	0.047	3
Melita n.sp.	D	1	0.022	3			
Maera danae	D	3	0.022	6	2	0.010	3
Ischyroceridae							
Ischyrocerus megacheir	S	2	—	5			
I. anguipes	S				1	0.004	4
Jassa falcata	S				7	0.003	1
Erichthonius difformis	S				1	0.006	1
E. rubricornis	S	6	0.002	5			
Corophidae							
Corophium bonelli	S				8	0.001	8
C. acherusicum		64	0.129	2			
C. crassicorne					1	—	1
Podoceridae							
Dyopedos monacanthus	S	1	—				
Aoridae							
Leptocheirus pinguis	S/D	9	0.118	18	5	0.044	5
Unciola irrorata	D	14	0.037	25	7	0.023	13
U. leucopis	D	1	—	4			
Lysianassidae							
Tmetonyx cicada		1	0.020	1			
Stenothoidae							
Metopa alderi		1	—	—			
Pleustidae							
Stenopleustes gracilis	D	1	0.001	1	2	0.002	2
Pleusymtes glaber	D				4	0.004	2
Pontogeneiidae							
Pontogeneia inermis					1	0.001	1

Table V Physical characteristics of the two seasonal sampling stations.

Parameter	Digdeguash estuary Shallow station No. 32	Bay of Fundy Deep station No. 82
Position	45°09.3′N, 66°57.5′W	44°55.7′N, 66°32.5′W
Depth, m at LW and HW	4-12	73-80
Temperature, °C:		
Seasonal range	−1.8-18.0	2.1-11.0
Tidal range, m	8.0	7.0
Salinity, o/oo	25-31	30-32
Tidal currents, cm/s	9.3 (max. 47.9)	20.5 (max. 39.6)
Max. wave height, m (direction in brackets)	1.0 (SSE)	12.2 (SSW)
Mean ATP bottom water, μg/L	324	98

A single "depopulation" event possibly occurred during the 2-year sampling program at Station 82 as suggested by the species area curve (Fig 4). The first asymptotic level, reached after 4-8 m^2 sampling, is 15-16 species. Following depopulation (in January 1980), both amphipod density and species richness showed a marked rise without indication, in the case of the latter, of asymptotic levelling off. The new equilibrium diversity may exceed 26 species (Fig 4). The cause for this change in species richness and density is unknown, but does not appear to be related to a change in sampling procedure. A more detailed seasonal investigation

Table VI Density and biomass of Gammaridea in the Digdeguash estuary sampled during 1977-79. The percentage probability of finding each amphipod is based on its presence/absence in 383 grab replicates.

Taxa	% probability	Trophic group	Density, m^2 mean	Density, m^2 max.	Wet wt, g/m^2 mean	Wet wt, g/m^2 max.
Ampeliscidae						
Ampelisca abdita	1	S/D	—		—	
Aoridae						
Leptocheirus pinguis	30	S/D	13	136	0.65	6.80
Unciola irrorata	1	D				
Gammaridae						
Marinogammarus obtusatus	4	A	—		—	
Haustoridae						
Pontoporeia femorata	23	D	24	206	0.83	7.11
Lysianassidae						
Orchomenella minuta	1	D	—		—	
Melitidae						
Casco bigelowi	67	D	22	56	1.98	5.04
Maera danae	5	D	—		—	

Trophic group: A = algal scraper, D = deposit feeder, S = suspension feeder.

Table VII Species list, mean and maximum density (no./m^2) and biomass (g alcohol wet wt/m^2) of Gammaridea at station 82 for 14 seasonal samples (165 replicates) in 1978-1980.

Taxa	% probability	Trophic group	Density, m^{-2} Mean± 1SD	Max.	Wet wt, g/m^{-2} Mean	Max.
Ampeliscidae						
Haploops fundiensis	100	S	407± 352	2010	0.480	2.372
Byblis gaimardi	1	S/D	—	10	—	
Photidae						
Photis reinhardi	92	S	166± 106	610	0.191	0.702
P. pollex	2	S	—	20	—	
Phoxocephalidae						
Harpinia propinqua	87	D	46± 19	140	0.068	0.207
Phoxocephalus holbolli	<1	D	—	10	—	
Melitidae						
Casco bigelowi	57	D	13± 7	200	0.173	2.660
Melita dentata	4	D	—	40	—	
Maera loveni	2	D	1± 2.4	120		
M. danae	1	D	—	20	—	
Ischyroceridae						
Ischyrocerus anguipes	7	S	2± 1.9	50	0.004	0.106
I. megacheir	1	S	—	10	—	
Corophidae						
Erichthonius rubricornis	24	S	7± 9	70	0.009	0.095
Podoceridae						
Dyopedos monacanthus	50	S	23± 30	280	0.013	0.160
Lysianassidae						
Anonyx liljeborgi	7	D	3± 6	(50)?	0.007	0.115
A. debruyni	<1	D	—	10	—	
Hippomedon serratus	2	D	—	10	—	
H. propinquus	2	D	2± 7	240	0.032	3.840
Onesimus edwardsi	<1	D	—	10		
Orchomenella pinguis	7	D	0.8± 1	20	0.014	0.340
Melphidippidae						
Melphidipella macera	<1		—	10		
Calliopiidae						
Calliopius laeviusculus	<1	A	—	10	—	
Oedicerotidae						
Monoculodes edwardsi	<1		—	10	—	
Argissidae						
Argissa hamatipes	3	D	0.3± 0.5	20	0.001	0.030
Aoridae						
Leptocheirus pinguis	3	S	0.4± 0.9	10	—	
Pleustidae						
Stenopleustes inermis	1	D	—	10	—	

The probability of at least one individual per species in a 0.1 m^2 grab is given with a trophic group classification. S = suspension feeder, D = deposit feeder, A = algal scraper.

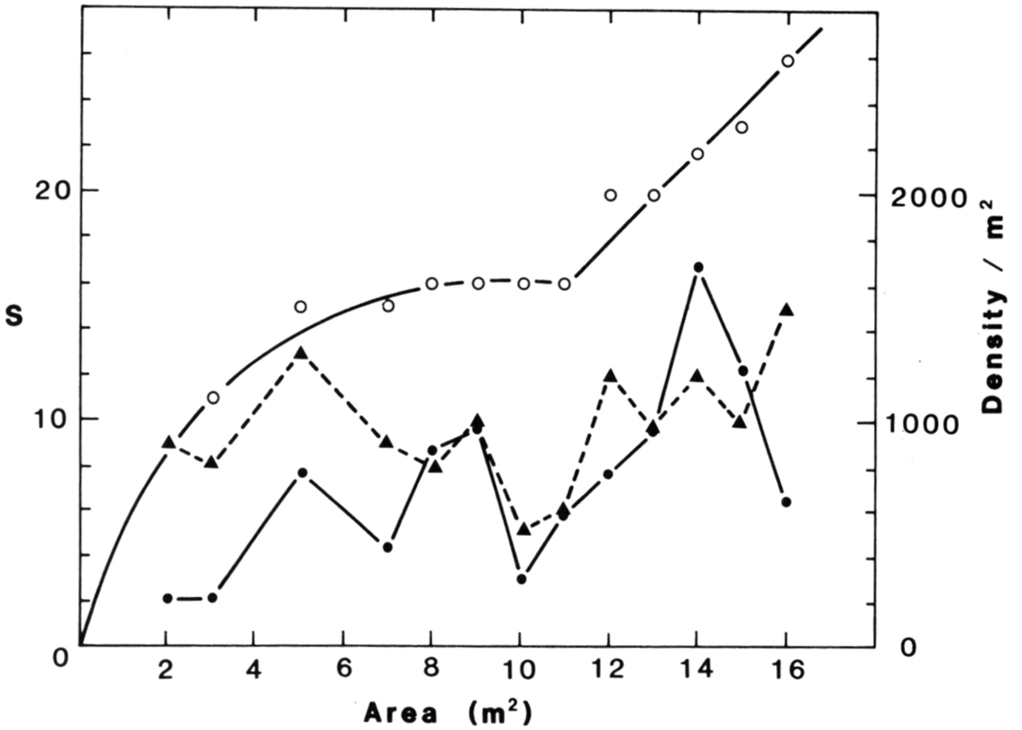

Fig 4 Gammaridean species/area curve for temporal sampling at station 82. Symbols: cumulative new species o, species per sampling date ▲, density/m^2 for each sample●.

of the species shown in Table VII indicated that subdominant species such as *Orchomenella pinguis* disappeared after January and the density of *Dyopedos monacanthus* was reduced until it disappeared after the April sampling. Species which appear in March and April for the first time and maintain high densities thereafter were *Hippomedon propinquus* and *Leptocheirus pinguis*. The pattern seen was thus one of species loss coupled with reduced density followed by replacement with new subdominant species and rapidly increasing density.

The probability of finding at least one individual of a given species was high for six species at Station 82. They include: *Haploops fundiensis, Photis reinhardi, Harpina propinqua, C. bigelowi, D. monacanthus,* and *Erichthonius rubricornis*. The characteristic species of this Station and indeed over much of the LaHave clay is *H. fundiensis*: it was found in all grab replicates at all times of the year with an average density at Station 82 of over 400 individuals/m^2.

Discussion

The known sublittoral, soft-sediment, gammaridean fauna for the Bay of Fundy is presented in the Appendix. A total of 99 species was recognized from concentrated geographic and seasonal sampling as well as from other samples of opportunity. All species present in the Bay of Fundy do not appear in the Appendix since we did not include known epifaunal gammarideans of rocks, fucoid or *Laminaria* beds or the gammarideans of suprabenthic and floating wrack communities. In general, the gammaridean fauna consists of subarctic and boreal elements in the Bay proper (e.g. *Gammarus setosus, Melita dentata*) and a few warm-water species in the estuarine upper Basins (e.g. *Ampelisca abdita, Stenopleustes gracilis*).

In a comparable study by Dickinson and Wigley (1981) on Georges Bank, a wider range of sampling devices was employed, including quantitative grabs, epibenthic sled nets, Dibby dredges, otter trawls, and fish-stomach analysis. These collection methods caught 97 species of gammaridean amphipods from 325 stations occupied. This compares with 55 species of gammarideans collected at 150 quantitative stations in the Bay of Fundy. Since the individual samples both within and between the two collections are not equivalent, it is not possible to compare the species diversity of the two areas based on equal sampling efforts. However, since our total sampling effort in the Bay of Fundy revealed at least 99 species of Gammaridea, we consider the two areas to be comparable in species richness.

The recognition of markedly increased densities and biomass of a few species of gammaridean amphipods in two estuaries receiving pulp mill wastes is consistent with previously reported information (Waldichuk & Bousfield 1962) and supports the concept of an enhanced zone of aerobic, heterotrophic production downstream from the anoxic/hypoxic zone (Poole *et al.* 1978). Some species (for example, *Gammarus oceanicus*) may be considered to be general indicators of eutrophication caused by nonspecific, organic pollution, although they are not present in anoxic or hypoxic zones.

That some of the most abundant species of gammaridean amphipods appear to be limited to one or two of the sediment types found in the Bay may be explained by physical factors, particularly tidal-current energy. For example, the Sambro sand stations support an impoverished macroinfaunal association (Wildish & Peer 1982), especially adapted to withstand high current speeds and sediment reworking of the sand substrate. A characteristic species present here is *Psammonyx nobilis* which, because of its excellent burrowing ability, is able to avoid the reworking of sandy sediment caused by high tidal currents. Dickinson and Wigley (1981) also found this species on the "shoals" region of Georges Bank in similar ecological conditions. The only other group identified by Dickinson and Wigley (1981) which showed concordance with co-occurring species of Bay of Fundy gammarideans was their "perimeter" group. This group only tolerates an annual temperature range between 4 and 13°C and is excluded from other parts of Georges Bank by warmer summer temperatures (up to 18°C). "Perimeter" species (including 14 of the 17 species listed by Dickinson and Wigley (1981) are: *Ampelisca macrocephala, Anonyx liljeborgi, Casco bigelowi, Corophium crassicorne, Dyopedos monacanthus, Erichthonius rubricornis, Harpinia propinqua, Hippomedon propinquus, Leptocheirus pinguis, Melita dentata, Phoxocephalus holbolli, Pleusmytes glaber, Protomedeia fasciata,* and *Stenopleustes gracilis*. These were found throughout the Bay of Fundy on all of the surficial sediment types. The limiting temperature hypothesis of Dickinson and Wigley (1981) provides a satisfactory reason for the restriction of many sublittoral species of Gammaridea to deeper water in the Bay because, in estuaries, the temperature range is wider (see Table V).

The difference in number of species of gammarideans at the shallow location (8 species) and deep location (16 or 26+ species) requires some explanation. Feeding conditions are probably better at the shallow location as evidenced by the much greater weight and length of *Casco bigelowi* there than at the deep location (Wildish 1980a, 1980b). Of the 3 dominant shallow species of gammarideans, all are medium to large as adults (15-25 mm body length) compared to the five adult dominants (3-6 mm body length) at the deep station. *Casco* also occurs at the deep station, and attains adult body lengths of up to 25 mm, although it occurs at a lower density and does not reach the same weight at maturity as in shallower water. We suggest that the shallow, inshore community is structured principally by physical factors, notably wave activity, which periodically removes two of the dominants, and by high temperatures during the summer, which limit colonization by cold-water stenotherms. Physical conditions are more stable at the deep location, with a narrow seasonal temperature range and less chance of wave activity near the bottom. Here the factors controlling the community are both physical (e.g. tidal current speed and suspension feeding) and biological in nature, including competition for food and avoidance of predators. The small size of most of the amphipods present here may be a successful adaptation to avoid fish predators.

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Appendix: Sublittoral Gammaridea from the Bay of Fundy

Single asterisks indicate that the specimen was sampled from a fish stomach, double asterisks indicate a new addition to the Canadian faunal records. Preserved material is deposited in the Atlantic Reference Centre collection, Biological Station, St. Andrews, N.B., E0G 2X0.

Acanthonotozomatidae
- *Acanthonotozoma serratum* (Fabricius, 1780)*

Ampeliscidae
- *Ampelisca abdita* Mills, 1964**
- *A. vadorum* Mills, 1963
- *A. macrocephala* Lilljeborg, 1852
- *A. aequicornis* Bruzelius, 1859
- *Byblis gaimardi* (Kroyer, 1846)
- *Haploops fundiensis* Wildish and Dickinson, 1982**
- *H. setosa* Boeck, 1871

Aoridae
- *Leptocheirus pinguis* (Stimpson, 1853)
- *Unicola inermis* (Shoemaker, 1942)
- *U. irrorata* Say, 1818
- *U. leucopis* (Kroyer, 1845)

Argissidae
- *Argissa hamatipes* (Norman, 1869)

Calliopiidae
- *Calliopius laeviusculus* (Kroyer, 1838)*
- *Halirages fulvocinctus* (Sars, 1854)*

Corophidae
- *Corophium bonelli* (Milne-Edwards, 1830)
- *C. crassicorne* Bruzelius, 1859
- *C. acherusicum* Costa, 1857
- *C. tuberculatum* Shoemaker, 1934
- *C. volutator* (Pallas, 1766)

Dexaminidae
- *Dexamine thea* Sars, 1893*

Eusiridae
- *Eusirus cuspidatus* Kroyer, 1838*
- *Rhachotropis oculata* (Hansen, 1887)*

Gammarellidae
- *Gammerellus angulosus* (Rathke, 1843)*

Gammaridae
Gammarus lawrencianus Bousfield, 1956*
G. mucronatus Say, 1818
G. oceanicus Segerstrale, 1947
G. setosus Dementieva, 1931
Marinogammarus obtusatus Dahl, 1936
Haustoriidae
Acanthohaustorius millsi Bousfield, 1965**
A. spinosus Bousfield, 1962
Isaeidae
Gammaropsis maculatus Johnston**
G. melanops G.O. Sars, 1882
Photis macrocoxa Shoemaker, 1945
Podoceropsis nitida (Stimpson, 1853)
Protomedeia fasciata (Kroyer, 1842)
Ischyroceridae
Erichthonius difformis Milne-Edwards, 1830
E. rubricornis (Smith, 1873)*
Ischyrocerus anguipes Kroyer, 1838
I. megacheir (Boeck, 1871)
Jassa falcata (Montagu, 1808)*
Lafystiidae
Lafystius sturionis Kroyer, 1842
Lysianassidae
Anonyx debruyni Hoek, 1882
A. liljeborgi Boeck, 1870
A. sarsi Steele and Brunel, 1968
Hippomedon propinquus Sars, 1890
H. serratus Holmes, 1903*
Menigrates obtusifrons (Boeck, 1861)**
Onesimus edwardsi Kroyer, 1842
Onesimus normani (Sars, 1890)*
Orchomene depressa Shoemaker, 1930
Orchomenella minuta Kroyer, 1846
O. pinguis (Boeck, 1861)
Psammonyx nobilis (Stimpson, 1853)
Tmetonyx caeculus (Sars, 1890)
T. cicada (Fabricius, 1780)
Melitidae
Casco bigelowi (Blake, 1929)
Maera danae Stimpson, 1853
M. loveni (Bruzelius, 1859)
Melita dentata (Kroyer, 1842)
N. nitida Smith, 1873**
M. n.sp.
Melphidippidae
Melphidippa goesi Stebbing, 1899*
M. macera (Norman, 1869)
Pontoporeiidae
Amphiporeia lawrenciana Shoemaker, 1929
Bathyporeia quoddyensis Shoemaker, 1949
Pontoporeia femorata Kroyer 1842

Oedicerotidae
Aceroides latipes (G.O. Sars, 1882)
Monoculodes edwardsi Holmes, 1903
M. intermedius Shoemaker
M. latimanus (Goes, 1866)
M. norvegicus (Boeck, 1861)
M. packardi (Boeck, 1861)
M. tesselatus Schneider, 1884
M. tuberculatus Boeck, 1861
Westwoodilla brevicalcar (Goes, 1866)
Paramphithoidae
Paramphithoe hystrix Bruzelius, 1858
Phoxocephalidae
Harpinia crenulata Boeck, 1871
H. propinqua Sars, 1895
H. truncata G.O. Sars, 1895
Phoxocephalus holbolli (Kroyer, 1842)
Pleustidae
Neopleustes pulchellus (Kroyer, 1846)
Pleusymtes glaber (Boeck, 1861)*
Pleustes panoplus (Kroyer, 1838)
Stenopleustes gracilis (Holmes, 1905)**
Stenopleustes inermis (Shoemaker, 1949)
Podoceridae
Dyopedos arcticus (Murdock, 1884)
D. monacanthus (Metzger, 1875)
D. porrectus (Bate, 1857)
Paradulichia typica Boeck, 1870
Pontogeneiidae
Pontogeneia inermis (Kroyer, 1842)
Stegocephalidae
Stegocephalus inflatus Kroyer, 1842
Stenothoidae
Metopa alderi (Bate, 1857)
M. boecki G.O. Sars, 1892
Metopella angusta Shoemaker, 1949
M. carinata (Hansen, 1887)
Stenothoe minuta Holmes, 1905
Tironidae
Syrrhoe crenulata Goes, 1866