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NOTES ON THE BOTTOM ENVIRONMENT OF THE MARINE INVERTEBRATES OF WESTERN NOVA SCOTIA.¹

BY E. M. KINDLE.

During the summer of 1914, a study of the relationship of the bottom materials to the composition of the faunas living upon them in the shallow coastal waters of western Nova Scotia was undertaken by the writer assisted by Mr. E. J. Whittaker. At the time the report^a on this work was written only the pelecypods and gasteropods collected during the progress of this work had been determined. The remainder of the fauna which was referred to Dr. Paul Bartsch of the U.S. Nat. Mus. for identification has since been studied by Dr. Bartsch and other specialists. The resulting list of species includes at least one species,—*Libinia emarginata* Leach,—not previously known in Nova Scotian waters. The following list which I am able to prepare through the courtesy of Dr. Bartsch is offered as a minor contribution to our knowledge of the bathymetric range and the bottom environment of the several species which were collected. For the sake of completeness the present list is made to include the pelecypoda and gasteropoda which were listed in the writer's earlier paper.^b

The character of the bottom at each collection station is indicated in the following list of stations.

COLLECTING STATIONS.

- Sta. No. 1. Digby, N.S., Intertidal zone, boulder strewn beach.
2. Digby, N.S., 300 to 400 yards east of Government pier in 2 fathoms. Soft black mud bottom.
3. Digby, N.S., 3 to 4 miles N.E. of Digby, Outer margin and inside of bar running S.W. from Bear Island; in 3 to 6 fathoms. Collection nearly all from muddy sand.

1. Published with the permission of the Director of the Geological Survey of Canada.

a. E. M. Kindle, Bottom control of Marine faunas as illustrated by dredging in the Bay of Fundy. Am. Jour. Sci. vol. XLI, 1916, pp. 449-461.

b. Ibid.

FAUNAL LIST	Boulders and sand. Intertidal zone.	Black mud.	Sandy mud.	Boulders & gravel, Intertidal zone.	Sand, gravel & mud Intertidal zone.	Gravel.	Sandy mud.	Gravel and rock. Intertidal zone.	Mud and sand, Intertidal zone.	Rocky and sandy bottom.
	1	2	3	4	5	6	7	8	9	10
MOLLUSCOIDEA.										
<i>Alcyonidium mytili</i> Dalyell			x							
<i>Cribrilina punctata</i> (Haasall)						x				x
<i>Membranipora monostachys</i> (Busk.)						x				x
<i>Membranipora flemingii</i> (Busk)						x				x
<i>Mucronella peachii</i> (Johnston)						x				x
<i>Schizoporella biaperta</i> (Michlin)						x				
PELECYPODA.										
<i>Anomia simplex</i> Orb.										x
<i>Astarte crenata</i> Gray						x				x
<i>Astarte undata</i> Gld.			x			x			x	x
<i>Callocardia morrhuana</i> Linsley						x	x		x	
<i>Cardium pinnulatum</i> Conr.		x	x							
<i>Cliidophora gouldiana</i> Dall.			x			x				
<i>Cyprina islandica</i> L.			x							
<i>Cytherea convexa</i> Say—(<i>Callo-</i> <i>cardia morrhuana</i> Linsley)					x					
<i>Ensis americana</i> Gould					x		x		x	
<i>Epitonium groenlandicum</i> Perry			x							
<i>Lyonsia hyalina</i> Conr.		x								
<i>Macoma balthica</i> L.							x		x	x
<i>Macoma balthica fusca</i> Say					x					
<i>Macoma calcarea</i> Gm.			x							
<i>Macoma</i> sp.			x							
<i>Mactra solidissima</i> Dillwyn (<i>Spisula solidissima</i>)									x	
<i>Modiolaria discors</i> L.										x
<i>Modiolaria nigra</i> Gray									x	
<i>Modiolus fragm.</i>						x				
<i>Modiolus modiolus</i> L.					x	x			x	x
<i>Modiolus plicatula</i> Lam. (M. <i>demissus</i> Dillw.)					x					
<i>Mya arenaria</i> L.	x			x	x	x	x	x	x	x
<i>Mytilus edulis</i> L.	x				x	x		x	x	x

FAUNAL LIST	Boulders and sand. Intertidal zone.	Black mud.	Sandy mud.	Boulders & gravel. Intertidal zone.	Sand, gravel & mud. Intertidal zone.	Gravel.	Sandy mud.	Gravel and rock. Intertidal zone.	Mud and sand. Intertidal zone.	Rocky and sandy bottom.
	1	2	3	4	5	6	7	8	9	10
<i>Nucula proxima</i> Say		x	x							
<i>Pecten magellanicus</i> Gm.						x				
<i>Periploma fragilis</i> Totten			x							
<i>Petricola pholadiformis</i> Lam.						x	x		x	x
<i>Saxicava arctica</i> L. (<i>S. rugosa</i>)			x							
<i>Thyasira obesa</i> Ver.		x	x							
<i>Venericardia borealis</i> Conr.						x			x	
<i>Yoldia limatula</i> Say		x	x							
GASTROPODA.										
<i>Acmaea testudinalis</i> L.	x			x						
<i>Aporrhais occidentalis</i> Beck.			x							
<i>Bela nobilis</i> Moll			x							
<i>Buccinum undatum</i> L.	x		x	x		x		x		x
<i>Chrysodomus decemcostatus</i> Say			x							
<i>Crepidula fornicata</i> L.						x		x	x	x
<i>Crepidula plana</i> Say						x		x	x	x
<i>Crucibulum striatum</i> Say						x				
<i>Cylichna alba</i> Brown		x	x							
<i>Ilyanassa obsoleta</i> Say					x	x	x	x	x	x
<i>Lacuna vincta</i> Turton		x	x							
<i>Littorina litorea</i> L.	x	x	x	x	x	x	x	x	x	x
<i>Littorina palliata</i> Say	x				x				x	
<i>Lunatia heros</i> Say		x	x		x			x		x
<i>Lunatia triseriata</i> Say	x		x		x			x		
<i>Melampus lineatus</i> Say					x					
<i>Thais lapillus</i> L.	x		x		x	x		x	x	x
<i>Tritonofusus stimpsoni</i> lirulatus Verr.			x							
<i>Tritia trivittata</i> Say	x	x	x		x	x			x	x
<i>Urosalpinx cinereus</i> Say										x
ECHINODERMATA.										
<i>Asterias vulgaris</i> Stimpson 15 specimens						x				
<i>Echinarachnius parma</i> (Lamarck) 6 specimens			x							

FAUNAL LIST

	Boulders and sand, Intertidal zone.	Black mud.	Sandy mud.	Boulders & gravel, Intertidal zone.	Sand, gravel & mud, Intertidal zone.	Gravel.	Sandy mud.	Gravel and rock, Intertidal zone.	Mud and sand, Intertidal zone.	Rocky and sandy bottom.
	1	2	3	4	5	6	7	8	9	10
<i>Henricia sanguinolenta</i> (O. F. Muller) 12 specimens						x				
<i>Strongylocentrotus drobachiensis</i> (O. F. Muller) 1 specimen			x							
CRUSTACEA.										
<i>Cancer irroratus</i> Say		x	x			x				x
<i>Hyas coarctatus</i> Leach										x
<i>Leptocheirus pinguis</i> (Stimpson)			x							
<i>Libinia emarginata</i> Leach (new to N. S.) 1 specimen										x
<i>Pagurus acadianus</i> Benedict 41 specimens		x	x							
<i>Pagurus longicarpus</i> Say, 6 specimens shells encrusted with <i>Hydractinia echinata</i> (Fleming)						x				x
<i>Pagurus pubescens</i> Kroyer 2 specimens			x							
CHORDATA.										
<i>Boltenia ovifera</i> (L.) 1 specimen Bay of Fundy; collected by fishermen in deep water off Digby										

BOTTOM ENVIRONMENT.

Analysis of the data given in the preceding table will show that different types of sea bottom are occupied by assemblages of animals which are almost as sharply contrasted in composition as are the land faunas of deserts and swamps. On land some plants can live only on wet marshy ground; other groups require dry uplands, and some flourish only on rocky slopes; while over great areas which support a rich flora trees cannot exist. The groupings of land animals is controlled in the same way directly by the character of the soil and indirectly by the plant life which itself is almost wholly influenced by surface

physical features. Thus the frog, salamander and turtle which dominate the animal life of the marshes give way entirely to other types on the uplands.

The influence of this familiar and powerful factor,—the character of the soil or rock,—in determining the major features of land biotas, is paralleled by the control which the physical character of the bottom exercises over marine biotas. When marine dredging is conducted with the object of ascertaining the relationship of the various kinds of bottom to the kinds of life living on them, as most of the writer's have been, the association of certain faunal with certain bottom facies becomes clearly apparent. The control exercised by the physical character of the bottom in bringing together certain groups of animals and plants into marine communities and in excluding others is just as effective as is the operation of the physical character of the land surface in producing varied faunal and floral groups.

The distribution of the sponges is one of the interesting features brought out in collecting the fauna listed above. These were found in such abundance on the coarse rocky bottom at the mouth of the Avon river and on the hard muddy sand bottom off Kingsport as to completely fill the dredge in some hauls. On soft mud bottom however, not a single sponge was taken. The molluscoidea also show a strong affinity for hard bottom, five species being taken on gravel and rocky bottom, one on firm muddy sand bottom, and not a single species on soft bottom. The four species of echinoderms taken were all found either on gravel or the comparatively firm sandy mud bottom. The preference of the crustacea for hard or firm bottom is also evident. The seven species listed were all taken either on gravel, rocky, or sandy mud bottom, and but two of them on soft bottom. Only two specimens of *P. acadianus* were taken on soft mud bottom and 39 specimens were taken on the sandy mud bottom.

The fauna of the soft mud bottom shown by the list includes thirteen species which are confined to the four groups, vermes, pelecypods, and gasteropods and crustacea. Two of the species were not found outside the limits of the soft mud. The specialized character of the black mud fauna is apparent from the fact that it contains no representatives of the *Porifera*, *Molluscoidea* nor *Echinodermata*. The mud bottom in developing its soft bottom facies draws from but four of the eight phyla which are abundantly represented in the region.

When you are in or near the forest this summer, never leave your camp fire until it is absolutely OUT. Never throw away lighted matches or tobacco or pipe ashes. These rules are followed by all veteran sportsmen and good citizens.

MY BIRD HOUSES.

BY CLYDE L. PATCH.

As it will soon be time to construct bird houses, which should be in place a couple of weeks before the feathered tenants arrive, thus giving the newness time to wear off, an account of my last summer's experience may assist and encourage other members of the O. F. N. Club.

Until last spring I had supposed that a martin house was usually in place two or three years before the birds discovered it, or at any rate would nest in it; also, that the person owning the house was particularly lucky, and thirdly that the house must be situated in a large open yard.

Having been requested to furnish bird house plans for manual training work, I built an experimental martin house, with twelve compartments measuring 6 in. x 6 in. x 6 in., each having an entrance 2 in. in diameter the bottom edge of which is 2 in. above the floor. Across the outside of the house and 2 in. below the entrance holes is a 3 in. platform, which forms a landing stage for the parent birds and a play ground for the young when they first venture out.

So, having constructed the house I, one evening, with the assistance of a neighbor, erected it on a twenty foot pole in my sixteen by twenty back yard in the Glebe, (Ottawa) expressing the hope that if the wind didn't blow it down I might get tenants by 1920. Three days later Mrs. Patch informed me that house seekers had been about during the morning, and upon looking out I saw a pair of those beautiful opals of the air, commonly called tree swallows, exploring my apartment house. A few days later they began carrying sticks and straws from all over the neighborhood and alighting promiscuously on the landing platform running under the three top holes, followed their noses straight into the nearest hole, thus building three nests. Seeing that this would never lead to a happy family, I constructed a box 6 in. x 6 in. x 15 in. deep with a landing platform under the 1½ in. entrance hole and the overhanging eave of the sloping roof above it. A day or so after placing this house on a near-by fifteen foot pole, the swallows examined it and after driving off another pair of persistent house-seekers, they abandoned the three nests in the martin house and began house furnishing in the new home. Following a few days of busy stick carrying the feather lining was added, and thereafter for the next two weeks Lady Swallow was seen only a short time each day when she trusted the four transparent and later delicate rose-coloured eggs to the care of Mr. Swallow and fed in the immediate neighborhood.

Then one day to my great delight a martin lit on the martin house, remaining a short time and returning next day with a mate. This pair

shortly began nest building in one of the apartments under the eave of the roof. Before the nest was completed another pair had taken an apartment under the eave on the opposite side of the house, which convinces me that eaves are desirable, therefore I intend to put hoods or some sort of protection above all the entrance holes.

Before the martin nests were complete a pair of wrens put in an appearance, clinging to the martin house hole and at every opportunity alighting on the house and peering in. The martins were very much annoyed and made ferocious swoops at the wrens, who darted, almost faster than the human eye could follow, behind the board fence.

I immediately built a box 5 in. x 5 in. x 12 in. deep with an entrance slightly larger than a silver quarter, under the entrance a landing platform and above it the overhanging eave of the sloping roof. This box was placed on a pole about five feet below the martin house. In half an hour the wrens were happily singing as they built their nest.

I wonder if all wrens are as intelligent as mine! A twig four or five inches long was frequently brought to the platform and one end shoved through the entrance hole, then the wren passed in drawing the twig with him. The martins, with the same length twig grasped in the centre, would attempt to pass straight through their two-inch entrance hole. If after several strenuous efforts the twig or straw did not break or bend it was dropped to the ground. Consequently the martins' nests were made chiefly of short or bendable material, while the wrens' nest were of surprisingly heavy twigs.

The swallows kept to their own premises, but not infrequently the curiosity of one of the martins—probably a female—necessitated a visit to the swallow home, where alighting on the front porch and putting her head through the entrance she was apparently given a peck in the face, as her head would be quickly withdrawn in time to see father swallow swooping down from a nearby telephone wire. Then both birds would rise in the air and for half a minute or so face each other apparently sitting on their tails and, with fluttering wings, say unprintable things; then the martin would fly home and the swallow back to his wire.

When the babies arrived the parent swallows were constantly busy capturing flying insects, while the parent wrens hunted the flower beds and bushes for hairless caterpillars.

The tree swallows were quiet birds and at no time did I see the young, although I frequently heard them in their nest box. Evidently they do not return to their nesting site after once leaving it. The martins were quite different, adhering to the old saying "the more the merrier," as the frequent appearance of visitors from Wellington Street eaves or bird houses in Ottawa South was the signal for a great chattering, melodious martin calls and circling in the air, and the

entrance to their home was nearly always filled with expectant baby mouths and later the youngsters ventured out onto the platform and when able to fly they, for two or three weeks, returned every night; then their visits became less frequent until one day, accompanied by some friends, there being twenty-three birds in all, they bade the old homestead a noisy farewell.

The young wrens remained in the neighborhood a week or so and the adults were often heard singing until late fall.

My two male martins had the white and gray plumage similar to that of the female. This spring I hope to see them in their black-purple-sheened plumage which is probably acquired in their second year.

BIRDS OBSERVED AT GRANDE PRAIRIE CITY, PEACE RIVER DISTRICT.

BY FRANK L. FARLEY, CAMROSE, ALTA.

I spent four days from June 30 to July 3, 1916, in and around Grande Prairie City, and noted the birds mentioned below. This town is the centre of the far famed district of the same name, and is about sixty miles due south of the old post, Dunvegan, on the Peace River and is, roughly, 250 miles northwest of Edmonton. The town is only a year or so old, and is now as large as some of the towns in the older settled portions of the Province. It is situated on Bear Creek, a small stream which flows into the Wapita, a few miles to the south. The country is mostly prairie, with scattered bluffs of poplar and willow, and rolls slightly. The grasses and shrubs are very similar to those around Edmonton. To the east of this prairie country the railway passes through one hundred miles of large poplar, some of which is twenty inches in diameter. This is surely the great summer home of the White-throated Sparrow and the Junco. There were more White-throats noticed than all other birds combined. I counted a dozen singing in the valley of the Smoky River, all within three hundred yards of the train. They were particularly very plentiful throughout this territory. On the prairie, the Vesper Sparrow was by far the most abundant bird. I was surprised to find the English Sparrow quite at home in the town, there being at least a hundred feeding around the elevators and warehouses. They of course, used their regular way of travel—the freight car. The list is given in the order that the birds were observed.

Junco; very common.

White-throated Sparrow; very common.

Clay-colored Sparrow; fairly common.

Crow; 50 seen.
 Red-eyed Vireo; common.
 Yellow Warbler; common.
 Wood Pewee; 10 heard.
 English Sparrow; 100 seen.
 Lincoln's Sparrow; fairly common.
 Robin; 25 seen.
 Yellow-shafted Flicker; common.
 Least Flycatcher; common.
 Savanna Sparrow; common.
 Red-winged Blackbird; a few seen.
 Leconte Sparrow; not common.
 Tree Swallow; fairly common.
 Spotted Sandpiper; few seen on creek.
 Mallard; one pair seen.
 Vesper Sparrow; very common on prairie.
 House Wren; fairly common.
 Fox Sparrow; about 25 heard.
 Brewer's Blackbird; a few seen.
 Trail's Flycatcher; not common.
 Warbling Vireo; common.
 Wilson's Thrush; a few heard in bluffs.
 Night Hawk; one heard.
 Cliff Swallow; common, nesting on the cliffs.
 Bank Swallow; common.
 Cow Bird; not common.
 Pewee; a few seen.
 Tennessee Warbler; heard several.
 Golden-eyed Duck; one seen.
 Red Start; one heard.
 Sparrow Hawk; not common.
 Song Sparrow; rare.

ARE OUR FORESTS VANISHING?*

Belgium, the most intensively cultivated country of Europe, with 652 inhabitants to the square mile, had, before the war, over eighteen per cent. of its area in permanent forest. Ontario, with some ten inhabitants to the square mile, has about five per cent. of its area in permanent forest. Similarly France, with 190 people to the square mile, has nearly one-fifth of its area in forest; Switzerland, with 235 persons to the square mile, has 23 per cent. in forest; Sweden is nearly

*Extracts from Address by Mr. R. H. Campbell, Director of Forestry, before O.F.N.C., January 9, 1917.

one-half forest and Germany and Austria, respectively, one-quarter and one-third of their area in forest. The above seems sufficient reply to those who argue that the making of forest reserves will hinder the development of Canada.

The wood manufactures of this Dominion have a total yearly value of \$177,000,000. In respect to capital invested, wages paid and cost of material they take first place, and the value of the product is one of the highest among the industries. Wood industries employ 110,000 employees, as compared with 66,000 for iron and steel, their nearest competitor.

In the present war wood is playing a great part. In the trenches it is used for walls, floors and braces. Behind the lines it is used for temporary buildings for the use of combatants and homeless non-combatants. For bridges, wharves and similar structures much is used and for replacing permanent structures destroyed by enemies it is indispensable. Wood cellulose is used for making a substitute for cotton for bandages, etc., crepe paper for slings and fibre board for splints. Paper clothing is worn to quite an extent in the Russian, Austrian and German armies, and in Austria paper is displacing many other textile products—from flour bags to twine. The chief products of the forest, in Canada, are lumber, wood for pulp, poles and railway ties.

In order to give the forest a chance to develop properly, it is necessary to ward off many injurious factors. Chief of these is fire. The average annual loss through forest fires in Canada is five million dollars, and it is estimated that two-thirds of Canada's forests have been burned over. Only seventeen per cent. of the forest area explored in the prairie provinces had been found to contain merchantable timber. The most important by far of the means of fire protection was the education of the inhabitants and frequenters of forest regions to guard against fire. After that, fire patrol, lookout stations, trails and various fire-fighting appliances had their places.

The forest must also be protected against insects and fungi. In British Columbia serious damage had been done to the western yellow pine by a bark-boring beetle. Poplar on Dominion lands had been much injured by a species of fungus, the chestnut in the United States had been almost exterminated by the chestnut tree blight, and a like fate was threatening the white pine of the east. The White Pine Blister Rust had obtained such a footing that much of the adult timber was threatened, and the planting of white pine put out of the question.

Improvements in forestry practice in the work of the Forestry Branch had been the marking of trees for removal, the disposal of brush after cutting and the study of natural regeneration and the natural mixture of species in the forest. The Forest Products Labora-

ories had also been established for the study of questions regarding the composition and characteristics of timber and the adapting of them to various uses.

F. W. H. J.

NOTES.

The Ottawa Humane Society held an exhibition during March at the Carnegie Library of over a thousand bird houses made by school children. Prizes were given to the exhibitor having the largest number of houses and the one exhibiting the best bird house. Several hundred bird houses were entered. There were many kinds, from little wren cottages of one room to large martin apartment houses big enough for twenty families. The houses were offered for sale and the proceeds, over \$75.00, were given to the Red Cross. The boys of forty years ago robbed birds' nests, sometimes to make egg collections. Such exhibitions and competitions as this will do much not only to cure boys of robbing nests and to replace the collecting of eggs by the more valuable observation and study of birds, but also to attract and increase a bird population of great value to our food supply. The efforts of the Ottawa Field-Naturalists' Club, which resulted in placing bird houses at the Experimental Farm and in Rockcliffe Park, doubtless had an influence towards this present interest in bird conservation.

The reclamation of swamps is one of the most important problems of the present time. Many of the best lands are still in swamp form, and the sanitation produced if this land were reclaimed would more than pay for the work necessary, by the increased healthfulness of the country. The draining of the swamps is one of the best means of destroying the breeding places of the mosquito, and the extermination of the mosquito is one of the great issues of the day. It was this extermination that made the Panama Canal possible, and has rendered Havana a justly favored health resort.

Miss M. Young of the Mines Branch recently gave a demonstration of pottery making in relation to Mr. J. Keele's work on Canadian clays at the Red Cross meeting of the Women's Branch of the Civil Service, Ottawa. Miss Young has been using designs from prehistoric Canadian Indian pottery in the Museum of the Geological Survey, to develop art pottery distinct from that of the old world or the orient and appropriately Canadian. Some of the best English ware had its birth in the private studio. There is an open field here in Canada for the commercially interested and for the lover of beauty.

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