MALACOSTRACAN CRUSTACEANS FROM THE SHORES OF WESTERN NOVA SCOTIA

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During the latter part of September, 1955, a number of mysid, isopod, and amphipod crustaceans were collected by dip net and hand picking at seashore localities in the Liverpool region of western Nova Scotia. This material and two lots of crustaceans from neighbouring fresh-water localities form the basis of this report.

The range of climatological and ecological factors indicates that the littoral marine fauna of southwestern Nova Scotia is probably one of the most varied and most interesting of eastern Canada. The coastline is rugged and much dissected, and offers steep exposed rocky shores, bayhead beaches and bars of smooth sand, and estuarine mud flats covered with eel-grass. The rise of spring tides is six to ten feet on the outer coast, increasing sharply at the entrance to the bay of Fundy. Stephenson and Stephenson (1954) have described the marine climatic conditions and the well-defined intertidal zonation of sessile plants and animals along the Atlantic coast of Nova Scotia, with particular reference to that of Peggy's Cove and Meteghan, east and west of the study area respectively. The outer beaches are exposed to strong wave action; gale blown salt spray is carried some distance inland and may significantly influence the ionic content of stream and lake water. Deep tidal upwelling at the entrance to the Bay of Fundy, and off-shoot eddies from the Gulf Stream combine to keep the shore waters relatively warm and ice-free in winter but relatively cool in summer. Thus the annual fluctuation in surface water temperature is relatively small, from a mean monthly average of 1.5°C in February to a maximum of 12-14°C. in August (Fuglister, 1947). Protected bays and estuaries probably reach higher temperatures. The population of shore animals has been characterized as cold-temperate, among which are widespread or cosmopolitan forms and eurythermic species at the northern limit of their range.

Despite the wealth of information on the general marine conditions of the area, little has been published on the shore crustaceans. The fresh-water isopod *Asellus communis* Say has been recorded near Yarmouth (Johansen 1920) and the salt marsh amphipod *Orchestia grillus* (Bosc) from the head of St. Mary's Bay (Johansen, 1930). Unpublished records of mater-

ial taken by C. H. Young and W. Spreadborough at Barrington Passage in 1910 (Catalogue of Crustacea, National Museum of Canada) include *Talorchestia megalophthalma* (Bate), *Leptocheirus pinguis* (Stimps.), *Cirolana polita* (Stimps.) and *Nebalia bipes* (Fabr.). In 1950 the first Canadian records of *Orchestia gammarella* (Pallas) and *Marinogammarus obtusatus* Dahl were obtained by the author at Argyle Beach and Sober Island respectively (Bousfield, 1952, 1956). Fourteen crustacean species, all but one of which (*T. megalophthalma*) are included in the present material, were noted at Green Bay in 1954 (Bousfield, 1956).

The present material comprises two species of Mysidacea, six of Isopoda, and twenty-one of Amphipoda, many of which are widespread in the Canadian Atlantic region. *Marinogammarus finmarchicus* Dahl is newly recorded for Canada and *Gammarus duebeni* Lillj. and *Crangonyx occidentalis* H. & H. are new to the mainland of Nova Scotia. To date *Amphiporeia virginiana* and *Marinogammarus stoerensis* have been found in Canada only in this region. Also described are sex characters in *Chiridotea caeca* (Say) and *Amphiporeia virginiana* Shoemaker, and the taxonomic status of *Gammarellus angulosus* is clarified.

TABLE I. Localities Visited in Western Nova Scotia.

Station	Locality	Habitat	Date
W1	Small lake 2 miles w. of Halifax, off Hwy 3.	Shallow margins, in mud and under stones	Sept. 24/55
W2a	Green Bay Beach, Lunenburg County	HW pools, rocks, under algae, etc.	Sept. 26/55
W2b	Green Bay Beach, Lunenburg County	LW pools, wave zone, under algae	Sept. 26/55
W3	Liverpool Wharf, Head of Liverpool Bay	Small shallow bay of eel grass and mud	Sept. 27/55
W4	Moose Point, SE of Liverpool	HW pools and under debris and algae at at driftline	Sept. 26/55
W5a	Hunt Pt. Beach, Queens County	LW line (mainly); sandy beach at mouth of small f.w. stream	Sept. 26/55
W5b	Hunt Pt. Beach Queens County	LW line (mainly); sandy beach and algae-covered boulders.	Sept. 27/55

Synopsis of the Species

i MYSIDACEA

1. *Mysis stenolepis* S. I. Smith 1873. W31 - ♀ (captured and released).

2. *Neomysis americana* S. I. Smith 1873. W5b - 8 ♂♂, 23 ♀♀ (sev. ovig.), 16 imm.

ii ISOPODA.

3. *Chiridotea caeca* (Say) 1818.

MATERIAL: W2a - 20 ♂♂, 3 females ♀♀ (1 ovig.), 22 imm.

W5a - 1 ♀, 12 imm.
W5b - 1 ♂, 9 imm.

REMARKS: Male and female specimens, 10-13 mm. in length (late imm. & mature) are dimorphic; the sexes are readily separable on prominent characters of the head region (see Fig. 1). Mature males resemble Fig. 1(a). The lateral margin of the head is narrowly cleft, the margins unlined with setae. Antenna 1, ultimate segment relatively short and broad, about equal in length to the penultimate segment, darkly pigmented distally. Antenna 2, flagellum 7-8 segmented, equal in length to the last two peduncular segments.

Mature female (with brood plates), head as in Fig. 1b, relatively less broad than in male. Lateral margin of head deeply indented with U-shaped cleft lined on both margins with strong, feathery, particle-restraining setae; anterior margin of posterior head lobe continued ventrally towards mouthparts forming a deep groove presumably along which water is drawn for the respiration of the brood young. Antenna 1, ultimate segment relatively long and slender, length exceeding the penultimate segment, deeply pigmented distally. Antenna 2, flagellum 5-6 segmented, length less than the last two peduncular segments. Peraeopods 2 and 3 less robust, but more heavily furnished anteriorly with tufts of feathery setae, in the female than in the male. "Eyes" in both sexes consist of a pair of rounded unpigmented protuberances on the dorsal surface of the head at the base of the posterior lobes.

Bowman (1955) has figured the head, dorsal view, of a male specimen from Cohasset, Mass., that in the characters outlined above, resembles the mature females of the present material.

4. *Idothea baltica* (Pallas) 1772. W2b - 10 ♂♂, 1 ♀ ovig., 3 imm.

   W5b-17 imm.

5. *Idothea phosphorea* (Harger) 1873. W2b - 4 imm.

6. *Asellus communis* Say 1818. W2a - 9 imm.

   REMARKS: This material, kindly examined by Dr. J. G. Mackin, is clearly distinct from the unnamed species erroneously described as *A. communis* by Racovitza (1920).

7. *Jaera marina* (Fabr.) 1780. W2a - 1 imm.; W5a - 1 ♂, 2 ♀ ♀.

8. *Trachaeoniscus rathkei* (Brandt) 1833. W5a - 1 imm.

iii *AMPHIPODA.*

9. *Tmetonyx nobilis* (Stimpson) 1853. W5b - 17 adult males.

10. *Amphiporeia virginiana* Shoemaker (1933).

    MATERIAL: W5a - 4 ♂, 100 ♀ ♀ (mostly ovig.);
    W5b - 1 ♂, 32 ♀ ♀ (mostly ovig.)

    DESCRIPTION OF MALE:

    Generally similar to female but much smaller in size (see Fig. 2). Length - ♂ 4-4.5.; ♀ 7-8 mm.

    Eye somewhat variable in shape and position, usually oval, narrowing anteroventrally, black, relatively larger than in female.

    Antenna 1, flagellum of six segments, the first three bearing platelike calceoli on inner distal margin; accessory flagellum longer than the first segment of the primary flagellum, 2-jointed, the second joint small and narrow.

    Antenna 2, flagellum of 7-8 segments, the first five or six bearing prominent calceoli; the posterior distal angles bearing long heavy setae which are distally pectinate (as in female).

    Mouthparts as in female, but generally less setose.

    Gnathopods 1 and 2 more or less similar, Gn_2 somewhat longer than Gn_1; segment 6 ovate, more powerfully

developed than in female, palm very oblique, concave, and furnished with three or four rows of blunt, peg-like spines; dactyl smooth, curved, nearly approximating palm when closed, the tip not reaching the hind-most spines. Uropod 3 as in female but proportionately longer, the second segment of the outer ramus being 10-20% longer than the peduncle.

Telson, length/width ratio less than in female.

REMARKS: Shoemaker (1933) did not find males in large numbers of specimens taken at Virginia Beach on July 17, 1916. Only five males were found in the present material of 137 specimens. The scarcity of males in collections may be partly attributable to their small size (fewer tend to be picked out in a net sample) and perhaps also to a limited seasonal distribution.

11. *Sympleustes glaber* (Boeck) 1861. W2b - 1 imm.

12. *Calliopius laeviusculus* (Kroyer) 1838.

MATERIAL: W2b - 83 specimens (incl. males and ovig. females).
W5a - 6 specimens (incl. one ovig. female).
W5b - 46 spec. (males and ovigerous females).

13. *Gammarellus angulosus* (Rathke) 1843.

MATERIAL: W2b - 8 ♂♂, 7 ♀♀ (ovig.) 4 imm.
W5a - 1 imm.
W5b - 12 ♂♂, 6 ♀♀ (ovig.), 7 imm.

REMARKS: Segerstrale (personal commun.) has followed Stephensen (1940), and others in uniting *G. angulous* and *G. homari* under the name *G. homari* Fabr. The present material supports Sars (1895), Schellenberg (1942) and others in maintaining *G. angulosus* as a distinct species. The present material compares closely with that taken previously in western Nova Scotia, Cape Breton Island, and Newfoundland (Bousfield, 1952, 1956) but differs in several respects from specimens of the same size taken in the St. Lawrence estuary (Bousfield, 1955) (see Fig. 3 and Table II). The latter material comprises immature stages of *G. homari*, a large arctic and subarctic littoral species.

G. angulosus: length of male 11-13 mm.; of female 14-16 mm. Body colouration of male usually more mottled than that of female.

G. homari: length of male up to 20 mm.; of female up to 35 mm.

TABLE II. Taxonomic characters distinguishing species of *Gammarellus*.

Character	Species	
	Gammarellus angulosus (*adult*) (15 mm.)	*Gammarellus homari* (15 mm. imm.)
Eyes	Very large in both male and female, occupying more than 50% of the head (lateral view), nearly meeting dorsally.	Large, but occupying less than 50% of head; widely separated dorsally
Antenna 1	Accessory flagellum, 4-6 segments	Access. flag, 2-3 segments
Antenna 2	Peduncle, 4th segment =3rd segment	Peduncle 4th shorter than 3rd.
Coxal Plate 1	antero- ventral angle acute	Antero-ventral angle nearly a right-angle
Per. 3-5	Relatively slender, claws medium strong	Relatively short and stout, claws large.
Dorsal Carination	Dorsum of Peraeon not distinctly carinated. Only Urosome dorsally carinated	Dorsum of Peraeon prominently carinated Urosome 1-4 also strongly carinated.

Gammarellus homari is common in Ungava Bay (Dunbar, 1954) and extends southward along the coast of Labrador at least to Cape Spear (St. John's Nfld.) and the St. Lawrence estuary, and very probably breeds in late winter and early spring.

G. angulosus occurs on the outer, high salinity coasts of the New England States, Nova Scotia, Newfoundland and Cape Gaspé, Quebec (Brunel, pers. commun.) but its northern limit has not yet been established. It breeds in summer.

14. *Gammarus duebeni* Lillj. 1851.

W2a - 30 ♂♂, 30 ♀♀ (non-ovig.).
W4 - 7 ♂♂, 23 ♀♀ (non-ov), 1 imm

REMARKS: Taken only in tidal pools (some fresh to the taste) at or above the HW line.

15. *Gammarus oceanicus* Segerstrale 1947.
MATERIAL: W2a - 10 ♂♂, 9 ♀♀, 30 imm.
W2b - 3 ♂♂, 3 ♀♀, 3 imm.
W5a - 1 ♂.
W5b - 11 ♂♂, 5 ♀♀, 4 imm.
REMARKS: Formerly known on the American Atlantic coast as *G. ornatus* M.-E. and *G. locusta* L.

16. *Gammarus lawrencianus*. Bousfield 1957.
MATERIAL: W2 - 3 ♂♂, 14 ♀♀ (ovig.), 5 imm.
W5b - 3 ♂♂, 7 ♀♀ (ovig.)
REMARKS: Mature specimens are separable from *G. annulatus* (Woods Hole Region) mainly on the setation of the antennae and 3rd uropods.

17. *Marinogammarus finmarchicus* Dahl 1938. W5 - 6 ♂♂, 14 ♀♀, 4 imm.
REMARKS: The species has previously been reported from the New England States (as *M. greenfieldi* Shoemaker, 1938) but the present record is the first from Canada. An immature male specimen from St. Andrews, N. B., has also recently been examined.

18. *Marinogammarus stoerensis* Reid 1938. W2 - 28 immatures.
REMARKS: previously recorded in N. America only from this station. (Bousfield, 1956).

19. *Crangonyx occidentalis* Hubricht and Harrison 1941. W1 - 5 immatures.
REMARKS: The eastern form is variable but is closely similar to material taken in eastern Ontario and Vancouver Island, the latter near the type locality.

20. *Dexamine thea* Boeck 1861. W2b - 2 ♀♀ (with brood lamellae).

21. *Hyale nilssoni* (Rathke) 1843. W2a - 23 ♂♂, 5 ♀♀ (ovig.), 8 imm.
W4 - 21 ♂♂, 4 ♀♀ (ovig.).
W5b - 6 ♂♂. 1 ♀♀, 1 imm. ♂

22. *Hyalella azteca* (Saussure) 1858. W1 - 3 ♂♂, 9 ♀♀ (non-ovig.)
W2a - 11 immatures.
REMARKS: Material from station W2a occurred in a pool at the mouth of a small f.w. stream, just above the H.W. level; bottom of coarse sand and filamentous algae.

23. *Orchestia platensis* Kroyer 1844. W4 - 6 ♂♂, 6 ♀♀, 100 imm.
W5b - 1 ♂, 1 ♀, 1 imm.
24. *Talorchestia longicornis* (Say) 1818.
W5a - 3 ♂♂, 2 ♀♀ 2 imm.
W5b - 9 immatures.
25. *Amphithoe rubricata* (Montagu) 1802.
W2b - 12 ♂♂, 6 ♀♀, 5 imm.
W5b - 1 immature.
26 *Ischyrocerus anguipes* Kroyer 1838 W5b - 3 ♂♂, 2 ♀♀ (ovig.)
27. *Jassa falcata* (Montagu) 1808 W2b - 24 ♂♂, 23 ♀♀ (mostly ovig.), 14 imm.
W5b - 14 ♂♂, 15 ♀♀ (mostly ovig.).
28. *Corophium insidiosum* Crawford 1937. W4 - 3 ♂♂, 7 ♀♀ (3 ovig.).
29. *Caprella septentrionalis* Kroyer 1838. W2b - 1 immature.

TABLE III. Zoogeographical Affinities of the Marine and Brackish Species.

Arctic-Boreal	Boreal	Mediterranean-boreal and cosmopolitan temperate
Calliopius laeviusculus	*Neomysis americana	*Mysis stenolepis
Sympleustes glaber	Idothea baltica	*Chiridotea caeca
Gammarus oceanicus	*I. phosphorea	Trachaeonicus rathkei
Ischyrocerus anguipes	Jaera marina	*Amphiporeia virginiana
Caprella septentrionalis	*Tmetonyx nobilis	
	Gammarellus angulosus	Orchestia platensis
	Gammarus duebeni	*Talorchestia longicornis
	*G. lawrencianus	Jassa falcata
	Marinogammarus finmarchieus	Corophium insidiosum
	finmarchicus	
	M. stoerensis	
	Dexamine thea	
	Hyale nilssoni	
	Amphithoe rubricata	

*American endemic.

Discussion: (See Table III).

Although the marine intertidal species in the collection number but twenty-six, their zoogeographic composition appears significant. Of these, 13 (50%) are boreal, eight (31%) are mediterranean-boreal and cosmopolitan-temperate, whereas but 5 (19%) are arctic-boreal. The proposition of boreal: arctic-boreal species is higher than that of Cape Breton Island and Newfoundland to the northeast, and agrees well with the cold-temperate composition of the shore biota described from the outer coast of Nova Scotia by Stephenson and Stephenson (1954). The western Nova Scotia region in winter is characterized by the absence of fast-frozen shore ice and by relatively brief periods of freezing water temperatures (Ice Atlas of the Northern Hemisphere, 1954). These conditions are reflected, on one hand, by the presence of the southward ranging *Amphiporeia virginiana*, *Marinogammarus finmarchicus*, *M. stoerensis*, and to a lesser extent *Gammarus duebeni*, and *Gammarellus angulosus*, and on the other hand by the apparent absence of arctic and subarctic indicator species such as *Gammarellus homari*, *Pontoporeia affinis*, and *Pseudalibrotus littoralis*.

Finally, only eight (39%) of the boreal and mediterranean-boreal species are American-endemic whereas the remainder are amphi-Atlantic. The prevalence of these amphi-Atlantic forms on the Canadian Atlantic coast has been interpreted (Bousfield, 1956) to signify a post-glacial continuous distribution from North America to Europe via Labrador, Greenland and Iceland, and that the marine climate in the North Atlantic must have been warmer at that time.

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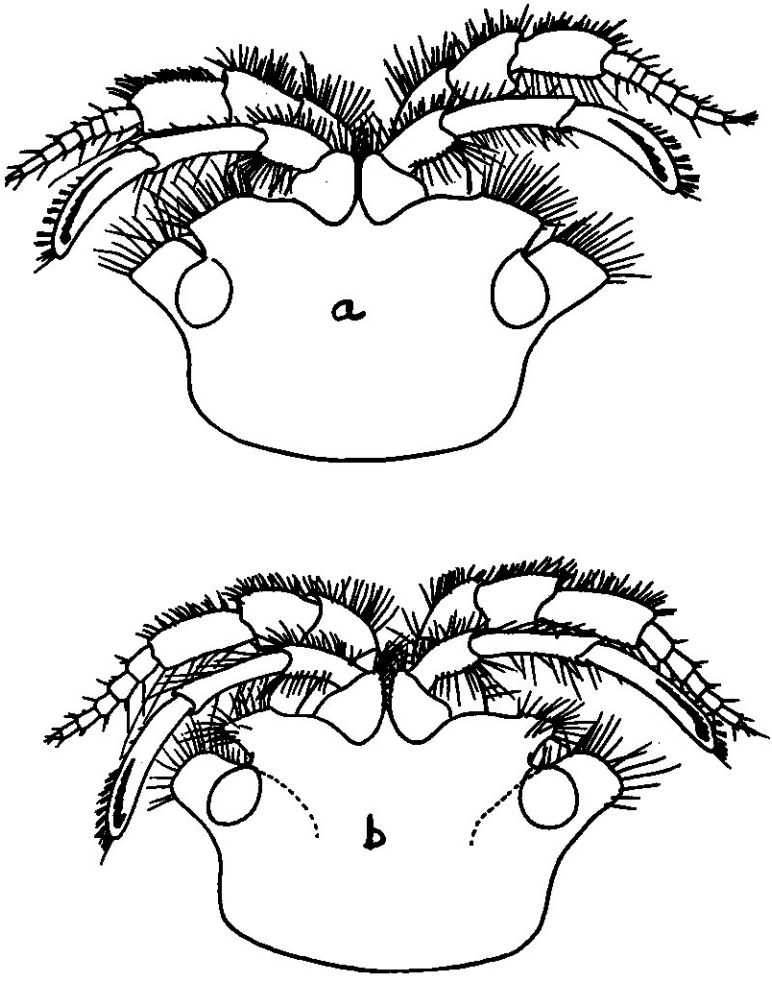

Figure 1. Chiridotea caeca (Say) Green Bay, Lunenburg County. Head and antennae (a) male, 13 mm. (b) female, 13 mm.

Figure 2. *Amphiporeia virginiana* (Shoemaker). Hunt's Point Beach, Queens County, N. S. Male (a) entire animal, (b) head region, (c) antenna 1 (d) antenna 2. Female (i) head region.

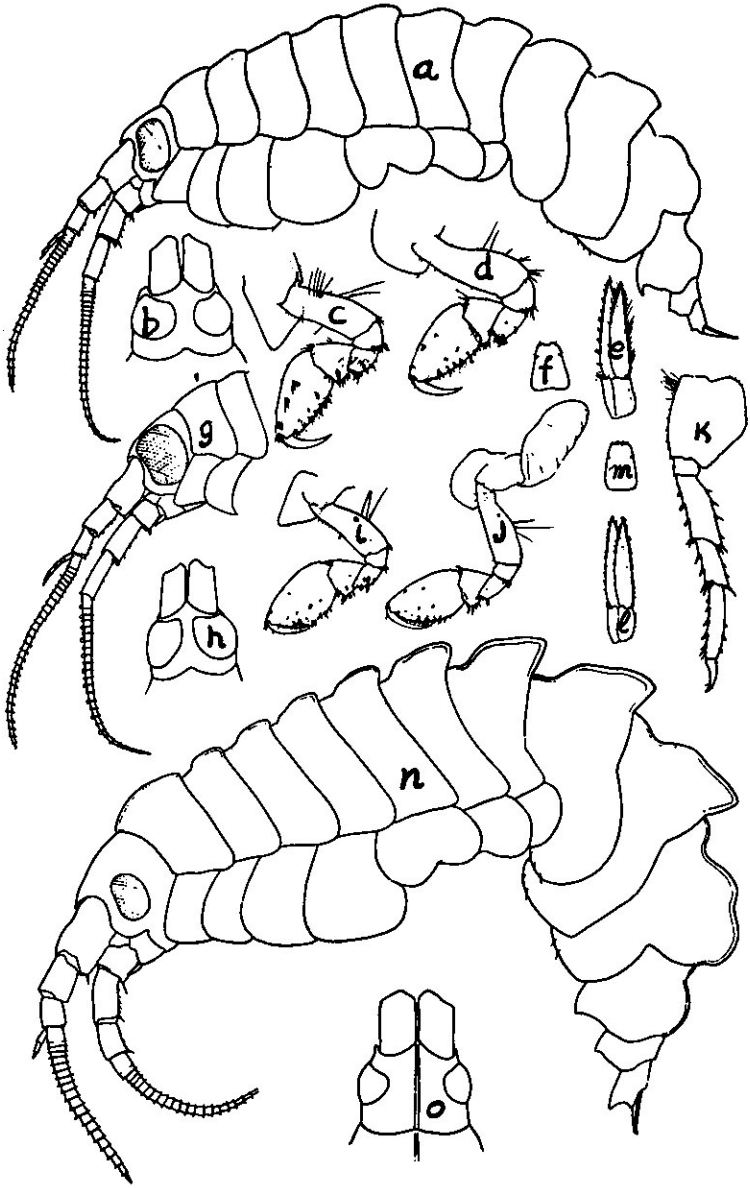

Figure 3. *Gammarellus angulosus* (Rathke), Green Bay, Lunenburg County, N. S. Female, 15 mm. (a) entire animal, (b) head (dorsal view), (c) gnathopod, (d) gnathopod 2, (e) uropod 3, (f) telson. Male 14 mm. (g) head region, (h) head (dorsal view) (i) gnathopod 1 (j) gnathopod 2, (k) peraeopod 5, (l) uropod 3, (m) telson. *Gammarellus homari* (Fabr.), Cape Gaspé, Quebec, immature female (n) entire animal, (o) head (dorsal view).