FISHERIES RESEARCH BOARD OF CANADA

MANUSCRIPT REPORTS OF THE BIOLOGICAL STATIONS

No. 169

Title

Contributions to the hydrography of the waters of the Scotian shelf. Hydrodynamics of the Waters - 1934.

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Contributions to the Hydrography of the Waters

of the Scotian Shelf

Hydrodynamics of the Waters--1934

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(with two figures)

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Introduction :

The hydrographic data, obtained during the spring (May) and summer (August) cruises over a portion of the Scotian shelf (Hachey, 1935) during 1934, have been subjected to the usual hydrodynamic analysis (see previous MSS reports on this subject by the author). The aim of the analysis is to work out the topography of various isobaric surfaces as indicative of water movements in the various isobaric sheets. In the present case the topography of the surface sheet as well as the topography of the isobaric surface of 50 decibars is determined for the spring and summer cruises (May and August). The topography in each case is indicated (figures 1 and 2) by plotting the dynamic height (in dynamic centimetres) of each point of observation relative to a chosen base. Isobars are then drawn for each dynamic centimetre of gradient, and these isobars aid in visualising the topography of a particular isobaric surface. The data concerned is furnished in tables 1, 2, and 3.

The Spring Cruise:

(a) topography of the surface of the sea in May.

The topography of the surface of the sea for the spring cruise is indicated in figure 1(a). The dynamic heights of all points of observation are expressed in dynamic centimetres and r referred to station 130 as base. Inshore, to the eastward, and offshore to the westward, are the chief elevations of the sea's surface relative to the main central portion of the area. The chief depression has its centre at station 130. Consequently, the flow tends to be clockwise around the elevations, and anticlockwise around the depression. There is a definite movement along and towards the coast from the eastward, which gradually tends to swing offshore, resulting in an anticlockwise circulation over the main portion of the area. A movement from west to east is indicated inshore in the extreme western portion of the area. This combined with an offshore movement in the central portion of the area results in a clockwise circulation in the western portion of the area. The maximum intensity of movement is in a direction at right angles to a line joining stations 122 and 123, and amounts to 0.34 knots or 8.4 nautical miles per day.

(b) the topography of the isobaric surface of 50 decibars in May.

The topography of the isobaric surface of 50 decibars is indicated in figure 1(b). The dynamic heights of all points of observation are expressed in dynamic centimetres and referred to station 128 as base. The main feature of the movements indicated by the topography of this isobaric surface is the large area of water which is in anticlockwise circulation. This anticlockwise circulation is confined within the limits of what has been termed the Scotian Gulf (Hachey, 1935). Another feature is the general movement along-shore from east to west. In the western extremity of the area, this east to west shoreward movement is affected by a tendency for clockwise circulation with its centre at station 123. In the extreme east, a tendency for an easterly movement, close to the coast, is apparently produced by a clockwise circulation about station 133. The most intense movement is in a direction at right angles to a line joining stations 123 and 124, and amounts to 0.25 knots or 6.0 nautical miles per day.

The Autumn Cruise:

(a) topography of the surface of the sea for August.

The topography of the surface of the sea in August is indicated by the various isobars in figure 2(a). The greatest elevation in the sea's surface is seen to be in the vicinity of station 130, and the lowest at station 131. As a result the most intense movement of the water is had at right angles to a line joining stations 130 and 131, and amounts to 0.32 knots or 7.7 nautical miles per day. On the whole, the elevations in the sea's surface are offshore with the result that the coastwise movement predominating in May has been offset by a strong northeasterly movement. This northeasterly movement conflicts with a general westerly set of the waters in the extreme eastern portion of the area resulting in the strong northwesterly set of the waters between stations 130 and 131. A tendency for anticlockwise circulation is present in the inshore central portion of the area.

(b) the topography of the isobaric surface of 50 decibars.

The topography of the isobaric surface of 50 decibars is indicated in figure 2(b). The outstanding feature is the anticlockwise circulation confined more or less to the area differentiated as the Scotian Gulf (op. cit.). The anticlockwise tendency is in part an east to west movement along the major portion of the coast. To the extreme west, a clockwise tendency centred about station 122 is evident, while offshore to the east the water movement varies between north, northeast and east.

Summary:

The hydrodynamical treatment of the data offered herein may be summarised as follows:

1. Along the south coast of Nova Scotia, there is a tendency for a shoreward movement from east to west of the upper fifty metres of water. This tendency is offset somewhat in the western end of the section, where there is a tendency for a west to east movement which partakes of the clockwise circulation centred roughly between Roseway (station 122) and LaHave (station 124) banks.

2. The Scotian Gulf tends to delimit an anticlockwise circulation of the upper fifty metres of water.

3. There would seem to be a ~~May~~ conflict between a tendency for a general east to west movement, and a tendency for an onshore movement. In the spring cruise, the east to west movement predominates, while in the August cruise, the onshore movement would seem to be the predominating one.

References Cited:

Hachey, H. B. Contributions to the Hydrography of the Waters of the Scotian Shelf.-- Hydrography of the Waters -- 1934.
MSS Report to the Biol. Board of Canada --- 1935.

Station	Depth	Density	Sp. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
121	0 m.	25.20	97542	00.000	5.3
"	25m.	25.62	97491	24.379	
122	0m.	25.10	97551	00.000	5.6
"	25m.	25.57	97496	24.381	
"	50m.	25.74	97467	48.752	3.1
123	0m.	24.79	97581	00.000	7.8
"	25m.	25.30	97521	24.388	
"	50m.	25.54	97486	48.764	4.1
"	75m.	25.89	97442	73.130	
"	100m.	26.38	97386	97.587	
"	150m.	26.97	97309	146.261	
124	0m.	24.69	97592	00.000	3.8
"	25m.	25.56	97497	24.386	
"	50m.	25.98	97445	48.754	1.1
"	75m.	26.36	97399	73.110	
125	0m.	24.86	97574	00.000	3.4
"	25m.	25.54	97498	24.384	
"	50m.	25.94	97448	48.752	0.9
"	75m.	26.39	97396	73.108	
"	100m.	26.82	97345	97.451	
"	150m.	27.04	97302	146.113	
"	200m.	27.13	97275	194.757	
50	0m.	24.86	97574	00.000	3.3
"	25m.	25.50	97502	24.385	
"	50m.	25.88	97454	48.755	0.5
"	75m.	26.57	97379	73.109	
"	100m.	26.79	97348	97.450	
126	0m.	24.98	97563	00.000	3.5
"	25m.	25.48	97504	24.384	
"	50m.	25.94	97448	48.753	0.9
"	75m.	26.42	97393	73.108	
"	100m.	26.70	97356	97.452	
58	0m.	25.05	97513	00.000	4.0
"	25m.	25.50	97502	24.377	
"	50m.	25.84	97458	48.747	2.0
"	75m.	26.03	97429	73.108	
127	0m.	25.29	97533	00.000	3.9
"	25m.	25.58	97495	24.379	
"	50m.	25.82	97460	48.744	2.2
"	75m.	25.89	97442	73.107	

Table 1. Hydrodynamical Data -- May Cruise.

(continued)

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
128	0m.	25.24	97538	00.000	1.0
"	25m.	25.90	97464	24.375	
"	50m.	26.11	97432	48.737	0.0
"	75m.	26.30	97404	73.092	
"	100m.	26.73	97353	97.437	
"	150m.	27.02	97304	146.102	
130	0m.	25.57	97507	00.000	0.0
"	25m.	25.68	97385	24.362	
"	50m.	25.91	97451	48.717	1.0
131	0m.	25.51	97512	00.000	3.0
"	25m.	25.57	97496	24.378	
"	50m.				
132	0m.	25.30	97532	00.000	2.7
"	25m.	25.60	97493	24.378	
"	50m.	25.91	97451	48.741	1.3
"	75m.	26.08	97424	73.101	
"	100m.	26.18	97404	97.455	
"	150m.	26.41	97360	146.146	
"	200m.	26.52	97328	194.818	
133	0m.	25.00	97561	00.000	5.9
"	25m.	25.60	97493	24.382	
"	50m.	25.82	97460	48.751	3.5
"	75m.	25.98	97434	73.113	
"	100m.	26.17	97405	97.486	
134	0m.	24.79	97581	00.000	6.1
"	25m.	25.24	97527	24.389	
"	50m.	25.63	97478	48.765	2.3
"	75m.	25.80	97451	73.131	
"	100m.	26.20	97402	97.488	

Table 1. Hydrodynamical Data -- May Cruise.

(concluded)

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
121	0m.	24.14	97643	00.000	2.2
"	25m.	25.19	97532	24.397	
"	50m.	26.07	97436	48.768	4.2
"	75m.	26.29	97405	73.123	
122	0m.	23.63	97691	00.000	4.8
"	25m.	24.65	97583	24.409	
"	50m.	25.77	97465	48.790	4.1
123	0m.	23.23	97730	00.000	4.4
"	25m.	24.95	97554	24.411	
"	50m.	25.80	97462	48.788	4.4
"	75m.	26.11	97421	73.148	
"	100m.	26.36	97388	97.600	
"	150m.	27.00	97306	146.274	
124	0m.	23.10	97742	00.000	3.6
"	25m.	24.48	97600	24.418	
"	50m.	26.01	97442	48.798	2.6
"	75m.	26.46	97389	73.152	
125	0m.	23.29	97724	00.000	3.4
"	25m.	23.61	97682	24.426	
"	50m.	26.25	97419	48.814	0.8
"	75m.	26.68	97368	73.163	
"	100m.	26.92	97335	97.501	
"	150m.	27.11	97296	146.159	
"	200m.	27.17	97269	194.801	
126 50	0m.	22.80	97771	00.000	1.9
"	25m.	24.52	97596	24.421	
"	50m.	26.25	97419	48.798	1.0
"	75m.	26.77	97360	73.145	
"	100m.	26.87	97340	97.483	
126	0m.	22.88	97763	00.000	1.2
"	25m.	24.92	97557	24.415	
"	50m.	26.22	97422	48.788	0.0
"	75m.	26.67	97369	73.137	
"	100m.	26.83	97344	97.476	
58	0m.	23.64	97690	00.000	1.5
"	25m.	24.97	97553	24.406	
"	50m.	25.85	97457	48.782	2.1
"					
127	0m.	22.99	97753	00.000	2.9
"	25m.	24.71	97578	24.417	
"	50m.	25.87	97455	48.796	2.1
"	75m.	26.19	97414	73.155	
128	0m.	22.69	97781	00.000	2.9
"	25m.	24.34	97613	24.424	

Table 2. Hydrodynamical Data -- August Cruise
(continued)

Station	Depth	Density	S. Volume (in situ)	Dyn. Depth (dyn. metres)	Gradient (dyn. cms.)
128	50m.	25.99	97444	48.806	1.1
"	75m.	26.35	97398	73.161	
"	100m.	26.66	97359	97.506	
"	150m.	27.00	97306	146.173	
129	0m.	23.24	97729	00.000	5.4
"	25m.	24.06	97640	24.421	
"	50m.	25.51	97489	48.812	3.0
"	75m.	26.08	97424	73.176	
130	0m.	23.09	97743	00.000	7.0
"	25m.	23.88	97657	24.425	
"	50m.	25.43	97498	48.820	3.8
"	75m.	25.82	97450	73.189	
"	100m.	26.24	97399	97.545	
131	0m.	22.94	97757	00.000	0.0
"	25m.	25.40	97512	24.409	
"					
132A	0m.	21.86	97861	00.000	4.9
"	25m.	24.58	97609	24.434	
"	50m.	25.77	97465	48.818	1.9
"	75m.	26.07	97425	73.179	
"					
133	0m.	21.80	97867	00.000	4.4
"	25m.	24.71	97578	24.431	
"	50m.	25.71	97470	48.812	2.0
134	0m.	22.83	97768	00.000	5.2
"	25m.	24.62	97586	24.419	
"	50m.	25.41	97499	48.805	3.5
"	75m.	25.99	97444	73.173	
"	100m.	26.36	97387	97.527	
"	150m.	26.50	97350	146.212	

Table 2. Hydrodynamical Data --- August Cruise

(Concluded)

Cruise	Depth (dyn. metres)	Stations A	B	D_A minus D_B (dyn. cms.)	L (naut. mi.)	Current
May	0	123	124	4.0	13	0.34 (8.4)
"	50	123	124	3.0	13	0.25 (6.0)
August	0	131	130	7.0	23	0.32 (7.7)
"	50	123	124	1.8	13	0.15 (3.6)

A and B refer to the stations or points of observation.

D_A minus D_B refers to the gradient existing between stations A and B.

L is the distance between the stations referred to. Distance expressed in nautical miles.

The current expressed in knots (figures in brackets is the current in nautical miles per day) is that at right angles to a line joining the two stations referred to.

The calculations were made according to the formula

$$C_0 - C_1 = \frac{(D_A - D_B)}{2\,\omega\,\sin\phi \times L}$$

where $C_0 - C_1$ is the current expressed in cms./sec.

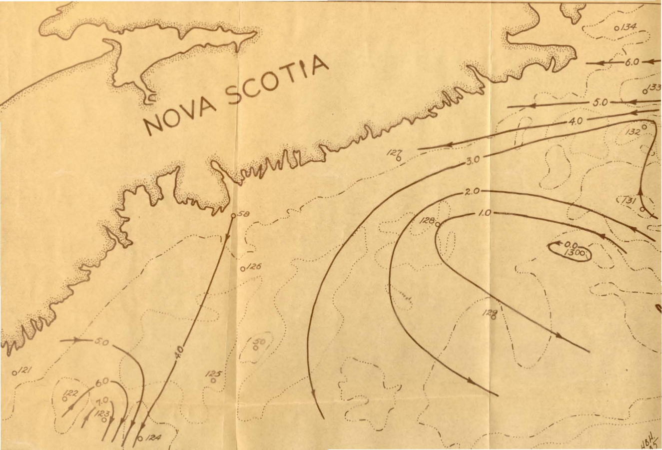
$D_A - D_B$ is the gradient expressed in dynamic metres,

ω is the angular velocity of the earth .0000729

L is the distance between two stations A and B expressed in kilometres, and

ϕ is the mean latitude of the two stations

Table 3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4.0
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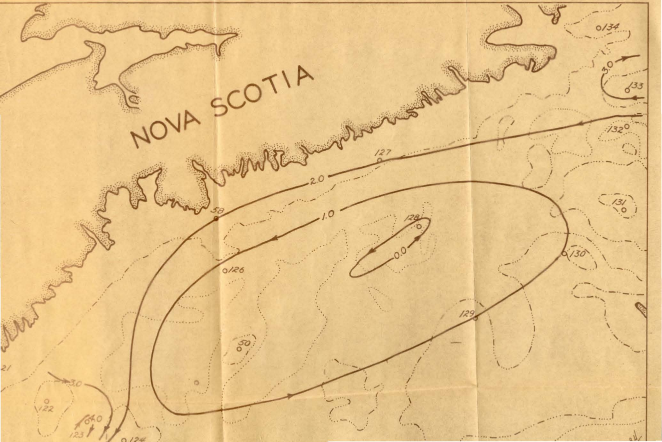
134
58
50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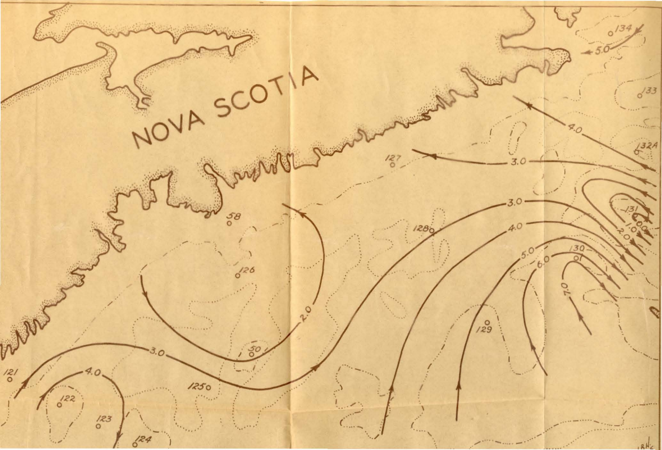

NOVA SCOTIA
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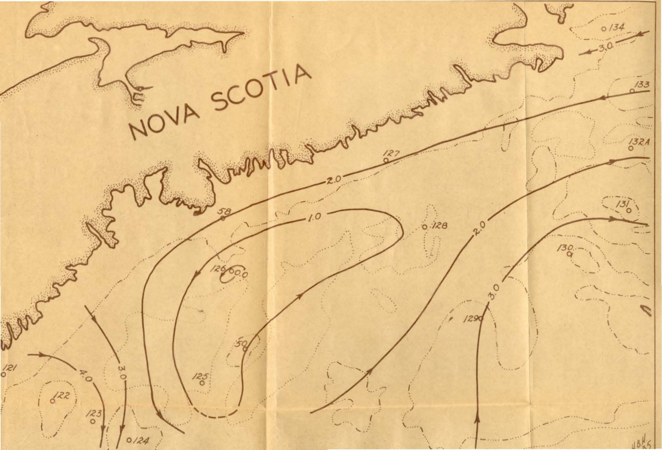
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