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### TITLE

Bottom fauna of Saint John Harbour and estuary as surveyed  
in 1959 and 1961. Detailed record  
of identifications and other data.

### AUTHORSHIP

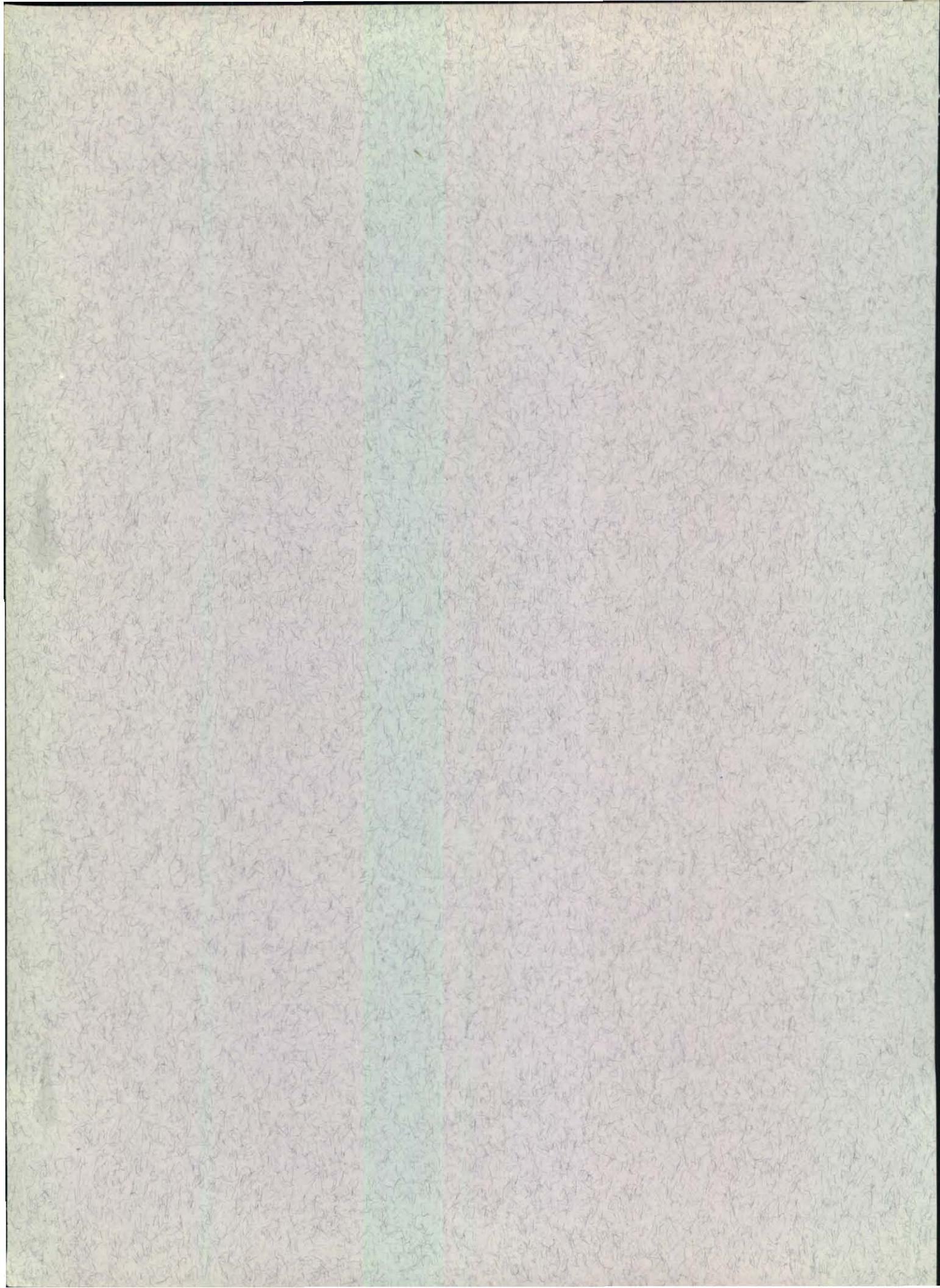
Delphine C. Maclellan and J.B. Sprague

### Establishment

Biological Station  
St. Andrews, N.B.

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## INTRODUCTION

The purpose of this report is to give a detailed record of the data obtained in two surveys of bottom fauna in the harbour and estuary at Saint John, N.B. There has been no attempt to summarize or interpret results. Subsequent reports or papers will give general accounts of findings and conclusions, without repeating the voluminous background of data given here. This report then, makes available the raw data for inspection of those specialists who may at some time in the future be particularly interested in the precise details of these bottom fauna surveys.

The senior author carried out all the identification and weighing of animals, with one or two minor exceptions. This was, of course, by far the biggest portion of the work represented in this report. The junior author was responsible for planning the surveys and collecting the samples.

The original purpose of these two surveys was to see whether there were changes caused by pollution from an oil refinery. The Irving Oil Refinery in East Saint John releases most of its chemical wastes into Saint John Harbour through a pipeline terminating near the tip of Courtenay Bay breakwater (near station X, Figure 1). The refinery started up in stages from late March to mid-June 1960 by which time it was in full operation.

The 1959 survey was carried out about four months before any waste was produced by the refinery, and thus serves as a base-line for detecting changes. The 1961 survey, following full-scale operation of the refinery for sixteen months, was the follow-up.

Sampling stations in the lower part of the estuary were included, with a view to assessing effects of pulp and paper mill waste released at the Reversing Falls.

The results represent a reasonably comprehensive survey of bottom fauna in the waters near Saint John. The 1959 or 1961 surveys, or both, will serve as base-lines in future pollution surveys, whether related to the oil refinery or to some other source of pollution.

#### ACKNOWLEDGMENTS

Almost all the sampling was done from the M.V. Mallotus, and we wish to thank William G. Carson, skipper of the vessel at that time, and his assistant Floyd R. Johnson. We also thank Gordon F. Wentworth for assistance in obtaining the samples.

For verifying identification of several of the polychaetes, we wish to thank Dr. Marian H. Pettibone, of the Smithsonian Institution. For verifying identification of amphipods, we thank Dr. Don H. Steele of Memorial University, St. John's, Newfoundland.

#### SAMPLING AND COLLECTING METHODS

##### Stations

The general location of stations is shown in Figure 1. There were 11 stations in Saint John Harbour. Stations I to VI form a line from the inner harbour out the main channel to the open bay opposite Black Point. Stations VII and VIII were located to the west of this line in the outer harbour. Stations IX, X, and XI were to the east, in Courtenay Bay.

There were four stations in the estuary of the Saint John River, above the Reversing Falls. These stations were numbered according to miles of river channel, starting far upstream where the river enters New Brunswick. Station 280.3 was upstream of Grand Bay, near Brandy Point. The station called "Kennebecasis Mouth" is described by its name, although this part of the river is a large bay. Station 284.8 is at the upper end of the gorge of the Saint John River, at the edge of Grand Bay. Station 287.7 was in the deep water just above the Reversing Falls.

Reference points which may be used to locate these stations exactly are given in Table XI.

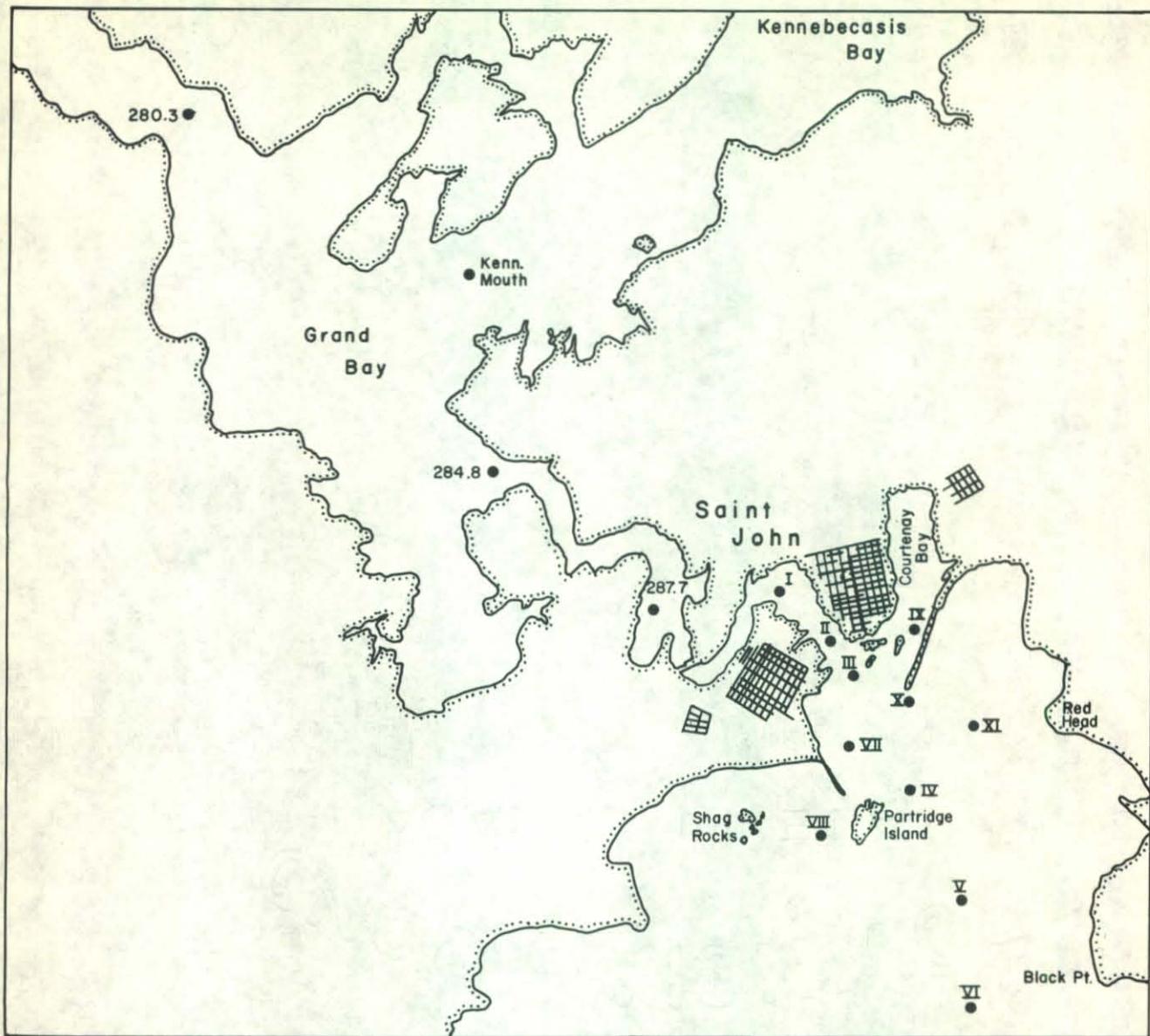


Fig. 1. General locations of stations used in biological surveys of the Saint John river estuary and Saint John harbour, in 1959 and 1961

The 1959 survey was carried out from October 30 to December 4, but most samples were collected from November 30 to December 4. The 1961 survey was collected in about the same season, October 24 to October 26. Exact dates of each station are given in Tables XII and XIII.

The vessel was not anchored for sampling, but was held on station by cruising against the current at whatever speed was necessary, with constant checking of reference points and checking to keep the wire of the sampler vertical.

A van Veen sampler was used, with a nominal sampling area of 0.1 sq. metres. This grab sampler was manufactured by Laboratoire Océanographique, Charlottenlund, Denmark. It is described and evaluated by Holmes (1964) and Lie and Pamatmat (1965). The sampler was operated on the usual hydrographic wire and davit, using a small gasoline-powered winch.

Three samples were collected at each station. Very good samples were obtained in muddy or soft bottoms. The sampler was usually nearly full, the layers of sediment were apparently little disturbed, and could be inspected if the sampler were opened carefully. In sandy bottom less material was obtained, the sampler usually being one-fifth to one-half full. However, it is assumed that this merely represented a shallower bite, with 0.1 sq. m. of surface material collected and representing an adequate sample.

Two stations, I and 287.7, seemed to have a bottom composed mostly of rocks, gravel, or woody detritus, and the adequacy of samples is uncertain. These materials were obtained in the sampler, but seldom occupied a very large proportion of the sampler's volume. Judgement was exercised in these cases, and the sample was accepted if it seemed to be a reasonable approximation of what might cover 0.1 sq. m. of bottom. Obviously poor samples which contained only a few pieces of material were discarded and another attempt made.

Samples were also discarded if something was jammed between the jaws of the sampler so that they did not close. This happened at various stations from time to time.

Each sample was emptied into a galvanized wash-tub and the inside of the sampler was thoroughly washed into the tub.

The sample was then rinsed through a series of three screens, the finest having 7.9 openings per cm. (20.1 per inch) and apparent size of openings of 0.87 mm. A hose delivering sea water at very low velocity was used to rinse the fine sediments to waste through the three screens. The material remaining on the screen was inspected carefully and all organisms were collected. Often the entire contents of the screens were rinsed into a sample bottle and final separation of the organisms was done in the laboratory. This procedure was followed in the 1961 survey and all empty mollusc shells were also preserved.

Samples were preserved in 70% alcohol and were changed to fresh 70% alcohol a few days later.

#### Bottom Materials

During the rinsing and screening process the percentage composition by volume of the various materials in the bottom sample was estimated and recorded. The sizes used to classify "rocks" and "gravel" are given in footnotes to Tables XII and XIII. Smaller particles were classified as "granules", "sand", "silt", or "clay" according to the common application of these terms. No measurements of particle size were made. These constituents were classified by appearance, feel, and ease of rinsing through the three sizes of screens. The estimates of percentage composition by volume were also aided by noting the separation of components as they were rinsed through the screens.

#### IDENTIFICATION METHODS

This phase of the work was carried out by the senior author. A few individuals of the amphipod family Caprellidae and the isopod Cyathura polita in some estuarial samples were identified by the junior author.

Taxonomy

Identifications were made with the aid of a Zeiss binocular microscope (magnification 10X) or the low-power objective of an Olympus compound microscope. Taxonomic publications consulted are given in the list of References. Difficulties were encountered in identification to species of certain polychaetes, since many were in juvenile stages or were fragmented.

The identification of the following polychaetes was verified by Dr. M. Pettibone, of the Smithsonian Institution:

<u>Family</u>	<u>Species</u>
Paraonidae	<u>Paraonis gracilis</u> (Tauber)
Cossuridae	<u>Cossura</u> sp. (2 anterior ends - specimens not complete)
Orbiniidae	<u>Scoloplos acutus</u> (Verrill)
Paraonidae	<u>Aricidea suecica</u> Eliason
Spionidae	<u>Polydora</u> sp. (specimens not complete)
Terebellidae	<u>Terebellides stroemi</u> Sars

Amphipods identified by Dr. D. Steele, Memorial University, Newfoundland were:

Gammaridae	<u>Gammarus oceanicus</u>
Ampeliscidae	Species 1
"	Species 2
Lysianassidae	<u>Hippomedon</u> sp.
Photidae	<u>Leptocheirus</u> sp.
Corophiidae	<u>Unciola</u> sp.
Phoxocephalidae	species

A reference collection, made up of suitably labelled representatives of the various kinds of animals found in this study, is available for observation and is presently stored with the Pollution Investigation, Fisheries Research Board of Canada, Biological Station, St. Andrews, N.B.

### Numbers and Weights

The animals were counted individually and numbers recorded for each kind in each sample. In the case of fragmented specimens, the number of heads was taken to be the total number of animals. To weigh animals, they were lifted from the alcohol, deposited for a second on a paper towel to blot the excess liquid, placed on a previously weighed watch glass and immediately weighed while wet. A Mettler balance of capacity 80 grams was used for weighing the smallest animals, and allowed weighing to the nearest 0.1 mg. A larger balance was used for larger animals, especially bivalves. The balance was adjusted between each weighing.

Usually the weight was determined for all individuals of a given species. When very small weights were involved, two or more kinds of animals were weighed together. The total weight was credited to the kind of animal which made up the most weight in the mixed group. Animals which were present but have no weight listed in Tables V to VIII were of negligible weight taken separately, although their weight is included in that given for a nearby taxonomic group.

Empty shells were excluded from tabulations.

The percentage of dry organic matter as compared with the rough alcohol weight was determined by using the following conversion factors:

polychaetes	14%
prosobranchs	6.6%
lamellibranchs	5.4%
crustaceans	4.06%

These were taken from Jensen, in Petersen (1911) and Molander (1928a) as given in Thorson (1957), Table 2, p. 495. Final figures for weights are given in mgms. per 0.1 sq. metre.

## RESULTS

The tabulations of kinds, numbers, and weights of animals are given in Tables I to IX. Although three samples were taken at each location, some of them subsequently dried up during storage and could not be analyzed. This explains six missing samples at four stations in the 1961 survey.

The final screen used for rinsing samples was 7.9 meshes/cm. (20.1 /inch). In tests of efficiency of such a screen, Reish (1959) found that it retained 95% or more of the biomass, 93% of the species, and 60% of the individuals which were actually contained in a series of samples. Most of the 40% of individuals which passed through the screen were small nematodes or polychaetes of the Genus Cossura. Reish was working on the coast of California, but it seems likely that our sampling and sorting can be considered effective for all but the very small invertebrates. The hole size of 0.87 mm. which was used in our screen apparently retains species much better than a screen with holes of 1.5 mm. diameter (12 mesh to the inch) commonly used in marine benthic surveys.

Bottom materials and other physical data obtained at the time of sampling are given in Tables XII and XIII. Table X lists the kinds and numbers of empty mollusc shells found in the 1961 samples. These shells are one kind of detritus, but the kinds represented at various places may prove to be of interest.

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Table I. Numbers of animals collected in the 1959 survey of Saint John Harbour. Sampling stations are listed across the top in Roman numbers. Usually there were three samples, A, B, and C, at each station, each representing the contents of one sample with a 0.1 sq. m. Van Veen grab. Kinds of animals are listed down the left hand side, the numbers corresponding to those in the species list, Table IX.

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	
	A	B	C	A	B	C	A	B	C	A	B	C
1												
2												
3	70	1	3	4	5	2	1	8	1	9	9	4
4												
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37	104	2	1	1	2	1	1	3	4	3	5	4
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40	44	6	28	75	55	216	12	20	7	1		
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49	4											
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59												
60	104	4	6	22	3	4	1	1	2	23	2	15
61	8											
62												
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336	12	48	103	298	233	22	27	11	18	12	10	175
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360	104	4	6	22	3	4	1	1	2	23	2	15
361	8											
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Table II. Numbers of animals collected in the 1961 survey of Saint John Harbour.  
Arranged as in previous table.

I	II	III	IV	V	VI	VII	VIII	IX	X	XI
A	B	C	A	B	C	A	B	C	A	B
1	2			2	4	1			1	1
3	4	5	1	2	2	2	1		1	1
6	7	8	3	1	13	18	30	1	1	1
9	10	11	12	13	1	4	7	7	10	14
14	15	16	17	18	19	29	6	2	1	1
20	21	22	23	24	25	4	12	15	1	1
26	27	28	29	30	31	6	7	6	1	1
32	33	34	35	36	37	1	4	15	7	2
38	39	40	41	42	43	2	159	730	1100	520
44	45	46	47	48	49	15	582	2	1	4
50	51	52	53	54	55	20	78	122	96	1
56	57	58	59	60	61	1	1	2	5	1
62	63	64	65	66	67	1146	1	3	1	1
68	69	70	71	72	73	19	1895	843	1259	660
74	75	76	77	78	79	25	19	1895	843	1259
80	81	82	83	84	85	279	1162	1571	1571	1571
86	87	88	89	90	91	279	1162	1571	1571	1571
92	93	94	95	96	97	279	1162	1571	1571	1571
98	99	100	101	102	103	279	1162	1571	1571	1571
104	105	106	107	108	109	279	1162	1571	1571	1571
110	111	112	113	114	115	279	1162	1571	1571	1571
116	117	118	119	120	121	279	1162	1571	1571	1571
122	123	124	125	126	127	279	1162	1571	1571	1571
128	129	130	131	132	133	279	1162	1571	1571	1571
134	135	136	137	138	139	279	1162	1571	1571	1571
140	141	142	143	144	145	279	1162	1571	1571	1571
146	147	148	149	150	151	279	1162	1571	1571	1571
152	153	154	155	156	157	279	1162	1571	1571	1571
158	159	160	161	162	163	279	1162	1571	1571	1571
164	165	166	167	168	169	279	1162	1571	1571	1571
170	171	172	173	174	175	279	1162	1571	1571	1571
176	177	178	179	180	181	279	1162	1571	1571	1571
182	183	184	185	186	187	279	1162	1571	1571	1571
188	189	190	191	192	193	279	1162	1571	1571	1571
194	195	196	197	198	199	279	1162	1571	1571	1571
200	201	202	203	204	205	279	1162	1571	1571	1571
206	207	208	209	210	211	279	1162	1571	1571	1571
212	213	214	215	216	217	279	1162	1571	1571	1571
218	219	220	221	222	223	279	1162	1571	1571	1571
224	225	226	227	228	229	279	1162	1571	1571	1571
230	231	232	233	234	235	279	1162	1571	1571	1571
236	237	238	239	240	241	279	1162	1571	1571	1571
242	243	244	245	246	247	279	1162	1571	1571	1571
248	249	250	251	252	253	279	1162	1571	1571	1571
254	255	256	257	258	259	279	1162	1571	1571	1571
260	261	262	263	264	265	279	1162	1571	1571	1571
266	267	268	269	270	271	279	1162	1571	1571	1571
272	273	274	275	276	277	279	1162	1571	1571	1571
278	279	280	281	282	283	279	1162	1571	1571	1571
284	285	286	287	288	289	279	1162	1571	1571	1571
290	291	292	293	294	295	279	1162	1571	1571	1571
296	297	298	299	300	301	279	1162	1571	1571	1571
302	303	304	305	306	307	279	1162	1571	1571	1571
308	309	310	311	312	313	279	1162	1571	1571	1571
314	315	316	317	318	319	279	1162	1571	1571	1571
320	321	322	323	324	325	279	1162	1571	1571	1571
326	327	328	329	330	331	279	1162	1571	1571	1571
332	333	334	335	336	337	279	1162	1571	1571	1571
338	339	340	341	342	343	279	1162	1571	1571	1571
344	345	346	347	348	349	279	1162	1571	1571	1571
350	351	352	353	354	355	279	1162	1571	1571	1571
356	357	358	359	360	361	279	1162	1571	1571	1571
362	363	364	365	366	367	279	1162	1571	1571	1571
368	369	370	371	372	373	279	1162	1571	1571	1571
374	375	376	377	378	379	279	1162	1571	1571	1571
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386	387	388	389	390	391	279	1162	1571	1571	1571
392	393	394	395	396	397	279	1162	1571	1571	1571
398	399	400	401	402	403	279	1162	1571	1571	1571
404	405	406	407	408	409	279	1162	1571	1571	1571
410	411	412	413	414	415	279	1162	1571	1571	1571
416	417	418	419	420	421	279	1162	1571	1571	1571
422	423	424	425	426	427	279	1162	1571	1571	1571
428	429	430	431	432	433	279	1162	1571	1571	1571
434	435	436	437	438	439	279	1162	1571	1571	1571
440	441	442	443	444	445	279	1162	1571	1571	1571
446	447	448	449	450	451	279	1162	1571	1571	1571
452	453	454	455	456	457	279	1162	1571	1571	1571
458	459	460	461	462	463	279	1162	1571	1571	1571
464	465	466	467	468	469	279	1162	1571	1571	1571
470	471	472	473	474	475	279	1162	1571	1571	1571
476	477	478	479	480	481	279	1162	1571	1571	1571
482	483	484	485	486	487	279	1162	1571	1571	1571
488	489	490	491	492	493	279	1162	1571	1571	1571
494	495	496	497	498	499	279	1162	1571	1571	1571
500	501	502	503	504	505	279	1162	1571	1571	1571
506	507	508	509	510	511	279	1162	1571	1571	1571
512	513	514	515	516	517	279	1162	1571	1571	1571
518	519	520	521	522	523	279	1162	1571	1571	1571
524	525	526	527	528	529	279	1162	1571	1571	1571
530	531	532	533	534	535	279	1162	1571	1571	1571
536	537	538	539	540	541	279	1162	1571	1571	1571
542	543	544	545	546	547	279	1162	1571	1571	1571
548	549	550	551	552	553	279	1162	1571	1571	1571
554	555	556	557	558	559	279	1162	1571	1571	1571
560	561	562	563	564	565	279	1162	1571	1571	1571
566	567	568	569	570	571	279	1162	1571	1571	1571
572	573	574	575	576	577	279	1162	1571	1571	1571
578	579	580	581	582	583	279	1162	1571	1571	1571
584	585	586	587	588	589	279	1162	1571	1571	1571
590	591	592	593	594	595	279	1162	1571	1571	1571
596	597	598	599	600	601	279	1162	1571	1571	1571
602	603	604	605	606	607	279	1162	1571	1571	1571
608	609	610	611	612	613	279	1162	1571	1571	1571
614	615	616	617	618	619	279	1162	1571	1571	1571
620	621	622	623	624	625	279	1162	1571	1571	1571
626	627	628	629	630	631	279	1162	1571	1571	1571
632	633	634	635	636	637	279	1162	1571	1571	1571
638	639	640	641	642	643	279	1162	1571	1571	1571
644	645	646	647	648	649	279	1162	1571	1571	1571
650	651	652	653	654	655	279	1162	1571	1571	1571
656	657	658	659	660	661	279	1162	1571	1571	1571
662	663	664	665	666	667	279	1162	1571	1571	1571
668	669	670	671	672	673	279	1162	1571	1571	1571
674	675	676	677	678	679	279	1162	1571	1571	1571
680	681	682	683	684	685	279	1162	1571	1571	1571
686	687									

Table III. Numbers of animals collected in the 1959  
survey of the Saint John River estuary.  
Arranged as in Table I.

	280.3			KENN. MOUTH			284.8			287.7			
	A	B	C	A	B	C	A	B	C	A	B	C	
1					1	1	6						8
2	4				1	1		98	800	4	454	1	2
3					1	1	13			1	470	60	1891
4													3
5													13
6													0
7													5
8	21	12	32				1	2		14	2		101
9	66	81	10				3	7		3	1		162
10					1								0
11													0
12													0
13													0
14	20						1						21
15													1
16												2	2
17													0
18													0
19							1						0
20													0
21		2					1					1	0
22													4
23					1								1
24						1							2
25							3						3
26												1	1
27							2						2
28													0
29													0
30													0
31													2
32													13
33													0
34													0
35	40	16		1			12	1					80
36	19	52	16				10		5				89
37									7				4
38									2				0
39													0
40				1					1	5	4	6	17
41													0
42													0
43													0
44													9
45													0
46													0
47													4
48	1	1	2										4
49													0
50													0
51													0
52													0
53													0
54													27
55													0
56													2
57													1
58													0
59													0
60													3
61	9	52	236	21	21		33	94		75		2	522
62		15	21					67		80			184
63													0
64													0
65													0
	180	231	319	24	35	67	274	828	166	465	507	89	3185

Table IV. Numbers of animals collected in the 1961 survey of the Saint John River estuary Arranged as in Table I.

~~Kenn. mouth samples A and B dried up~~

Table V. Weights of animals collected in the 1959 survey of Saint John Harbour. Arrangement as in Table I except dry weights in milligrams are given instead of numbers.

Table VI. Weights of animals collected in the 1961 survey of Saint John Harbour.

Table VII. Weights of animals collected in the 1959 survey of the Saint John River estuary. Weights are in mg. of dry weight.

Table VIII. Weights of animals collected in the 1961 survey of the Saint John River estuary.

280.3			Kenn. Mouth	284.8			287.7				
A	B	C	C	A	B	C	A	B	C		
1			88.3	2.9		1.9					
2			1509.3								
3			82.0			0.2					
4			0.5								
5	0.5	0.5	0.5								
6											
7											
8	103.8	100.8	67.3	33.3	90.9	50.0			18.9		
9											
10	0.9	1.4	0.1	0.1	0.1	0.2					
11											
12											
13											
14											
15											
16											
17											
18											
19											
20	0.5										
21			15.4								
22			28.4								
23			5.3								
24											
25											
26											
27			0.1	1.8							
28											
29											
30											
31											
32			0.2								
33											
34											
35		2.2	5.5						1.0		
36	6.2	0.9	4.4								
37	0.9		0.1	0.4							
38											
39											
40											
41											
42											
43											
44											
45											
46											
47											
48	3.5		0.2								
49											
50											
51											
52											
53											
54											
55	1.7										
56											
57											
58											
59											
60											
61	1871.8	1810.7	1839.0	229.9	974.2	424.5	1776.7	0.3	1.8	1.3	9830.2
62	466.2	624.0	646.4	0.4	210.8	150.5	226.7				2325.0
63											0
64											7.1
65											13682.9
	2456.0	2540.5	2563.6	1962.0	1274.3	668.2	2074.3	63.7	1.8	78.5	

Table IX. List of kinds of animals found in 1959 and 1961 surveys  
of Saint John Harbour and the Saint John River estuary.

1	NEMERTEA			Unident. species
2	PRIAPULOIDEA	Priapulida	Priapulidae	<i>Priapulus caudatus</i>
3*	ANNEELIDA	Oligochaeta	+ Nemathelminthes	Unident. species*
4**		Polychaeta	Miscellaneous or unidentified species**	
5			Phyllodocidae	<i>Phyllocoete arenae</i>
6			Phyllodocidae	<i>Eteone longa</i>
7			Nereidae	<i>Nereis diversicolor</i>
8			Nereidae	<i>Nereis succinea</i>
9			Nephthyidae	<i>Nephthys buceria</i>
10			Nephthyidae	<i>Nephthys sp.</i>
11			Lumbrineridae	<i>Lumbrineris sp.</i>
12			Lumbrineridae	<i>Ninoë nigripes</i>
13			Hesionidae	<i>Microphthalmus sczelkowii</i>
14			Paraonidae	<i>Paraonis gracilis</i>
15			Paraonidae	<i>Aricidae suecica</i>
16			Orbinidae	<i>Scoloplos acutus</i>
17			Sternaspidae	<i>Sternaspis sp.</i>
18			Flabelligeridae	<i>Pherusa sp.</i>
19			Scalibregmidae	<i>Scalibregma inflatum</i>
20			Maldanidae	<i>Clymenella torquata</i>
21			Maldanidae	<i>Maldanopsis sp.</i>
22			Opheliidae	<i>Ophelia sp.</i>
23			Opheliidae	<i>Ammotrypane aulogaster</i>
24			Trochochaetidae	<i>Trochochaeta sp.</i>
25			Capitellidae	species
26			Goniadidae	<i>Goniada maculata</i>
27			Polynoidae	<i>Harmothoë imbricata</i>
28			Polynoidae	<i>Antinoella sarsi</i>
29			Sigalionidae	<i>Sthenelais limicola</i>
30			Terebellidae	<i>Pista maculata</i>
31			Terebellidae	<i>Terebellides stroemi</i>
32			Cirratulidae	<i>Cossura sp.</i>
33			Cirratulidae	<i>Cirratulus sp.</i>
34			Spionidae	<i>Prionospio malmgreni</i>
35			Spionidae	<i>Scolelepides viridis</i>
36			Spionidae	<i>Streblospio benedicti</i>
37			Spionidae	<i>Polydora sp.</i>
38			Glyceridae	<i>Glycera dibranchiata</i>
39	ARTHROPODA	Decapoda	Cragon	species
40		Amphipoda	Gammaridae	<i>Gammarus oceanicus</i>
41			Ampeliscidae	Species 1
42			Ampeliscidae	Species 2
43			Photidae	<i>Leptocheirus sp.</i>
44			Corophiidae	<i>Unciola sp.</i>
45			Phoxocephalidae	species
46			Lysianassidae	<i>Hippomedon sp.</i>
47		Isopoda	Caprellidae	species
48			Anthuridae	<i>Cyathura polita (?)</i>
49			Idoteidae	<i>Edotea triloba</i>
50			Idoteidae	<i>Chiridotea sp.</i>
51			Janiridae	<i>Jaera marina</i>
52		Cumacea	Diastylidae	<i>Diastylis bispinosus</i>
53			Leuconidae	<i>Eudorella hispida</i>
54		Mysidacea	Mysidae	<i>Michtheimysis stenolepis</i>
55		Cirripedia	Balanidae	<i>Balanus sp.</i>
56	BRACHIOPEDA		Terebratulidae	<i>Terebratulina sp.</i>
57	MOLLUSCA	Gastropoda		Unidentified spp.
58			Bullidae	species
59		Pelecypoda		Unidentified spp.
60			Mytilidae	<i>Mytilus edulis</i>
61			Myacidae	<i>Mya arenaria</i>
62			Tellinidae	<i>Macoma balthica</i>
63			Nuculidae	<i>Nucula proxima</i>
64			Astartidae	<i>Astarte sp.</i>
65	HEMICHORDATA	Ascidiae		Unidentified spp.

3\* It proved difficult to separate with certainty, the Annelida from Nemathelminthes. Both were represented by small individuals. It is believed that most of the individuals were Annelida, Oligochaeta.

4\*\* As well as a few unidentified polychaetes, and many unidentifiable fragments, the following five single specimens have been included in this grouping for the sake of abbreviating the tables. Each is given with the year and station at which it occurred, and the weight of the individual:

Aphroditidae,	Aphrodisa sp.,	1961,	VIII-B,	2.9 mg.
Nereidae,	Nereis sp.,	1959,	284.9-C,	99.1 "
Arenicolidae,	Arenicola marina,	1959,	I-B,	0.5 "
Maldanidae,	Maldane sarsi,	1959,	Kenn. mouth-C,	0.6 "
Terrebellidae,	Amphitrite cirrata,	1959,	Kenn. mouth-B,	12.0 "

Table X. Numbers of empty shells collected in samples during the 1961 surveys of Saint John harbour and estuary. Kinds of shellfish are listed down the left hand side following the code of Table IX.

	I			II			III			IV			V			VI			VII		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
55																					
56																					
57		1		20		4	2	1		1	2			1	43			2	9	6	
58																		2	2		
59																					
60	7	21	5	3040	1		2	4	10					1	3	1		25		2	
61				110		4								1	1	3		4		6	
62														2							
63																					
64																					
	7	22	5	3170	J	8	4	5	10	1	2	2	2	2	48	4	4	0	5	40	14

	VIII			IX			X			XI	280.3			K.M.	284.8			287.7			TOTAL				
	B	C	A	B	C	A	B	C	C	A	B	C	C	A	B	C	A	B	C	A	B	C			
55										1	1			10								37			
56																						0			
57																									
58	3			11	4		1			159		3	1					1				1	230		
59																						54			
60																						5			
61				11		1				17	12	50	22	11	34	267	100						3139		
62				4							2				2	12	18						638		
63																						40			
64																						0			
	3	0	26	4	1	1	0	0	176	13	56	23	11	47	279	148	0	0	1			4143			

Table XI. Reference points used to locate sampling stations in Saint John harbour and estuary.

Locations and reference points in the estuary refer to Canadian Hydrographic Service chart number 4344, Edition of 1953. Locations in the harbour refer to chart 4319, Edition of 1945.

Stations above the reversing falls are designated by numbers which give miles of river channel, starting from the mouth of the St. Francis River, in northwestern New Brunswick, at the point where the Saint John River enters the province. Stations in the harbour are designated by Roman numerals arbitrarily assigned.

280.3 Opposite Brandy Point, in direct line with deepest part of cove on the other bank. Mid-river, in line between Sand Point lighthouse and westerly tip of Kennebecasis Island. Chart depth 70 feet.

Kennebecasis Mouth. In line between upstream tip of upper Brothers Island and southerly tip of Kennebecasis Island. Half way between these two points, in deep hole. Chart depth 123 feet.

284.8 Seven hundred metres out from Swift Point lighthouse in a line between that lighthouse and Brandy Point. About level with Green Head. Chart depth between 66 and 86 feet.

287.7 Above falls, directly west of Prospect Point and Goat Island, in deep hole. Chart depth 152 feet.

I. In line between S W corner of Long Wharf and can buoy 61J, about 200 metres off buoy, in deepest hole. Chart depth 153 feet, nearby.

II. In line between upstream corner of wharf of Atlantic Sugar Refinery and CPR elevator. Mid-channel. Chart depth 55 feet.

III. In 1959, 40 metres to west of buoy 60J, in channel. Chart depth between 37 and 50 feet.

In 1961, 30 metres to east of same buoy, out of the channel. Chart depth, between the 10-foot and 20-foot contours.

- IV. In line between buoy 54J and edge of wharves number 10 and 11. Also in line between mast at Red Head and northerly edge of Partridge Island. Chart depth, 30 feet, on contour.
- V. In direct line extended from channel to main harbour. Beyond buoy 43J by 1250 metres. This station found by compass bearings on landmarks. Chart depth 31 feet.
- VI. Generally, west of Black Point, out from harbour channel. Found by compass bearings on landmarks.  
On chart, found by producing line from Atlantic Sugar Refinery chimney through buoy 43J, station is 300 metres past the line which would join buoy 41J with Black Point. Chart depth 49 feet.
- VII. Near Negro Point. In line between the inside angle at base of Negro Point breakwater and buoy 54J. Also in line between Partridge Island Mast and end of No. 14 wharf. Chart depth 23 feet.
- VIII. In line between southerly tip of Partridge Island and middle of Shag Rocks. In line produced from tip of Courtenay Bay breakwater through buoy 54J. Chart depth 24 feet.
- IX. On immediate shore side of buoy 67J, just off dredged channel.
- X. Due south of tip of Courtenay Bay breakwater, by 150 metres. In line produced from St. John Baptist Church past buoy 66J. In line produced from corner of no. 13 wharf past buoy 60J. Chart depth 18 feet. Should be 75 metres west of nominal position of diffuser outfall of oil refinery.
- XI. In line between Red Head mast and Martello Tower. In line produced from outer angle of wharves no. 9 and 10, past tip of Courtenay Bay breakwater. Chart depth 15 feet.

Table XIII. Physical characteristics of bottom materials obtained in bottom samples of 1959 survey.

Date of sampling	Dec. 1	Oct. 30	Dec. 2	Dec. 1	Nov. 30	Nov. 30	Dec. 2	Nov. 30	Dec. 2	Dec. 1	Dec. 3	Dec. 4	Oct. 30	Dec. 3	
Time, hour, AST	13	12	13	14	16	15	11	17	9	16	15	15	10	16	13
Chart depth at low tide, metres	47	17	13	9	9	15	7	7	6?	6	5	21	37	46	46
Recorded depth, m.	21	44	54	23	23	23	28	28	28	18	16	16	-	-	-
Station no.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	280.3	K.M.	284.8	.287.7
Sample no.	A B C	/A B C	A B C	A B C											
Constituents, % :															
e. Rubble															
f. Rubble															
e. Gravel	5	5	30			15									15 5
f. Gravel	70	70	10	85	40	60	10	40			10	10			15
Granules	10	10	5	25	10	10	5	20	10	5	5		20		
Sand			25	55	20	15	10	30	10			80	90	10	99 99 95
Silt			5	40	5	10	50	90	60	95	90	90	98	95	95
							br	br	br						
Clay													5	95	90
Detritus		50	5	5	wd	25	75	20		5				99	99
													b1	b1	b1
Other	15	15	10	shl								10			
cinders in C													very fine sand		
														clams = 5%	

The bottom particles and sediments were classified according to the following standards:

coarse Rubble - rock material 6" to 12" in diameter

fine Rubble - " " 3" to 6" "

coarse Gravel - " " 1" to 3" "

fine Gravel - " " 1/8" to 1" "

Granules

Sand

Silt - bl = black, br = brown, gr = gray

Clay

Detritus - Shl = shell fragments, Wd = woody, Bk = bark, Vg = general vegetable materials

Other

Table XIII. Physical characteristics of bottom materials obtained in bottom samples of 1961 survey.

Date of sampling	Oct. 24	Oct. 25	Oct. 26	Oct. 26	Oct. 26	Oct. 26	Oct. 26	Oct. 26	Oct. 26	Oct. 26	Oct. 26	Oct. 26	Oct. 24	Oct. 24	Oct. 24
Time, hour, AST	13	14	15	13	9	8	17	10	14	12	11	17	16	14	12
Chart depth at low tide, metres	47	17	13	9	9	15	7	7	6?	6	5	21	37	46	46
Recorded depth, m.	43 49 45	26 22	16 16 16	12 12	11 11 11	16 16 16	12 12 12	10 10	14 14 14	8 8 8	6 21 21	21	25 50 40 24	37 37 37	
Station no.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	280.3	K.M.	284.8	287.7
Sample no.	A B C	A B C	A B C	A B	A B C	A B C	A B C	B C	A B C	A B C	C	A B C	C	A B C	A B C
Constituents, %:															
c Rubble															90
f Rubble															
c Gravel	5 5														5 50
f Gravel	5			10 10											30
Granules		20 20 10		10 20								5			5
Sand		20 30 10		60 50 br br		10			70 10 10	15 60 60	95				5
Silt		50 40 70 70 60		20 20	85 60 90 br br br	90 95 95 br br br	95 95 95 gr gr gr	90 90 br br	30 60 60 br br br	50 30 30 br br br	10	98 98 98 bl bl bl	95	95 90 85 bl bl bl	50
Clay			10 10 10		10 40 10			10 10	10 10	30 5 5				5 5	50
Detritus	90 95 95 Wd Wd Wd	10 40 30	20 20 30						20 20 Vg Vg						5 Bk
Other		Shl Bk	Bk Leaves						Some oil in mud		fine sand			5 Shl	8 Shl, Cinders, Stones, in C

The bottom particles and sediments were classified according to the following standards:

coarse Rubble - rock material 6" to 12" in diameter

fine Rubble - " " " 3" to 6" "

coarse Gravel - " " " 1" to 3" "

fine Gravel - " " " 1/8" to 1" "

Granules

Sand

Silt

Clay

Detritus

Other

- bl = black, br = brown, gr = grey

- Shl = shell fragments, Wd = woody, Bk = bark, Vg = general vegetable materials

