FISHERIES RESEARCH BOARD OF CANADA

MANUSCRIPT REPORTS OF THE BIOLOGICAL STATIONS

No. 167

Title

Contributions to the hydrography of the waters of the Scotian shelf. Hydrodynamics of the waters - 1933.

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Introduction:

Various reports dealing with the waters of the Scotian shelf during the seasons 1932 and 1933 may be referred to in connection with the hydrodynamical methods in use. The data collected during the season of 1933 were subjected to the usual treatment and the results form the subject matter of this report. Data are furnished in tables 1, 2, 3, and 4.

Topography of Various Isobaric Surfaces for May, 1933:

The topography of the sea's surface in May, 1933 is indicated in figure 2. The isobars are drawn from the plotted gradients in dynamic centimetres referred to station 48 as base. The arrowheads indicate the general direction of the movement of the water at this time, while the proximity of the isobars to one another indicates the relative intensity of the movements in different parts of the area. The topography of the isobaric surfaces of fifty decibars, one hundred decibars, and one hundred and fifty decibars is indicated in figures 2, 3, and 4 respectively. The movements in the upper one hundred metres of water are thus shown to consist of , in general, a coastwise movement from northeast to southwest with a general tendency to follow the contour of the bottom. The movement in the isobaric surface of one hundred and fifty decibars is towards the coast. The maximum current in the surface amounts to 0.6 knots or 14.6 nautical miles per day in a direction at right angles to a line joining stations 52 and 53. In the extreme

offshore region the resulting movements seem to result from the mutual effect of two streams proceeding in opposite directions --- the resulting movement being an offshore one. The magnitude of the currents in the various isobaric surfaces is given in table 5. Isobaric

Topography of the Various Isobaric Surfaces for June, 1933.

In figures 5, 6, 7, and 8, the topography of the various isobaric surfaces is indicated for June, 1933. Off shore, the westerly movement has seemingly overcome the tendency for an easterly movement with the result that inshore waters are moving coastwise in a west to southwesterly direction, while extreme offshore waters are moving in an easterly direction. In the isobaric surface of one hundred and fifty decibars the movement is shorewards. The maximum movement in the surface layer is in a direction at right angles to a line joining stations 52 and 53, and amounts to 0.6 knots or 14.7 nautical miles per day. Additional data in connection with the movements in the various isobaric surfaces are given in table 5. It might be of interest to note here that estimates of the current (0.5 knots westerly) made by Captain Calder while following a charted course, agree very closely with the calculated value (0.6 knots).

Topography of the Various Isobaric Surfaces for July, 1933.

The topography of the various isobaric surfaces for July, 1933 is indicated in figures 9, 10, 11, and 12. The general movement of the upper layers of the inshore waters to the west and southwest prevails. Off shore, the northeasterly movement in the surface layer has been partially overcome and turned into a clockwise movement around the shoaler areas and an anticlockwise movement around the deeper areas. At greater depths, the northeasterly movement in the offshore waters is quite pronounced. The movements in the upper layers are not as

pronounced as in previous months, with the maximum movement in a direction at right angles to a line joining stations 52 and 53 and which amounts to 0.5 knots or 11.9 nautical miles per day. The movements in the isobaric surface of one hundred and fifty decibars are from the east to the west and southwest. Additional data in connection with the movements in the various isobaric surfaces are furnished in table 5.

Topography of the Various Isobaric Surfaces for late August, 1933.

The topography of the various isobaric surfaces for late August, 1933 is indicated in figures 13, 14, 15, and 16. In the upper layers, west to southwesterly movements are particularly intense in the immediate inshore area. The northeasterly movement in the offshore waters has been turned into clockwise movement around the banks. Maximum movements in the surface waters are found to exist in a direction at right angles to a line joining stations 45 and 46, and amounts to 1.3 knots or 31.7 nautical miles per day. Movements in the isobaric surface of 150 decibars are more or less contra clockwise. Additional data in connection with the strength of the water movements in the various isobaric surfaces are furnished in table 5.

Comparison of Water Movements in 1932 and 1933.

In comparing the general topography of the various isobaric surfaces as determined in 1933 with that determined in 1932, two outstanding points become evident as follows:

1. During the months of June, July, and August, the gradients are much greater in 1933 than in 1932. This is indicative of more intense water movements in the latter year. In general, the intensity of the water movements in 1933 were about five times as intense as those in 1932. Inthe latter part of August the maximum movement in

in 1933 amounted to 31.7 nautical miles per day. In the latter part of September, 1932, the maximum movement amounted to 16.5 nautical miles per day. Both of these intense movements are the aftermath of abnormal disturbances.

2. The offshore northeasterly movement of considerable note in 1933 was not present in the area in 1932.

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
45	0m.	24.59	97600	00.000	10.7
"	25m.	25.02	97548	24.394	
"	50m.	25.44	97496	48.775	8.6
46	0m.	24.84	97576	00.000	7.3
"	25m.	25.44	97508	24.386	
"	50m.	25.56	97485	48.760	6.7
"	75m.	25.72	97458	73.128	
"	100m.	26.02	97419	97.488	4.3
47	0m.	24.96	97565	00.000	2.6
"	25m.	25.38	97514	24.385	
"	50m.	25.77	97465	48.758	2.2
"	75m.	26.09	97423	73.119	
"	100m.	26.52	97372	97.469	1.5
"	150m.	26.97	97308	146.139	2.4
48	0m.	25.18	97544	00.000	0.0
"	25m.	25.34	97517	24.383	
"	50m.	25.93	97449	48.754	0.0
"	75m.	26.24	97410	73.112	
"	100m.	26.70	97355	97.458	0.0
"	150m.	27.02	97303	146.123	1.4
"	200m.	27.17	97268	194.766	
49	0m.	25.08	97553	00.000	3.7
"	25m.	25.33	97518	24.384	
"	50m.	25.91	97451	48.755	3.6
"	75m.	26.46	97389	73.110	
"	100m.	26.73	97352	97.453	4.2
50	0m.	25.05	97556	00.000	6.6
"	25m.	25.17	97534	24.386	
"	50m.	25.75	97466	48.761	5.9
"	75m.	26.27	97406	73.120	
"	100				
51.	0m.	24.99	97562	00.000	6.3
"	25m.	25.31	97520	24.385	
"	50m.	25.84	97458	48.757	6.0
"	75m.	26.21	97412	73.116	
"	100m.	26.60	97365	97.463	5.8
52	0m.	24.75	97585	00.000	3.2
"	25m.	25.51	97501	24.386	
"	50m.	25.76	97466	48.757	2.9
"	75m.	25.96	97436	73.120	
"	100m.	26.04	97417	97.477	1.3
"	150m.	26.53	97348	146.169	0.0
"	200m.	27.09	97276	194.825	
53	0m.	24.52	97607	00.000	12.8
"	25m.	24.99	97551	24.395	
"	50m.	25.63	97478	48.774	10.8
"	75m.	25.84	97447	73.140	
"	100m.	25.97	97424	97.4999	8.7

Table 1. Hydrodynamic Data for Mast (cont.)

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
54	0m.	24.50	97609	00.000	13.9
"	25m.	25.18	97533	24.393	
"	50m.	25.59	97482	48.770	12.3
55	0m.	24.44	97614	00.000	13.7
"	25m.	25.29	97522	24.392	
"	50m.	25.55	97485	48.768	12.3
56	0m.	24.82	97578	00.000	13.5
"	25m.	25.27	97524	24.388	
"	50m.	25.44	97496	48.766	12.3
57	0m.	24.66	97594	00.000	14.4
"	25m.	24.95	97554	24.394	
"	50m.	25.47	97493	48.775	12.3
58	0m.	24.66	97594	00.000	13.8
"	25m.	25.07	97543	24.392	
"	50m.	25.50	97490	48.771	12.1
"	75m.	25.56	97474	73.142	

Table 1. (concluded) Hydrodynamical data for May.

Station	Depth	Density	S. Volume - (in situ).	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
45	0m.	23.44	97709	00.000	12.6
"	25m.	25.00	97550	24.408	
"	50m.	25.21	97518	48.792	10.9
46	0m.	23.67	97688	00.000	8.4
"	25m.	24.90	97559	24.406	
"	50m.	25.55	97387	48.774	8.5
"	75m.	25.74	97456	73.130	
"	100m.	25.97	97424	97.490	8.5
47	0m.	23.77	97678	00.000	5.5
"	25m.	25.06	97544	24.403	
"	50m.	25.83	97459	48.779	5.1
"	75m.	26.19	97414	73.138	
"	100m.	26.52	97372	97.486	6.0
"	150m.	26.80	97324	146.160	6.3
"					
48	0m.	24.20	97637	00.000	0.6
"	25m.	25.18	97533	24.396	
"	50m.	25.84	97458	48.770	1.1
"	75m.	26.34	97356	73.122	
"	100m.	26.75	97350	97.460	3.7
"	150m.	26.98	97308	146.125	4.9
"	200m.	27.16	97269	194.770	
49	0m.	23.92	97664	00.000	6.3
"	25m.	25.12	97538	24.400	
"	50m.	25.86	97456	48.774	6.4
"	75m.	26.42	97393	73.130	
"	100m.	26.70	97355	97.474	8.0
50	0m.	24.13	97644	00.000	7.2
"	25m.	24.86	97563	24.401	
"	50m.	26.02	97441	48.777	7.0
"	75m.	26.31	97402	73.133	
51	0m.	23.89	97667	00.000	6.6
"	25m.	25.16	97535	24.4000	
"	50m.	25.87	97455	48.7774	6.7
"	75m.	26.29	97404	73.132	
"	100m.	26.61	97364	97.478	7.9
52	0m.	23.57	97697	00.000	0.0
"	25m.	25.32	97519	24.402	
"	50m.	25.81	97461	48.775	0.0
"	75m.	25.95	97436	73.137	
"	100m.	26.32	97391	97.491	0.0
"	150m.	26.90	97314	146.168	0.0
"	200m.	27.01	97.283	194.967	
53	0m.	23.80	97675	00.000	9.8
"	25m.	24.89	97560	24.405	
"	50m.	25.40	97500	48.788	8.5
"	75m.	25.69	97461	73.158	
"	100m.	25.99	97423	97.519	7.0

Table 2. Hydrodynamic Data for June. (continued)

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. Metres)	Gradient (dyn. cms.)
54	0m.	23.92	97664	00.000	10.7
"	25m.	25.24	97527	24.399	
"	50m.	25.40	97500	48.778	10.4
"					
55	0m.	23.69	97686	00.000	11.5
"	25m.	25.02	97548	24.404	
"	50m.	25.32	97507	48.786	10.4
56	0m.	23.72	97683	00.000	11.1
"	25m.	25.19	97532	24.402	
"	50m.	25.36	97504	48.782	10.4
57	0m.	23.69	97686	00.000	12.1
"	25m.	24.78	97571	24.407	
"	50m.	25.36	97504	48.792	10.4
58	0m.	23.76	97679	00.000	11.6
"	25m.	24.82	97567	24.406	
"	50m.	25.35	97504	48.790	10.1
"	75m.	25.51	97478	73.163	

Table 2. Hydrodynamic Data for June. (concluded).

Tabel

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
45	0m.	22.29	97820	00.000	7.4
"	25m.	24.28	97619	24.430	
"	50m.	25.45	97495	48.819	6.9
46	0m.	22.28	97821	00.000	4.8
"	25m.	24.47	97601	24.428	
"	50m.	25.51	97489	48.814	4.8
"	75m.	25.84	97447	73.181	
"	100m.	26.12	97410	97.538	4.0
482	0m.	22.86	97765	00.000	2.7
"	25m.	23.63	97680	24.431	
"	50m.	25.41	97499	48.829	1.2
"	75m.	26.10	97422	73.207	
"	100m.	26.47	97377	97.557	0.0
"	150m.	26.87	97317	146.231	0.0
"	200m.	27.08	97277	194.880	
49	0m.	22.71	97779	00.000	4.1
"	25m.	23.94	97651	24.429	
"	50m.	25.78	97464	48.819	3.6
"	75m.	26.14	97418	73.179	
"	100m.	26.61	97364	97.527	4.4
50	0m.	22.57	97793	00.000	3.8
"	25m.	24.16	97630	24.428	
"	50m.	25.72	97469	48.816	3.6
"	75m.	26.46	97388	73.173	
47	0m.	22.41	97808	00.000	3.2
"	25m.	24.01	97644	24.432	
"	50m.	25.44	97496	48.825	2.1
"	75m.	26.11	97421	73.190	
"	100m.	26.29	97394	97.542	2.0
"	150m.	26.73	97350	146.223	1.3
51	0m.	22.49	97801	00.000	1.8
"	25m.	25.12	97538	24.418	
"	50m.	25.77	97465	48.794	3.8
"	75m.	26.10	97422	73.155	
"	100m.	26.56	97369	97.504	4.4
52	0m.	22.18	97830	00.000	0.0
"	25m.	24.50	97598	24.429	
"	50m.	25.63	97478	48.814	0.0
"	75m.	26.12	97420	73.176	
"	100m.	26.53	97371	97.525	0.5
"	150m.	26.87	97317	146.197	0.7
"	200m.	26.92	97291	194.849	
53	0m.	22.16	97832	00.000	7.9
"	25m.	24.34	97613	24.431	
"	50m.	25.58	97483	48.818	7.5
"	75m.	25.84	97447	73.184	
"	100m.	26.08	97414	97.542	6.7

Table 3. Hydrodynamic Data for July (continued)

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
54	0m.	22.44	97805	00.000	9.0
"	25m.	24.71	97578	24.423	
"	50m.	25.43	97497	48.808	9.6
"					
55	0m.	22.34	97815	00.000	10.3
"	25m.	24.29	97618	24.429	
"	50m.	25.22	97517	48.821	9.6
56	0m.	22.16	97832	00.000	9.8
"	25m.	24.59	97589	24.428	
"	50m.	25.24	97515	48.816	9.6
57	0m.	22.13	97835	00.000	9.2
"	25m.	24.79	97570	24.426	
"	50m.	25.43	97497	48.810	9.6
58	0m.	22.29	97820	00.000	9.4
"	25m.	24.55	97593	24.427	
"	50m.	25.29	97510	48.815	9.3
"	75m.	25.60	97470	73.188	

Table 3. Hydrodynamic Data for July. (concluded).

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
45	0m.	21.56	97885	00.000	18.6
"	25m.	22.37	97801	24.461	
"	50m.	24.17	97618	48.889	10.0
46	0m.	22.10	97838	00.000	7.4
"	25m.	24.14	97632	24.434	
"	50m.	25.39	97501	48.826	5.1
"	75m.	25.92	97439	73.194	
"	100m.	26.00	97421	97.552	3.6
47	0m.	21.83	97864	00.000	5.8
"	25m.	24.18	97628	24.437	
"	50m.	24.54	97582	48.838	2.3
"	75m.	26.17	97416	73.213	
"	100m.	26.44	97380	97.563	0.9
"	150m.	26.91	97313	146.237	0.9
48	0m.	21.94	97853	00.000	2.1
"	25m.	24.54	97594	24.431	
"	50m.	25.52	97488	48.816	0.8
"	75m.	26.08	97424	73.180	
"	100m.	26.36	97388	97.532	0.3
"	150m.	26.84	97320	146.209	0.0
"	200m.	27.06	97279	194.859	
49	0m.	21.79	97868	00.000	4.2
"	25m.	25.07	97543	24.427	
"	50m.	25.88	97454	48.802	4.3
"	75m.	26.35	97399	73.159	
"	100m.	26.50	97373	97.506	5.0
50	0m.	21.92	97855	00.000	5.9
"	25m.	24.59	97589	24.431	
"	50m.	25.64	97477	48.814	4.8
"	75m.	26.11	97394	73.173	
"					
51	0m.	21.88	97859	00.000	5.4
"	25m.	24.79	97570	24.429	
"	50m.	25.76	97466	48.809	4.8
"	75m.	26.14	97418	73.170	
"	100m.	26.48	97376	97.519	4.9
52	0m.	21.81	97866	00.000	1.1
"	25m.	24.85	97564	24.429	
"	50m.	25.69	97472	48.809	0.5
"	75m.	26.07	97425	73.171	
"	100m.	26.52	97372	97.521	0.4
"	150m.	26.84	97320	146.194	0.5
"	200m.	26.97	97287	194.846	
53	0m.	21.93	97854	00.000	9.7
"	25m.	24.35	97612	24.433	
"	50m.	25.53	97487	48.821	7.9
"	75m.	25.92	97439	73.187	
"	100m.	26.09	97413	97.544	6.7

Table 4. Hydrodynamic Data for August. (continued).

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
54	0m.	21.95	97852	00.000	18.2
"	25m.	22.58	97781	24.454	
"	50m.	24.93	97554	48.871	11.4
55	0m.	21.67	97879	00.000	19.1
"	25m.	22.32	97806	24.461	
"	50m.	24.92	97545	48.880	11.4
56	0m.	21.43	97902	00.000	17.5
"	25m.	22.93	97747	24.456	
"	50m.	25.20	97519	48.864	11.4
57	0m.	21.48	97897	00.000	18.6
"	25m.	22.51	97788	24.461	
"	50m.	25.13	97526	48.875	11.4
58	0m.	21.57	97889	00.000	18.7
"	25m.	22.10	97827	24.465	
"	50m.	25.36	97504	48.882	10.8
"	75m.	25.52	97477	73.255	
70	0m.	22.87	97764	00.000	3.7
"	25m.	24.79	97570	24.417	
"	50m.	25.86	97456	48.795	4.5
"	75m.	26.20	97414	73.154	
71	0m.	22.43	97806	00.000	0.0
"	25m.	25.02	97548	24.419	
"	50m.	25.80	97462	48.795	0.8
"	75m.	26.27	97406	73.154	
"	100m.	26.53	97371	97.501	1.3
"	150m.	26.89	97315	146.173	1.5
"					
72	0m.	22.00	97847	00.000	0.4
"	25m.	24.85	97564	24.427	
"	50m.	25.70	97471	48.807	0.0
"	75m.	26.17	97416	73.168	
"	100m.	26.56	97369	97.516	0.0
"	150m.	26.91	97313	146.187	0.5
"	200m.	27.08	97277	194.835	

Table 4. Hydrodynamic Data for August. (concluded).

	Depth (dyn. metre)	Stations A	Stations B	D_A	D_B	L	Current
ay	0	53	52	12.8	3.2	17 mi.	0.6 knots 14.6 mi/day
	50	53	52	10.8	2.9	17 mi.	0.5 knots 11.9 mi/day
	100	53	52	8.4	1.3	17 mi.	0.4 knots 10.7 mi/day
	150	47	48	2.4	1.4	17 mi.	0.06 knots 1.5 mi/day
une	0	53	52	9.8	0.0	17 mi.	0.6 knots 14.6 mi/day
	50	53	52	8.5	0.0	17 mi.	0.5 knots 12.5 mi/day
	100	53	52	7.0	0.0	17 mi.	0.4 knots 10.5 mi/day
	150	48	52	5.0	0.0	30 mi.	0.2 knots 4.3 mi/day
uly	0	53	52	7.9	0.0	17 mi.	0.5 knots 11.9 mi/day
	50	53	52	7.5	0.0	17 mi.	0.5 knots 11.3 mi/day
	100	53	52	6.7	0.5	17 mi.	0.4 knots 9.3 mi/day
	150	47	48	1.3	0.0	17 mi.	0.06 knots 2.0 mi/day
ugust	0	45	46	18.6	7.4	9 mi.	1.3 knots 31.7 mi/day
	50	45	46	10.0	5.1	9 mi.	0.6 knots 13.9 mi/day
	100	53	52	6.7	0.4	17 mi.	0.4 9.5 mi/day
	150	71	48	1.5	0.0	18 mi.	0.08 knots 2.1 mi/day

A and B refer to the stations.

D_A minus D_B refer to the dynamic depth of the vertical gradient existing between stations A and B.

L is the distance between the stations referred to.

The current is that at right angles to a line joining the two stations referred to. The direction is indicated in the various diagrams. The current is expressed in knots and or nautical miles per day.

Table 5.