LITTORAL MARINE ARTHROPODS AND MOLLUSKS COLLECTED IN WESTERN NOVA SCOTIA, 1956

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ABSTRACT

Sixty-nine species of marine arthropods and sixty-three species of marine mollusks collected in Western Nova Scotia, are recorded and discussed in connection with the main features of intertidal ecology and faunal composition of the region.

During the period June 19 to July 31, 1956, the distribution and ecology of shore-dwelling crustaceans, pycnogonids, and insects of western Nova Scotia were investigated. More than 4600 specimens were obtained at 33 localities in the open coast region from Halifax County to Yarmouth County (see Fig. 1). The present report is a continuation of regional studies on littoral marine invertebrates of the Atlantic Coast of Canada (see Bousfield 1952, 1955, 1956a, 1956b, 1958). The present material contains sixty-nine species, of which four (*Heteromysis formosa*, *Metopa solzbergi*?, *Leptochelia rapax*, and *Petrobius maritimus*) are new to Canada, and three (*Amphiporeia virginiana*, *Marinogammarus finmarchicus*, and *M. stoerensis*) are presently unknown elsewhere in eastern Canada. *Cirolana polita*, *Chiridotea caeca*, *Pagurus longicarpus*, and *Carcinides maenas* have been recorded elsewhere in Canada from the Bay of Fundy, and *Orchestia gammarella*, *Dexamine thea*, and *Oniscus asellus* from southern Newfoundland.

During this investigation, 698 specimens of shell-bearing marine mollusks were also collected. The 63 species listed herewith have all been previously recorded from Canadian Atlantic waters (Whiteaves, 1901; LaRocque, 1953). However, 12 of these (10 gastropods, 2 bivalves) are not given by Willis (1862) from the fishing banks off Halifax and from Sable Island, by Jones (1877) from Halifax Harbour and vicinity, nor by subsequent collectors on the Atlantic coast of western Nova Scotia (e.g. Stephenson *et al* (1954) from Peggy's Cove and Mason's Cove) and are presumed new to the region as follows: *Lacuna pallidula neritoidea*, *Cingula aculeus*, *Mitrella lunata*, *Haminoea solitaria*, *Retusa canaliculata*, *Turbonilla interrupta*, *Pyramidella fusca*, *Odostomia trifida*, *O. bisuturalis*,

Melampus lineatus and the bivalves *Volsella demissa* and *Lyonsia hyalina*. Five other gastropods (*Puncturella noachina, Crepidula plana, Lora bicarinata, Admete couthouyi* and *Cylichna alba*) and nine bivalves (*Nucula delphinodonta, Turtonia minuta, Petricola pholadiformis, Tellina agilis, Siliqua costata, Spisula polynyma, Mesodesma arctatum, Zirphaea crispata*, and *Periploma leanum*) may be mentioned as hitherto unrecorded from inshore waters of mainland western Nova Scotia. In 1910, Mr. C. H. Young of the Geological Survey of Canada dredged extensively at Yarmouth, Barrington Passage, and LaHave, N. S. The mollusk material, consisting of approximately 100 species, was identified by Drs. W. H. Dall and P. Bartsch of the U. S. National Museum. It includes three (*Lacuna pallidula neritoidea, Cingula aculeus*, and *Lyonsia hyalina*) of the twelve species listed herewith as new to the region, and nearly all those mentioned above as new to inshore waters. Unfortunately, only five marine species of Young's material were subsequently published upon (see Dall and Bartsch, 1913); the collection remains in the National Museum, Ottawa, as an important reference source of Canadian Atlantic littoral marine mollusks.

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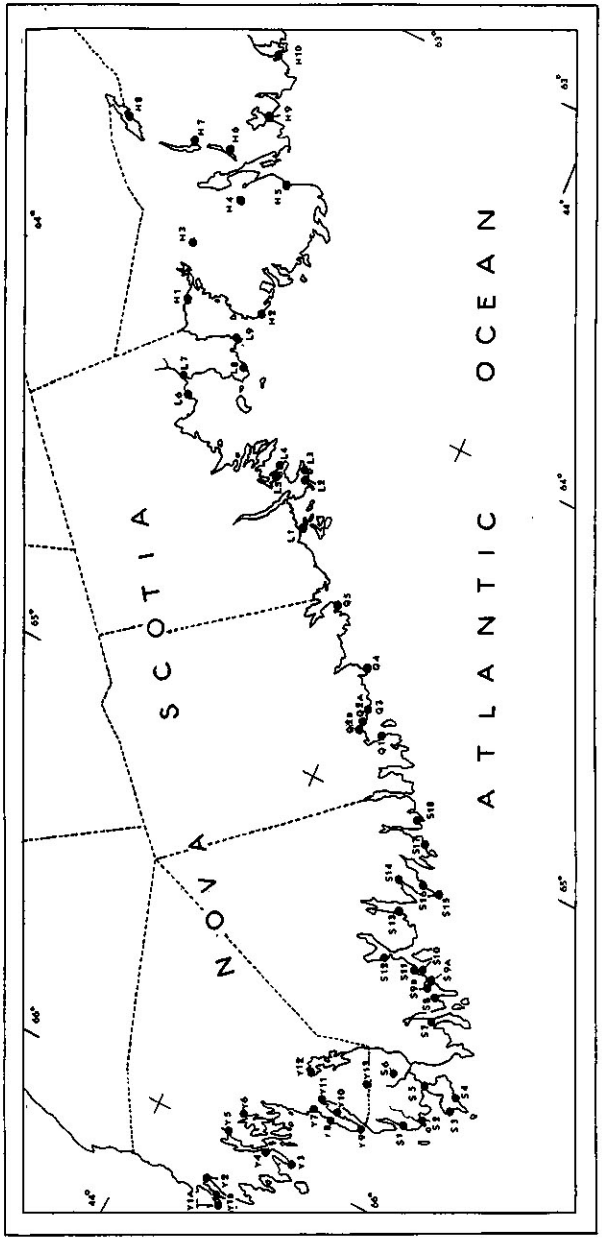

Fig. 1. Localities Visited in Western Nova Scotia.

STATIONS VISITED IN WESTERN NOVA SCOTIA

Key to Station Numbers—Y Yarmouth County S Shelburne County Q Queen's County L Lunenburg County H Halifax County

* Observations only, no biol. coll'ns.

Sta. No.	Date	Locality	Habitat	Water Temp. (°C)	Water Sal'y (0/00)
Y1a	July 5	Cape Fourchu.	Pools from MW-HW levels. Rocks, boulders and gravel.	12.2	31.5
Y1b	,, ,,	,, ,,	Sandy Beach, at HW level.	—	—
*Y2	,, ,,	Head of Yarmouth Harbour.	Rocks, mud, MW-HW levels.	20.0	30.3
Y3	,, ,,	Wedge Pt.	Pools, LW-HW levels. Rocks, boulders and sand.	—	—
*Y4	,, ,,	Tusket Estuary, west shore	*Spartina* mud flat, boulders, MW-HW levels.	—	—
*Y5	,, ,,	Tusket Estuary, at highway.	Stones, mud.	—	—
Y6	,, 4	Outlet of Eel Lake.	Mud, *Enteromorpha* and *Zostera*.	14.6	25.5
Y7	,, 11	Argyle Sound, mouth of East Goose R.	Pebble and boulder beach, fucoids and *Zostera*; LW-HW levels.	14.6	25.5
Y8	,, ,,	Abbott Harbour	Boulders and sand; LW-HW levels	12.9	30.1
Y9	June 27	Ste. Anne Pt., Lower W. Pubnico	Rock pools, stones, sand; MW-HW levels.		— —
Y10	July 10	Middle W. Pubnico at old wharf	Mud, small stones, eel grass; LW-HW levels.	16.0	30.3

Sta. No.	Date	Locality	Habitat	Water Temp. (°C)	Water Sal'y (0/00)
*Y11	June 27	Pig Yoke estuary, at highway bridge.	*Spartina* mud flats, peat, stones.	—	—
Y12	,, ,,	Great Pubnico Lake W. end.	Stones and sand, shallows	20.5	—
*Y13	,, 28	Stream above French Lake at 9 mile road	Stones and aquatic plants	—	—
S1	July 12	Between Lower Woods Harbour and Shag Harbour.	Boulders, pebbles, at LW-HW levels. HW pools in bedrock.	10.9	30.6
S2	June 27	Shag Harbour, Mouth of Ohio R.	Stones and mud; MW-HW levels.	17.0	15.8
S3	July 12	Clarke's Harbour at Split Point.	Boulders, sand, and eel grass, LW-MW levels.	12.6	30.0
S4	June 26	Cape Sable I., near Absolem Pt.	Boulders and sand; LW-HW levels.	13.5	31.3
*S5	July 12	Cape Sable I., E of Causeway	Sand beach at HW	—	—
*S6	June 28	Cold stream N. of Barrington Passage.	Moss and wood chips	—	—
*S7	,, 26	Small bay south of Thomasville.	*Spartina* mud flats.	—	—
*S8	,, ,,	Head of North-east Harbour, opp. Cape Negro Id.	*Spartina* mud flats and brackish sloughs	—	—
S9a	July 13	Round Bay	Outer sand beach, boulders; LW-HW levels.	11.3	27.5
S9b	,, ,,	,, ,,	B.W. mud and boulder flats.	—	—

Sta. No.	Date	Locality	Habitat	Water Temp. (°C)	Water Sal'y (0/00)
*S10	June 26	Crane Pt., S. of Roseway	Protected sand and pebble beach at HW	—	—
*S11	,, ,,	N. of Crane Pt.	Steep stony beach	—	—
*S12	.. ,,	Gunning Cove, at wharf	Boulder beach	—	—
S13	July 13	MacLean I., inner shore	Mud, sand and boulders; LW-HW levels.	18.9	26.9
S14	,, 17	Head of Green Hbr.	*Spartina* mud flats, sand, boulders, eel grass; LW-MW levels.	abt. 20°C.	brackish
S15	July 3	Western Hd., Lockeport region	Rock and stones at HW level.	—	—
S16	July 3	Lockeport, at Causeway	Sand beach & boulders; LW-HW levels.	—	—
*S17	,, 18	Little Harbour	Gravel and sand beach	—	—
S18	,, 13	Jones Harbour	Boulders, muddy sand and eel grass at LW level.	13.0	29.9
Q1	,, 18-19	Port Mouton south, at mouth of stream	Sandy beach; MW-HW levels.	—	—
Q2a	June 28	Summerville	Outer sandy beach at HW level.	—	—
Q2b	,, ,,	Summerville estuary	Inner sand flats and pebbles at LW	cold	brackish
*Q3	July 6	Hunt's Pt., at wharf	Bedrock at HW level	—	—
Q4	,, 18	Western Head, S.E. of Liverpool	Tidal pools on bedrock; MW-HW levels.	—	—

Sta. No.	Date	Locality	Habitat	Water Temp. (°C)	Water Sal'y (0/00)
Q5	,, 19	Long Cove, S.E. of Pt. Medway	Bedrock, pebbles, sandy mud, and eel grass. LW-MW levels.	15.3	30.3
L1	,, 19-20	Crescent Beach	Sand beach, MW-HW	16.0	—
L2	,, 25	Hartling Bay, Hirtle Beach	Dark sand and gravel at HW level.	—	—
L3	,, ,,	King's Bay, S. of Kingsburg	Dark sand at HW level	—	—
L4	,, 10	Spindler's Cove	Slate and black sand beach; LW-HW levels.	11.6	30.7
*L5	,, 10	Indian Path Cove	Stones and algae; lagoon	—	—
L6	,, 26	Graves I. western shore	Boulders, pebbles, sand, eel grass; LW-HW levels.	19.2	30.4
L7	,, 27	Mouth of East R.	Boulders, mud, algae	15.5	brackish
*L8	,, 17	Bayswater Beach	Sand beach, f.w. seep at HW level.	—	—
L9	,, 25	South-west Cove	Granite, boulders, coarse sand; LW-HW	18.8	29.9
H1	July 17	Black Pt.	Boulders and gravel; LW-MW levels.	16.9	29.3
*H2	,, 27	Peggy's Cove	Pools in bedrock, at HW level.	—	—
*H3	,, 17	"Punch Bowl", small lake off HW 3, 12 mi. w. Halifax	Boggy shores	—	—

Sta. No.	Date	Locality	Habitat	Water Temp. (°C)	Water Sal'y (0/00)
*H4	June 23	Hfx water supply, 3 m. w. Hfx.	Boggy shores and stones	—	—
H5	,, ,,	Bear Cove, Chebucto Bay	Rock pools; MW-HW levels	8.9°	—
*H6	,, ,,	Lake Charles above Dartmouth	Stony shores	—	—
*H7	,, ,,	Miller Lake	Stony shore, sandy mud	—	—
*H8	July 28	Grand Lake	Rock, stones, mud and weeds	20.2	—
H9	June 30	Cole Harbour	Sand and sandy mud, eel grass; LW-HW levels	15.0	brackish
H10	July 24	Three Fathom Hbr.	Boulders, coarse sand, mud; LW-HW levels.	15.5	30.0

STATION LIST OF MATERIAL

Sub-phylum Crustacea
Class Cirripedia
Order Thoracica

1. *Balanus balanoides* (L.). Y10 (3). Observed on rocky shores at Y1, Y2, Y3, Y6, Y9, Y13, S1, S2, S4, S9, S13, Q1, Q2, Q4, Q5, L4, L6, L7, L9, H1, H5, H9, and H10.
2. *Balanus crenatus* Brug. Y10 (3, plus fragments).
3. *Balanus improvisus* Darwin. Y8 (1, plus fragments), Y20 (4, plus numerous small dead shells), S2 (20). Observed on stones, shells, etc., near LW level at Y4, Y5, Y6, and Y14.

Class Malacostraca
Subclass Peracarida*
Order Mysidacea

4. *Mysis stenolepis* S. I. Smith. Y7 (15 imm.), Y8 (2 imm.), Y10 (1 f.), S1 (5 imm), S3 (3 imm.), Q2 (1 imm.), Q5 (19 imm.), L7 (4 imm.), and H10 (21 imm.).
5. *Neomysis americana* S. I. Smith. Y10 (5 m., 6 f. ovig.), Q2 (6 f. ovig.). Observed in pools at Y3.
6. *Heteromysis formosa* S. I. Smith. Y10 (1 f. ovig.).

Order Cumacea

7. *Oxyurostylis smithi* Calman. S13 (2f.), S14 (1 m.), L6 (8 f. ovig., 2 imm.), L9 (1 f. ovig.), H1 (1 m. imm.).

Order Amphipoda

8. *Hippomedon serratus* Holmes. L6 (1 m.).
9. *Orchomenella minuta* (Kr.). Y7 (2 f.), S3 (3 f. ovig.), S13 (14 imm.).
10. *Orchomenella pinguis* (Boeck). Y8 (4 m., 5 f. ovig.).
11. *Tmetonyx nobilis* (Stimps.). Y8 (7 ad., 14 imm.), S16 (1 ad.), L6 (12 ad., 42 im.), L9 (1 ad., 1 imm.).

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*In addition, the following peracarids were taken at fresh water stations:
Hyalella azteca (Sauss.)—Y12 (13 m., 10 f. ovig.); observed at S14, H3, H6, H7, and H8.
Asellus communis Say—Y12 (5 m., 11 f., 2 im.); observed at Y9, Y13 and S6.

12. *Ampelisca spinipes* Boeck. Y7 (1 imm.), Y8 (1 m.), L6 (1 m., 4 f. ovig., 1 im.).

13. *Amphiporeia lawrenciana* Shoem. L4 (1 f. ovig.).

14. *Amphiporeia virginiana* Shoem. S4 (2 f. ovig.), S9 (19 f. ovig.), S16 (2 m., 2f., 2 im.), Q2 (1 m., 3 f. ovig., 1 imm.), H9 (3 f. ovig.). Observed at L8.

15. *Phoxocephalus holbolli* (Kr.). Y7 (1 im.), Y8 (7 ad.), S1 (1 m., 3 f. ovig.), S3 (1 m., 7 f.), S13 (25 f.), S18 (11 f.), Q5 (3 f.), L4 (1 f.), L6 (8 f.), L9 (7 f.).

16. *Metopa* sp. S18 (1 f. ovig.). The species is close to *M. sölsbergi* Schneider.

17. *Calliopius laeviusculus* (Kr.). Y7 (15 m., 12 f., 11 im.), Y8 (18 m., 25 f. ovig., 22 im.), Y9 (5 m., 4 f. ovig.), S1 (3 m., 4 f. ovig., 2 im.), S3 (4 m., 3 f. ovig.), S4 (5 m., 1 f.), S9 (10 m., 10 f. ovig.), S18 (2 f., 3 im.), Q2 (1 m.), Q5 (8 m., 7 f. ovig.), L4 (29 m., 17 f., 14 im.), L6 (10 m., 16 f. ovig., 14 im.), L9 (4 m., 9 f. ovig., 2 im.), H1 (13 m., 18 f. ovig.), H5 (1 m., 2 f. ovig.), H9 (6 m., 15 f. ovig., 5 im.), H10 (5 m., 12 f. ovig., 2 im.).

18. *Sympleustes glaber* (Boeck). Y7 (1 m.), Y8 (4 m., 2 f. ovig., 2 im.), S1 (2 m., 4 f. ovig.), L4 (1 m., 2 f. ovig.), H1 (1 im.).

19. *Pontogeneia inermis* (Kr.). Y8 (4 m., 4 f. ovig., 11 im.), S1 (17 m., 17 f. ovig.), S3 (1 f.), L4 (1 m., 1 f.).

20. *Gammarellus angulosus* Rathke. Q5 (2 m., 9 imm.), L4 (1 m.), H1 (4 im.),

21. *Melita dentata* (Kr.). Y8 (1 m. im.), S1 (1 m.), Q5 (7 im.).

22. *Gammarus oceanicus* Segers. Y1a (6 m., 6 f., 41 im.), Y3 (5 m., 2 f. ovig., 13 im.), Y6 (12 m., 1 f., 59 im.) Y7 (30 im.), Y8 (6 m., 3 f. ovig., 80 im.), Y9 (39 m., 11 f., 65 im.), Y10 (8 m., 12 f., 15 im.), S1 (2 m., 2 f., 78 im.), S2 (19 im.), S3 (1 m., 1 f., 4 im.), S9 (23 im.), S13 (1 m., 1 f., 2 im.), S14 (4 m., 2 f., 39 im.), S18 (7 im.), Q2 (2 m., 1 f. ovig., 11 im.), Q5 (12 m., 4 f., 69 im.), L4 (1 f. ovig., 4 im.), L6 (2 m., 53 im.), L7 (30 imm.), L9 (2 m., 1 f., 9 im.), H9 (5 m., 5 f. ovig., 34 im.), H10 (7 m., 2 f., 52 im.).

23. *Gammarus setosus* Dement. Q5 (1 f.), L6 (1 m., 1 f.), H5 (1 m.).

24. *Gammarus lawrencianus* Bousfield. Y3 (6 m., 5 f. ovig.), Y6 (16 m., 10 f., 3 im.), Y7 (5 m., 8 f. ovig.), Y9 (1 m., 1 f. ovig.), Y10 (2 m., 6 f. ovig., 1 im.), S2 (18 m., 13 f. ovig., 7 im.), S3 (3m., 2 f. ovig.), S9 (24 m., 39 f. ovig., 5 im.), S14 (2 m., 3 f. ovig.), S16 (1 f. ovig.), Q2 (14 m., 16 f. ovig.), Q5 (2 m., 2 f., 1 im.), L7 (14 m., 21 f. ovig.), L9 (14 m., 17 f., 5 im.), H9 (21 m., 23 f. ovig.), H10 (5 m., 3 f. ovig.).

25. *Gammarus tigrinus* Sexton. Y6 (1 f. ovig.), S2 (6 m., 4 f. ovig., 1 im.), S9b (1 m., 5 im.), S14 (4 m., 6 f. ovig.), L7 (4 m., 8 f. ovig.). Observed at Y5, Y11.

26. *Gammarus mucronatus* Say. Y6 (2 m., 3 f. ovig., 3 im.), S2 (3 m., 8 f.), S14 (1 m., 1 f.), H9 (6 m., 7 f. ovig., 1 im.), Observed in marsh ponds at Y4, S8.

27. *Gammarus duebeni* Lillj. Y1 (5 m., 10 f. ovig., 30 im.) Y7 (3 m., 4 f., 9 im.), Y9 (2 m.), Y10 (1 m., 5 f. ovig., 7 im.), S1 (1 m., 2 f. ovig., 31 im.), Q4 (2 im.), H5 (12 m., 22 f. ovig., 51 im.). Observed in HW rock pools at H2.

28. *Marinogammarus obtusatus* Dahl. Y3 (1 m., 1 f. ovig.), S4 (21 m., 13 f. ovig.), Q5 (2 m., 4 f. ovig., 5 im.), L6 (2 m., 1 f.), L9 (6 m., 4 f. ovig., 5 im.), H1 (11 m., 8 f. ovig.), H5 (1 f.). Observed at S12.

29. *Marinogammarus finmarchicus* Dahl. Y1a (3 m., 2 f. ovig., 7 im.), Y3 (1 m.), Y9 (11 m., 8 f. ovig., 7 im.), S1 (4 m., 11 f. ovig., 31 im.), S3 (1 m.), S9 (1 im.), Q5 (6 m., 2 f. ovig., 11 im.), L6 (2 m., 7 f. ovig., 5 im.), L9 (1 im.), H5 (3 m., 2 f. ovig.), H10 (2 m., 2 f. ovig., 1 im.).

30. *Marinogammarus stoerensis* Reid. Y1 (1 f.), Y7 (2 f. ovig.), S1 (2 f. ovig.), S9 (1 m., 1 f. ovig.), Q5 (2 f. ovig.), H5 (37 m., 58 f. ovig.)

31. *Dexamine thea* Boeck. Y7 (8 f. ovig.), Y8 (7 f. ovig.), Y9 (1 f. ovig.), S1 (16 f. ovig.), S3 (7 f. ovig.), S18 (7 f. ovig.), Q5 (2 f.), L4 (7 f. ovig.), L6 (6 f.), L9 (1 f. ovig.), H1 (2 f.).

32. *Hyale nilssoni* Rathke. Y1 (1 m.), Y9 (1 m.), S1 (3 m., 4 f. ovig.), S9 (2 f. ovig.), S16 (1 m.), L6 (13 m., 6 f. ovig.), H5 (11 m., 10 f. ovig.). Observed on rocks under algae at S10, L4, and H1.

33. *Orchestia gammarella* (Pallas). Y1a (5 m., 8 f. ovig., 20 im.), Y8 (2 m., 4 f. ovig., 10 im.), Y9 (13 m., 10 f. ovig.). Observed at Y3.

34. *Orchestia grillus* Bosc. Y6 (3 m., 4 f. ovig.), S13 (1 m., 5 f. ovig.), H9 (2 m., 7 f. ovig.). Observed at S7.

35. *Orchestia platensis* Kr. Y1 (4 m., 9 f. ovig.), Y8 (3 m., 1 f. ovig., 1 im.), Y9 (24 m., 26 f. ovig.), S1 (2 m., 1 im.), S4 (8 m., 1 f. ovig), S15 (2 m., 3 f.), S16 (21 m., 20 f. ovig., 68 im.), Q4 (3 m., 2 f. ovig.), L4 (2 m., 1 f. ovig.), L6 (22 m., 21 f. ovig., 24 im.), H1 (6 m., 3 f. ovig.). Observed at Y3, Y10, S9, S11, H5.

36. *Talorchestia megalophthalma* (Bate). S16 (27 m.), Q2a (23 m., 9 f. ovig., 2 im.), L1 (1 m., 1 f.).

37. *Talorchestia longicornis* (Say). Y1b (21 m., 14 f., 4 im.), S4 (2 m., 10 f.), S16 (182 m., 206 f., 426 im.), Q1 (85 m., 109 f., 118 im.), Q2a (3m., 4 f., 41 im.), L1 (68 m., 45 f., 152 im.), L2 (2 im.), L3 (149 m., 78 f., 151 im.), L4 (2 m., 4 f.), Nearly all females ovigerous. Observed on sand beaches at S3, S5, S10, L8.

38. *Leptocheirus pinguis* (Stimps.). Y10 (1 m., 1 f. ovig., 3 fragments.), S3 (3 m., 12 im.).

39. *Podoceropsis nitida* (Stimps.). L4 (7 f. ovig., 10 im.). Apparently living on or in whelk shells inhabited by *Pagurus acadianus*.

40. *Amphithoe rubricata* (Mont.). Y3 (1 m.), Y6 (2 im.), Y8 (5 m., 4 f. ovig., 18 im.), Y9 (1 m.), S1 (4m., 4 f. ovig., 4 im.), S4 (1 m.), S18 (1 f. ovig., 1 im.), Q5 (3 m., 1 im.), L4 (2 m., 4 im.), L6 (22 im.), L9 (1 im.), H1 (4 m., 7 f. ovig., 7 im.), H10 (1 m., 8 f. ovig., 2 im.).

41. *Ischyrocerus anguipes* Kr. Y8 (4 m., 48 f., 8 im.), S1 (13 m., 41 f. ovig., 11 im.), S3 (2 m., 2 f. ovig.), S18 (8 m., 37 f. ovig.), Q5 (5 m., 15 f. ovig.), L4 (1 m., 9 f. ovig.), L6 (3 f. ovig.), L9 (1 m., 4 f. ovig.), H1 (1 f. ovig.) H10 (2 f. ovig.).

42. *Jassa falcata* Mont. Y8 (7 m., 1 f. ovig.), S1 (3 m., 2 f. ovig.), S18 (8 m., 7 f. ovig.), L4 (13 m., 32 f. ovig., 14 im.), L6 (25 m., 22 f. ovig.), L9 (16 m., 24 f. ovig.), H1 (10 m., 35 f. ovig.), H9 (1 m., 2 f. ovig.), H10 (1 im.).

43. *Corophium insidiosum* Crawf. Y6 (13 f. ovig.), Y8 (1 f.), S9a (4 f. ovig.), S13 (1 f. ovig.), Q5 (1 f. ovig., 4 im.), L6 (6 m., 9 f. ovig.), H9 (3 m., 7 f. ovig.).

44. *Corophium bonelli* (M.-E.). Y7 (1 im.), Y8 (4 f., 1 im.), S3 (2 f. ovig.), S18 (3 f. ovig.), L4 (9 f. ovig.), L9 (1 f. ovig.).

45. *Unciola irrorata* Say. Y8 (1 m., 2 f. ovig., 4 im.), S1 (1 m., 1 f., 8 im.), L9 (8 m., 6 f. ovig., 8 im.).

46. *Aegina longicornis* (Kr.). S18 (1 m.).

47. *Caprella linearis* (L.). Y7 (1 f. ovig.), Y8 (6 m., 1 f.), S1 (10 m., 3 f. ovig.), S3 (2 m., 6 f. ovig.), S18 (3 m.), L4 (4 m., 3 f. ovig., 1 im.).

48. *Caprella acutifrons* Latr. Y10 (2 m.), L6 (12 m., 8 f. ovig.).

Order Tanaidacea

49. *Leptochelia rapax* Harger. S2 (9 m., 1 f.), L7 (4 m.).

Order Isopoda

50. *Cirolana polita* (Stimps.). Y8 (1 m., 4 im.), S3 (3 m., 3 f.).

51. *Chiridotea caeca* (Say). Y3 (1 m., 4 f. ovig.), Y9 (7m., 5 f., 1 im.), S3 (1 m., 2 im.), S9 (7 m., 4 f. ovig., 4 im.), S13 (2 m., 2 f. ovig., 1 im.), S14 (2 im.), Q2b (6 m., 3f. ovig.), Q5 (1 m., 1 f. ovig., 8 im.), L6 (6 m., 2 f. ovig.), L9 (1 im.), H9 (1 f., 4 im.).

52. *Chiridotea tuftsi* (Stimps.). Y8 (3 m., 3 f.), S3 (1 f. ovig.), L6 (6 m., 2 f. ovig.), L9 (1 im.).

53. *Idothea baltica* (Pallas). Y3 (4 m., 5 f. ovig.), Y7 (2 m.), Y8 (2 m., 2 f. ovig.), Y10 (1 f.), S1 (1 f. ovig.), S3 (2 m., 4 f. ovig.), S4 (1 m.), S9 (2 m., 5 f. ovig., 2 im.), S13 (3 m., 3 f.), Q5 (5 m., 1 f.), L4 (1 m.), L6 (1 m., 1 f., 13 im.), L9 (1 f., 1 im.), H9 (4 m., 3 f.), H10 (5 m., 7 f.).

54. *Idothea phosphorea* (Harger). Y7 (2 im.), Y8 (1 m., 6 f. ovig., 5 im.), Y10 (1 m., 4 f. ovig., 12 im.), S3 (1 m., 1 im.), S13 (1 m., 6 f. ovig., 1 im.), L4 (1 m., 1 f. ovig.), L6 (5 im.), L9 (6 im.), H9 (1 m., 2 f.), H10 (1 m., 1 f., 2 im.).

55. *Edotea montosa* (Stimps.). Y3 (1 m., 1 f.), Y7 (1 m., 2 f.), Y8 (6 m., 6 f.), S18 (1 f. ovig.), H10 (1 im.).

56. *Jaera marina* (Fabr.). Y1a (4 ad.), Y6 (3 m., 5 f. ovig.), Y7 (1 m., 3 f. ovig.), Y8 (1 m. 5 f. ovig.), Y9 (1 f.), Y10 (1 f.), S1 (1 f. ovig.), S2 (1 m., 5 f.), S4 (1 f.), S9 (1 im.), S14 (1 m., 1 f. ovig.), Q5 (6 f. ovig., 1 im.), L6 (3 f.), L7 (5 im.), L9 (2 m., 3 f.), H1 (4 f.), H5 (1 im.), H9 (1 f.), H10 (2 f. ovig.).

57. *Oniscus asellus* L. Y6 (1 m., 1 f. ovig), Q4 (1 f. ovig.).

58. *Porcellio scaber* Latr. Y1a (5 ad.), Y6 (1 f. ovig.), Y9 (1 im.), S16 (1 f. ovig., 1 im.), Q4 (5 m., 7 f. ovig.), L6 (1 im.), H5 (1 im.), H9 (1 im.).

Subclass Eucarida

Order Decapoda

59. *Spirontocaris groenlandica* (Phipps). S18 (3 m.).

60. *Eualus pusiolus* Kroyer. Y8 (3 m., 1 f. ovig.), S1 (2 m., 6 f. ovig.), S3 (1 m.), S18 (4 m., 3 f.).

61. *Palaemonetes vulgaris* Say. Y6 (3 m., 9 f. ovig.).

62. *Crago septemspinosus* Say. Y7 (2 m.), Y8 (1 m., 1 f.), Y10 (1 m., 2 f. ovig., 4 im.), S1 (3 m.), S2 (4 m., 1 f.), S3 (1 m., 1 f.), S9 (1 m.), S14 (1 f., 1 im.), S18 (1 m., 1 f. ovig.), Q2b (2 m., 3 f. ovig.), Q5 (2 m.), L6 (1 f. ovig., 1 im.), L9 (1 m.), H9 (1 m., 2 f. ovig.), H10 (1 m., 3 im.). Observed in spray pool at Y1a.

63. *Pagurus acadianus* Benedict. S1 (3 ad.), L4 (1 m., 7 ad., 5 im.). Observed in shallow pools at LW at L9.

64. *Pagurus longicarpus* Say. Y8 (5 ad.), Y10 (5 ad.).

65. *Cancer irroratus* Say. Y3 (1 f.), Y7 (1 frag.), Y8 (2 f.), S18 (2 im.), Q5 (2 im.), L4 (1 f., 2 im.), H10 (1 im.). Observed at Y10, S1, S5, S9, L9, H1, and H9.

66. *Carcinides maenas* (L.). Y1a (2 m., 1 f.), Y7 (2 ad.), Y8 (1 m., 1 frag.). Not found at Y3, Y6, Y9, Y10, S1, S3, and S5 despite intensive search.

67. *Neopanope texana sayi* (S. I. Smith). Y10 (2 m., 1 f. ovig.).

Sub-phylum Insecta
Class Apterygota
Order Thysanura

68. *Petrobius maritimus* (L.). Y1a (6 ad.), Q4 (3 ad., 4 im.), L4 (1 im.).

Sub-Phylum Arachnida
Class Pantopoda
Family Phoxichilidiidae

69. *Phoxichilidium femoratum* (Rathke). S3 (1 f.), S18 (2 f.), L6 (1 m.).

Phylum Mollusca*
Class Gastropoda
Sub-Class Prosobranchia

1. *Puncturella noachina* L. S1 (1).
2. *Acmaea testudinalis* Muller. Y7 (1), Y10 (4), S1 (2), S4 (1), S18 (3), L1 (5), L6 (2), L9 (1), H9 (1); observed at Y1, S15, and L4. A common intertidal species on rocks, especially in surf-exposed localities.
3. *Margarites helicinus* Phipps. Y8 (1), S1 (3), S3 (2), S13 (5), S18 (1), Q5 (2), L4 (3), L1 (1). Common in algae near LW level, along with the following species.
4. *Lacuna vincta* (Turton). Y10 (2), S1 (3), S3 (5), S4 (4), S13 (6), S18 (5), L1 (11), L4 (6), L6 (10), L9 (4), H1 (1), H9 (9); noted as a beach shell at Y7 and Y8.
5. *Lacuna pallidula neritoidea* Gould. Y8 (2), L6 (1).
6. *Littorina littorea* L. Y1 (1), Y6 (1), Y7 (1), Y8 (2), Y10 (3), S1 (1), S3 (1), S4 (1), S13 (12), L1 (1), L9 (3), H9 (2); observed at S5, Q4, and L4. The edible periwinkle is a common interidal species of outer coast and estuary throughout the region.
7. *Littorina obtusata* L. Y1 (1), Y8 (1), S3 (1), S4 (3), Q5 (1), L1 (1), L7 (1).

*Nomenclature according to Abbott (1954)

8. *Littorina saxatilis* Olivi. Y1 (18), Y3 (1), Y6 (6), Y7 (2), S2 (8), S4 (1), S8 (6), Q2b (6), L7 (2), H9 (13), H10 (2); noted also at Q4. Very common along rocky shores near HW level, and in estuaries, among eel grass, in company with *Hydrobia minuta.*

9. *Cingula aculeus* (Gould). Y7 (2), Y8 (5), S13 (15), H1 (1).

10. *Hydrobia minuta* (Totten). Y6 (12), S2 (17), S8 (2), S13 (3), S18 (5), Q2b (1), H9 (20); observed in salt marsh pools at S7, S14.

11. *Turritellopsis acicula* Stimpson. S1 (1), S3 (6), S13 (1).

12. *Bittium alternatum* (Say). H9 (3).

13. *Skenea planorbis* (Fabr). Y7 (1), S13 (1), Q5 (1), L6 (1). A minute species of the infralittoral fringe on exposed coasts.

14. *Crepidula fornicata* Say. Y7 (1), Y9 (2), Y10 (6), S13 (1); observed at S5, L4.

15. *Crepidula plana* Say. Y10 (9).

16. *Velutina undata* Brown. S3 (1).

17. *Lunatia heros* (Say). L1 (2), S15 (1); noted on sandy shores at S5 and H9.

18. *Lunatia triseriata* (Say). Y7 (1), Y8 (1), S13 (3), S15 (1), Q2b (2), L6 (3), H10 (2), and also noted at Y10.

19. *Thais lapillus* L. Y3 (3), Y7 (4), Y10 (4), S8 (1), S13 (3), S15 (3), S18 (2), L6 (3), L7 (1), L1 (4), H10 (2), and observed as a beach shell at S5, L5, and H9. The dogwinkle is a common rock-dwelling species of exposed and semi-protected shores.

20. *Mitrella lunata* (Say). Y7 (1), Y8 (3), Y10 (1), L6 (6).

21. *Buccinum undatum* L. Y1 (1), Y7 (1), Y8 (2), S4 (1); noted as a beach shell at L4

22. *Colus stimpsoni* (Mörch). Observed on the beach at Y8.

23. *Neptunea decemcostata* (Say). S4 (1); noted on the beach at Y8, S5, and L4

24. *Nassarius trivittatus* (Say). Y7 (1), Y10 (3), S15 (2), L6 (9), L9 (1).

25. *Nassarius obsoletus* (Say). Y6 (13), Y10 (3); S8 (2), S13 (5); observed on tidal flats at Y4, S14, L1, and H10.

26. *Lora bicarinata* (Couthouyi). S3 (1).

27. *Admete couthouyi* (Jay). S15 (1).

Sub-Class Opisthobranchia

28. *Haminoea solitaria* (Say). H9 (4).

29. *Retusa canaliculata* (Say). S13 (12), L6 (9), H9 (1).

30. *Cylichna alba* (Brown). S3 (2). The only cold-water opisthobranch taken.

31. *Turbonilla interrupta* (Totten). Y7 (1), Y10 (3), L6 (2), S13 (4).

32. *Pyramidella fusca* (Adams). Y6 (3).

33. *Odostomia trifida* (Totten). S13 (5), L6 (1), H9 (9).

34. *Odostomia bisuturalis* (Say). Y6 (1), Y7 (2), S13 (10).

Sub-Class Pulmonata

35. *Melampus lineatus* (Say). Y6 (7), S13 (3), H9 (1).

Class Amphineura

36. *Ischnochiton ruber* L. Y8 (3), S18 (1).

Class Pelecypoda
Order Protobranchia

37. *Nucula delphinodonta* Mighels. S13 (1).

Order Filibranchia

38. *Volsella modiolus* (L). A moderately common beach shell, particularly along gravel bars. Observed at S9, L4.

39. *Volsella demissa* (Dillwyn). Y6 (10).

40. *Mytilus edulis* L. Y3 (2), Y6 (2), Y10 (½), S3 (1), S13 (1½), S15 (2-½), S18 (5); L4 (1), L9 (1), H1 (3), H9 (20+); noted along shore at virtually every marine station visited.

41. *Musculus discors* (L). Y7 (2½), S1 (½).

42. *Anomia aculeata* Gmelin. The typical or rough form was taken as follows: L9 (½), S15 (½); the smooth form (*ephippium*) at Y3 (2), S18 (1), and L1 (4).

Order Eulamellibranchia

43. *Astarte undata* Gould. Observed as a beach shell at S5.

44. *Arctica islandica* (L). S4 (1), S9 (6-½), S15 (5-½).

45. *Turtonia minuta* (Totten). Y7 (15+), S13 (½), Q5 (½), H1 (1).

46. *Cerastoderma pinnulatum* (Conrad). Y8 (3); S18 (1), L6 (1½).

47. *Pitar morrhuana* (Lindsley). S13 (1); also as a beach shell at L4.

48. *Gemma gemma* (Totten). S3 (1), S8 (8), S13 (11), H9 (1); a common salt-marsh and estuarine species.

49. *Petricola pholadiformis* Lamarck. L1 (1½), H9 (1).

50. *Tellina agilis* Stimpson. Y3 (1), Y7 (3½), Y8 (3), S13 (2), S18 (3), L6 (1), L9 (2), H10 (10).

51. *Macoma balthica* (L). Y6 (3), S8 (4), S13 (3); a beach shell at S14 and H9.

52. *Siliqua costata* (Say). S4 (4), S15 (3½); observed on the beach at Green Bay.

53. *Ensis directus* (Conrad). S15 (3); noted on sand at L4, H9.

54. *Spisula solidissima* (Dillwyn). S4 (1); also a beach shell at S9 and Q2a.

55. *Spisula polynyma* (Stimpson). Observed as a beach shell at S5 and L4.

56. *Mesodesma arctatum* (Conrad). S9 (2-½); noted on the beach at Q1 and Q2a.

57. *Hiatella arctica* (L). S15 (2+5-½), S18 (4), Q5 (1), H1 (1); observed at Y6.

58. *Mya arenaria* (L). Y6 (3), Y7 (½), Y10 (½), S3 (1); S8 (4+), S13 (4), L7 (1), S4 (½), and noted on the beach at nearly all other stations.

59. *Mya truncata* (L). S15 (4-½).

60. *Zirphaea crispata* (L). S9 (½); noted commonly on th beach at S3, S5, and L1.

61. *Lyonsia hyalina* (Conrad). Y7 (4), S3 (1), S13 (1), L6 (1).

62. *Pandora gouldiana* Dall. Y10 (4-½).

63. *Periploma leanum* (Conrad). L9 (½).

Zoogeographical and Ecological Considerations

The main features of intertidal ecology and faunal composition in the western Nova Scotia region have been outlined elsewhere by the writer (1956b). The present results serve to amplify the earlier findings based on twenty-six species of crustaceans collected in the Liverpool area in 1955. Littoral marine arthropods of the Halifax-Yarmouth region are essentially cold-temperate or boreal in composition. Those inhabiting high-salinity waters and the surf-swept outer beaches include *Amphiporeia virginiana*, *Marinogammarus* spp., *Chiridotea caeca*, *Oxyurostylis smithi*, *Dexamine thea*, *Cirolana polita*, and others that apparently do not withstand prolonged low winter temperatures (at and below 0°C.) nor tolerate shore ice action, and species such as *Gammarellus angulosus*, *Amphithoe rubricata*, *Corophium bonelli*, *Gammarus duebeni*, and *Phoxichilidium femoratum* that withstand more rigorous winter conditions and slightly lower summer temperatures. Eurythermal subarctic-boreal species such as *Balanus balanoides*, *Phoxocephalus holbolli*, *Ischyrocerus anguipes*, *Calliopius laeviusculus*, *Gammarus oceanicus*, *Jaera marina*, and *Crago septemspinosus* are very common along the shores, but more stenothermal subarctic forms such as *Pontogeneia inermis*, *Gammarus setosus*, *Gammarellus homari*, and *Caprella septentrionalis*, are much less common, scarce, or absent. The low-salinity and estuarine fauna is rich in mediterranean-boreal or warm-temperate forms that require moderately high minimum summer breeding temperatures (15-20°C.). Many of these (e.g. *Balanus improvisus*, *Gammarus mucronatus*, *Mysis stenolepis*, *Leptocheirus pinguis*, *Corophium insidiosum*, *Caprella acutifrons*, *Palaemonetes vulgaris* and *Neopanope texana sayi*) are winter-hardy species that range northward into the ice-bound Gulf of St. Lawrence, but conditions there are probably too rigorous for *Heteromysis formosa*, *Leptochelia rapax*, *Pagurus longicarpus* and *Carcinides maenas*, that reach their

northern limit in the Bay of Fundy region. Noteworthy is the apparent absence of cold-water estuarine forms such as *Mysis gaspensis*, *Pontoporeia affinis* and *Pseudalibrotus littoralis*. Semi-terrestrial and terrestrial marine halophiles, particularly *Orchestia gammarella*, *Oniscus asellus*, and *Petrobius maritimus*, are favoured by the relatively mild winters in this peninsular region of eastern Canada.

On the basis of suitable ecological conditions, faunal associates, and apparent absence of zoogeographical barriers to dispersal, other common littoral marine arthropods of the North Atlantic might be expected to occur in the western Nova Scotia region. Despite moderately intensive search in suitable habitats, these animals were not taken and are very probably not present. Most of them occur on the east coast of the United States; they include the spray-zone rock barnacle *Chthamalus fragilis* (north to Cape Cod), the estuarine ivory barnacle *Balanus eburneus* (to New Hampshire), the brackish-water talitrid amphipod *Hyale plumulosa* (to Cape Cod), the rock isopod *Ligia oceanica* (to southern Maine), the fiddler crab *Uca pugilator* (to Boston, Massachusetts), and the horse-shoe crab *Limulus polyphemus* (to northern Maine), among others. Also not found were the common European littoral marine amphipods *Gammarus locusta* and *Marinogammarus marinus*, recorded (probably erroneously) from the New England States by Holmes (1904) and others. Continued amelioration of the coastal marine climate may eventually result in the spread of some or all of these organisms to western Nova Scotia, as has apparently taken place during the past ten years in the green crab *Carcinides maenas* (see MacPhail, *et al*, 1955, Swan, 1956).

A number of littoral and sub-littoral species, usually taken by dredging, are here recorded within hip-boot reach of the shore line at low water. These include the sand-burrowing *Hippomedon serratus*, *Orchomenella* spp., *Tmetonyx nobilis*, *Ampelisca spinipes*, *Amphiporeia lawrenciana*, *Phoxocephalus holbolli*, *Cirolana polita*, *Chiridotea tuftsi*, and *Edotea montosa*, the free-swimming *Melita dentata*, *Podoceropsis nitida*, and *Spirontocaris groenlandica*, the algae-clinging *Aeginina longicornis* and *Phoxichilidium femoratum*, and the domicolous *Leptocheirus pinguis* and *Unciola irrorata*. These records reflect the year-round nutritive richness and thermal uni-

formity of inshore waters and the winter stability of shore-line substrata; these characteristics, in turn, are mainly attributable to strong tidal upwelling at the entrance to the Bay of Fundy.

In general the above zoogeographical considerations on the littoral marine arthropod fauna of the region are borne out by the present assemblage of shelled mollusks. The surf-swept outer beaches and semi-protected rocky shores are dominated by boreal marine forms such as *Margarites helicinus*, *Lacuna vincta*, *Littorina obtusata*, *Cingula aculeus*, *Skenea planorbis*, *Ischnochiton ruber*, *Anomia aculeata*, *Musculus discors* and *Volsella modiolus*. A characteristic bivalve shell of the outer sand beaches is *Siliqua costata*, accompanied by *Spisula solidissima* and *Ensis directus*, an occasional *Arctica islandica*, *Periploma leanum*, and *Zirphaea crispata*, and the gastropods *Lunatia heros* and *Nassarius trivittatus*. The presence of beach shells of sub-arctic forms such as *Spisula polynyma*, *Mesodesma arctatum*, and *Mya truncata*, indicates cold bottom water fairly close inshore. On the other hand, the warm-temperate and brackish-water molluscan fauna of protected bays and estuaries is surprisingly rich in species and includes the gastropods *Bittium alternatum*, *Crepidula* spp., *Mitrella lunata*, *Nassarius obsoletus*, *Haminoea solitaria*, *Retusa canaliculata*, *Turbonilla interrupta*, *Pyramidella fusca*, *Odostomia* spp., the semi-terrestrial *Melampus lineatus*, and the bivalves *Volsella demissa*, *Pitar morrhuana*, *Petricola pholadiformis*, *Tellina agilis*, *Lyonsia hyalina*, and *Pandora gouldiana*. All except *Lyonsia* find their northern limit in the southwestern part of the Gulf of St. Lawrence where surface summer temperatures reach 20°C. or better. The fact that these warm-water forms are almost precisely those species listed as new to western Nova Scotia is further indication of the paucity of previous shore collecting in this region. In recent times the American oyster, *Crassostrea virginica* (Gmelin), has been farmed with limited success in certain small estuaries of the region, especially in the Tusket and Pubnico areas. Both the oyster and the northern quahog, *Mercenaria mercenaria* (L)., are known from Indian shell heaps on Mahone Bay, Lunenburg County (Wintemberg, 1917), which could be interpreted as a sign of warmer marine conditions along these shores in pre-colonial times. Jones (1877) records "Venus mercenaria L." and also "Bittium nigrum St." as occurring along the whole coast, the former abundantly. Today, however, the quahog does not occur naturally in western Nova Scotia and the

alternate Bittium is restricted to certain isolated lagoons that are sufficiently warm in summer.

Live specimens of littoral and sub-littoral mollusk species taken close to shore include *Bora bicarinata*, *Admete couthouyi*, *Velutina undata*, *Turritellopsis acicula*, *Nucula delphinodonta*, and *Turtonia minuta*, among others.

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