West coast of Newfoundland capelin (*Mallotus villosus* M.) and Atlantic herring (*Clupea harengus harengus* L.) larval survey, part 7: Description of the data collected in partnership with the industry (Barry Group) in July 2008

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2011

WEST COAST OF NEWFOUNDLAND CAPELIN (*Mallotus villosus* M.) AND ATLANTIC HERRING (*Clupea harengus harengus* L.) LARVAL SURVEY, PART 7: DESCRIPTION OF THE DATA COLLECTED IN PARTNERSHIP WITH THE INDUSTRY (BARRY GROUP) IN JULY 2008

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ABSTRACT

Grégoire, F., W. Barry, J.-J. Barry, J. Barry, C. Lévesque, J.-L. Beaulieu, and M.-H. Gendron. 2011. West coast of Newfoundland capelin (*Mallotus villosus* M.) and Atlantic herring (*Clupea harengus harengus* L.) larval survey, part 7: Description of the data collected in partnership with the industry (Barry Group) in July 2008. Can. Data Rep. Fish. Aquat. Sci. 1235: vi + 27 pp.

In partnership with the Barry Group, a larval survey was conducted on the west coast of Newfoundland from 16 to 18 July 2008 to measure the abundance of fish eggs and larvae sampled with plankton nets. A second objective was to describe the spatial distribution of fish larvae including those from two significant commercial species, capelin (*Mallotus villosus*) and Atlantic herring (*Clupea harengus harengus*). The two most abundant egg groups were the CYT group (cunner [*Tautogolabrus adspersus*] and yellowtail flounder [*Limanda ferruginea*]) and the CHW group (cod [*Gadus morhua*], haddock [*Melanogrammus aeglefinus*], and witch flounder (*Glyptocephalus cynoglossus*]). In addition, Atlantic mackerel (*Scomber scombrus*) eggs were collected at all stations. Of the 16 larva species identified, the most abundant were capelin and cunner, followed by radiated shanny (*Ulvaria subbifurcata*), Atlantic herring, fourbeard rockling (*Enchelyopus cimbrius*) and Atlantic mackerel. Temperature and salinity profiles according to depth were made at each station. All biological and oceanographic data were collected and compiled and are presented in the tables, figures, and appendices in this document. These data will be analyzed and published in a forthcoming report.

RÉSUMÉ

Grégoire, F., W. Barry, J.-J. Barry, J. Barry, C. Lévesque, J.-L. Beaulieu et M.-H. Gendron. 2011. West coast of Newfoundland capelin (*Mallotus villosus* M.) and Atlantic herring (*Clupea harengus harengus* L.) larval survey, part 7: Description of the data collected in partnership with the industry (Barry Group) in July 2008. Can. Data Rep. Fish. Aquat. Sci. 1235: vi + 27 pp.

En partenariat avec le Groupe Barry, un relevé larvaire a été réalisé sur la côte ouest de Terre-Neuve entre le 16 et le 18 juillet 2008. Ce relevé avait pour objectif de mesurer l'abondance des œufs et des larves des poissons échantillonnés à l'aide de filets à plancton. Un second objectif consistait à décrire la distribution spatiale des larves de poissons dont celles de deux espèces commerciales importantes, le capelan (*Mallotus villosus*) et le hareng (*Clupea harengus harengus*). Les deux plus abondants groupes d'œufs ont été CYT (tanche-tautogue [*Tautogolabrus adspersus*] et limande à queue jaune [*Limanda ferruginea*]) et CHW (morue [*Gadus morhua*], aiglefin [*Melanogrammus aeglefinus*] et plie grise [*Glyptocephalus cynoglossus*]). De plus, des œufs de maquereau bleu (*Scomber scombrus*) ont été récoltés à toutes les stations. Des 16 espèces de larves identifiées, les plus abondantes ont été celles du capelan et de la tanche-tautogue. Ces dernières ont été suivies de l'ulvaire deux-lignes (*Radiated shanny*), du hareng, de la motelle à quatre barbillons (*Enchelyopus cimbrus*) et du maquereau bleu. Des profils de la température et de la salinité de l'eau en fonction de la profondeur ont été réalisés à chaque station. Toutes les données biologiques et océanographiques recueillies ont été compilées et sont présentées dans les tableaux, figures et annexes du présent document. Ces données seront analysées et publiées dans un rapport à venir.

INTRODUCTION

In collaboration with the industry, larval surveys were carried out on the west coast of Newfoundland in July 2004, 2005, and 2007. The main objective of these surveys was to calculate the abundance of capelin (*Mallotus villosus*) and Atlantic herring (*Clupea harengus harengus*), two important species for this region's economy. Survey results (Grégoire et al. 2005, 2006, 2008) showed the presence of a large number of fish species. The study of their spatial distribution is now a second study objective. In 2004 and 2005, the survey area was located from south of Bonne Bay to Port-au-Port Bay (Figure 1). In 2007, the survey extended to St. George's Bay, which is one of the main fishing areas for pelagic fish on the west coast of Newfoundland.

A fourth larval survey conducted in July 2008 had the same sampling plan as in 2007. This report presents the physico-chemical data measured during the survey as well as the egg and larva counts from survey samples.

MATERIAL AND METHODS

The 2008 larval survey was conducted aboard the *Ocean Leader*, a large seiner from the west coast of Newfoundland. Egg and larva samples were collected using two bongo nets (Posgay and Marak 1980) with 61 cm openings and mesh size of 333 µm. The minimum tow duration was set at 10 minutes. The tows followed a saw-tooth pattern (Hempel 1973) between the surface and a maximum depth of 50 m, or down to 5 m off-bottom for shallower stations. Two flowmeters were fixed near the opening of the nets to measure the volume of water filtered. Once on deck, the nets were rinsed with sea water. Samples from one of the nets were kept in a formaldehyde solution (4–5%) (Hunter 1985) and the others in an ethanol solution (95%). A CTD (Sea-Bird SBE19) probe was placed on the frame holding the nets to obtain water salinity and temperature profiles. After validation, mean temperature and salinity were calculated for 2 m intervals between the surface and 20 m and 5 m intervals for depths exceeding 20 m.

The samples were analyzed in the Department of Fisheries and Oceans laboratory at Mont-Joli, Quebec, in the fall of 2008. To facilitate sorting, each sample was fractionated based on the Van Guelpen beaker technique (Van Guelpen et al. 1982). The egg and larva identification criteria were primarily from Fritzsche (1978), Elliott and Jimenez (1981), and Fahay (1983). Results from these analyses were recorded and validated.

RESULTS

Physical-chemical parameters

The survey was conducted between 16 and 18 July 2008. A total of 46 stations were sampled in the study area (Figure 2). Nets were damaged at Station 3, and technical problems with the CTD probe occurred at Stations 26 and 29. The position and depth of stations are presented in Table 1 along with the depth sampled, tow duration, and the volume of water filtered. Temperature profiles are presented in Appendix 1. Between 0 m and 12 m, the warmest temperatures were measured in St. George's Bay and near the coast between the Bay of Islands and Port-au-Port Bay (Figure 3). Water cooled rapidly beginning at 12 m, in particular near St. George's Bay.

Temperatures below 10°C were measured at depths of about 25 m (Table 2). Salinities increased slightly between the surface and the bottom except for the first stations sampled in the Bay of Islands (Table 3). For these stations, salinities were lower at the surface due to the freshwater input.

Egg and larval counts

Eggs were found at all stations sampled (Appendix 2). The most abundant were from the CYT and CHW groups. The CYT group is associated with cunner (*Tautogolabrus adspersus*) and yellowtail flounder (*Limanda ferruginea*) and the CHW group with cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), and witch flounder (*Glyptocephalus cynoglossus*). The third most abundant group was H4B, which includes hake (*Urophycis* spp.), fourbeard rockling (*Enchelyopus cimbrius*), and butterfish (*Peprilus triacanthus*). Mackerel eggs were found at all stations. Of these groups, development stages one and three (Girard, 2000) were the most abundant. Few American plaice (*Hippoglossoides platessoides*) and windowpane flounder (*Scophthalmus aquosus*) eggs were sampled during the survey.

Larvae from 16 species were collected, and the most abundant were from capelin and cunner (Appendix 3). These were followed by radiated shanny (*Ulvaria subbifurcata*), Atlantic herring, fourbeard rockling, and Atlantic mackerel. Broken and unidentifiable larvae were sampled on a few occasions. These egg and larva abundance data will be analyzed in detail in a forthcoming document.

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Table 1. Description of the stations and tows completed during the capelin and Atlantic herring larval survey of July 2008.

STATION NUMBER	DATE (yyyy/mm/dd)	TIME (hh:mm) (NDT)	LONGITUDE °W (degrees minutes)	LATITUDE °N (degrees minutes)	DEPTH Station bottom (m)	DEPTH Maximum sampled (m)	TOW DURATION (mm:ss)	VOLUME OF WATER FILTERED (m^3)
1	2008/07/16	11:51	58° 12'	49° 09'	125	39	11:47	513
2	2008/07/16	12:33	58° 12'	49° 12'	185	65	15:48	558
3*	2008/07/16	18:26	58° 12'	49° 27'	31	27	10:10	---
4	2008/07/16	17:33	58° 12'	49° 33'	60	48	13:36	473
5	2008/07/18	18:25	58° 18'	49° 06'	54	37	12:45	453
6	2008/07/16	13:21	58° 18'	49° 11'	137	60	18:50	653
7	2008/07/16	14:29	58° 18'	49° 15'	79	39	14:29	410
8	2008/07/16	15:18	58° 18'	49° 20'	29	27	10:39	422
9	2008/07/16	19:24	58° 18'	49° 27'	56	46	11:08	389
10	2008/07/16	21:25	58° 24'	49° 11'	58	38	10:43	391
11	2008/07/16	20:48	58° 24'	49° 15'	32	17	10:41	425
12	2008/07/16	15:56	58° 24'	49° 20'	45	28	10:53	433
13	2008/07/18	14:56	58° 30'	49° 03'	43	28	10:52	404
14	2008/07/18	17:16	58° 30'	49° 07'	87	51	13:35	221
15	2008/07/18	16:23	58° 30'	49° 12'	69	46	12:32	206
16	2008/07/18	11:55	58° 36'	48° 51'	38	27	11:50	441
17	2008/07/18	13:33	58° 36'	48° 57'	30	22	10:21	389
18	2008/07/18	14:19	58° 36'	49° 03'	42	28	11:34	418
19	2008/07/18	15:39	58° 36'	49° 07'	60	39	12:58	408
20	2008/07/18	8:43	58° 42'	48° 39'	27	20	10:31	401
21	2008/07/18	9:32	58° 42'	48° 45'	25	18	10:08	391
22	2008/07/18	11:19	58° 42'	48° 51'	14	8	10:20	395
23	2008/07/18	12:51	58° 42'	48° 57'	28	20	11:05	428
24	2008/07/18	8:02	58° 48'	48° 36'	20	18	10:48	427
25	2008/07/18	7:31	58° 48'	48° 39'	16	15	10:08	405
26	2008/07/18	6:59	58° 48'	48° 42'	15	10	10:12	396
27	2008/07/17	21:00	58° 48'	48° 48'	23	15	10.06	381
28	2008/07/18	10:43	58° 48'	48° 51'	40	29	11:50	430
29	2008/07/18	6:14	58° 54'	48° 39'	14	10	10:15	398
30	2008/07/17	20:21	58° 54'	48° 45'	25	16	10:51	402
31	2008/07/17	19:16	59° 06'	48° 39'	35	21	10:59	406
32	2008/07/17	17:58	59° 18'	48° 30'	52	34	12:07	358
33	2008/07/17	15:48	59° 06'	48° 28'	66	45	13:52	223
34	2008/07/17	14:07	58° 54'	48° 28'	66	39	12:40	264
35	2008/07/17	13:08	58° 42'	48° 30'	20	11	10:24	396
36	2008/07/17	12:31	58° 36'	48° 30'	35	19	10:40	412
37	2008/07/17	11:56	58° 36'	48° 27'	80	47	13:59	453
38	2008/07/17	16:58	59° 12'	48° 24'	85	52	13:32	203
39	2008/07/17	14:54	59° 00'	48° 24'	90	42	14:05	225
40	2008/07/17	10:35	58° 48'	48° 24'	40	27	11:43	344
41	2008/07/17	11:14	58° 42'	48° 24'	40	29	11:47	440
42	2008/07/17	6:26	59° 06'	48° 18'	97	50	14:10	171
43	2008/07/17	9:07	58° 54'	48° 18'	100	46	13:37	429
44	2008/07/17	9:48	58° 48'	48° 18'	40	25	11:37	438
45	2008/07/17	7:42	59° 00'	48° 12'	77	47	13:00	457
46	2008/07/17	8:25	58° 54'	48° 13'	22	15	11:04	425

* Damaged nets

Table 2. Mean water temperature (°C) by depth interval (m) for the stations sampled during the capelin and Atlantic herring larval survey of July 2008.

DEPTH	STATION																						
(m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0-2	16.68	17.38	16.27	13.82	16.40	14.99	14.87	15.87	14.17	14.61	15.21	14.63	15.60	15.34	14.49	15.10	14.91	15.51	15.02	16.81	16.30	14.63	14.67
2-4	15.08	16.24	16.04	13.78	15.77	14.64	14.68	14.42	13.89	14.48	15.14	14.53	15.40	15.14	14.37	15.02	14.83	15.29	14.83	16.79	16.15	14.51	14.47
4-6	14.62	15.33	15.52	13.67	14.73	14.30	14.28	13.66	13.46	14.15	14.68	14.21	15.26	14.96	14.29	14.95	14.78	15.18	14.72	16.74	16.00	14.43	14.42
6-8	13.87	14.15	14.66	13.50	14.57	14.07	13.97	13.53	13.28	14.03	13.97	13.92	15.24	14.58	14.28	14.92	14.73	14.61	14.27	16.61	15.87	14.39	14.40
8-10	13.69	13.97	13.68	13.34	14.23	14.00	13.77	13.44	13.25	14.00	13.55	13.85	15.22	14.27	14.26	14.86	14.71	14.45	13.96	15.77	15.70	14.33	14.38
10-12	13.72	13.69	13.46	13.27	14.07	13.92	13.63	13.38	13.24	13.93	13.44	13.82	15.20	13.90	14.26	14.71	14.69	14.40	13.81	14.36	15.41		14.33
12-14	13.75	13.54	13.41	13.20	13.81	13.81	13.60	13.33	13.20	13.82	13.40	13.78	15.18	13.75	14.30	14.57	14.64	14.27	13.72	13.05	14.82		14.16
14-16	13.77	13.52	13.37	13.06	13.68	13.77	13.58	13.28	13.15	13.66	13.38	13.76	15.13	13.64	14.32	14.39	14.47	14.11	13.68	11.85	14.37		13.96
16-18	13.72	13.47	13.33	12.75	13.47	13.76	13.58	13.27	13.12	13.60	13.36	13.73	14.99	13.55	14.09	14.07	14.31	13.99	13.59	10.99	13.89		13.73
18-20	13.63	13.42	13.31	11.90	13.22	13.66	13.56	13.15	13.00	13.56		13.67	14.46	13.50	13.54	13.89	14.19	13.90	13.54	10.06			13.64
20-25	13.40	12.85	13.19	11.45	12.90	13.53	13.47	12.88	12.08	13.37		13.39	14.12	13.23	11.85	13.51	14.04	13.68	13.28				13.56
25-30	12.59	12.06	11.95	11.07	10.94	12.84	13.17	12.03	9.56	12.05		12.64	13.75	11.89	7.73	12.73		10.90	10.46				
30-35	11.77	10.87	7.60	10.32	6.05	11.52	11.68		7.79	10.49				9.67	4.45				8.00				
35-40	11.47	9.17		9.21	5.16	9.56	9.71		6.38	8.93				6.20	3.80				5.94				
40-45		7.68		7.07		6.53			5.19					3.19	3.27								
45-50		5.69		2.64		3.69			4.51					1.91	2.86								
50-55		2.61				2.33								0.64									
55-60		1.31				1.51																	
60-65		0.89				1.07																	
65-70		0.74																					

Table 2. (Continued).

DEPTH	STATION																						
(m)	24	25	26*	27	28	29*	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
0-2	15.64	16.26		14.77	14.53		14.81	14.83	14.57	18.47	18.50	17.92	17.24	16.16	15.82	17.28	16.29	16.38	16.06	15.72	15.95	15.66	16.11
2-4	15.64	16.22		14.68	14.48		14.79	14.76	14.41	16.89	17.92	17.78	17.19	15.83	15.60	16.50	16.06	16.05	15.91	15.61	15.87	15.58	14.89
4-6	15.55	16.12		14.39	14.46		14.57	14.67	14.30	16.16	16.78	16.89	16.80	15.50	15.50	15.73	15.52	15.35	15.29	15.56	15.18	15.18	14.40
6-8	15.39	15.78		14.05	14.41		14.28	14.59	14.25	14.96	15.46	15.64	16.15	15.38	15.35	14.91	15.10	14.64	13.66	15.21	14.53	14.77	14.24
8-10	14.65	15.21		13.94	14.35		14.20	14.56	14.19	13.73	14.79	15.26	15.70	15.27	14.90	13.91	14.68	14.42	13.21	14.58	14.39	14.52	14.18
10-12	13.77	14.49		13.89	14.25		14.17	14.35	14.07	13.50	14.58	15.12	15.50	14.93	14.74	12.95	13.43	14.24	13.16	14.25	14.25	14.19	14.11
12-14	13.35	13.52		13.82	14.01		14.13	13.93	13.86	13.46	14.19		15.22	14.71	14.12	11.97	12.62	14.15	13.09	13.31	14.01	13.93	14.07
14-16	13.02	12.65		13.75	13.78		14.10	13.55	13.69	13.03	12.88		14.78	14.55	12.82	11.20	12.18	13.92	13.07	12.59	13.29	13.80	13.90
16-18	12.45				13.60			13.42	13.61	12.42	11.82		14.42	14.38	11.87	9.94	11.88	13.57	12.48	12.41	12.55	13.64	
18-20	12.14				12.88			13.27	13.53	11.65	10.97		14.03	13.99	10.98	9.20	11.54	12.99	11.83	12.04	11.88	13.31	
20-25					11.15			12.69	13.23	9.67	9.54			12.58	9.71	8.33	10.55	12.37	10.40	11.18	11.02	12.00	
25-30					8.42				12.54	7.51	6.85			7.25	7.36	7.64	8.08	10.91	8.01	9.33		5.33	
30-35									9.33	4.23	4.23			2.52	5.15	5.91			6.05	5.87		1.38	
35-40										2.10	2.70			1.43	3.62	3.74			4.79	3.85		0.68	
40-45										1.08				0.84	2.32	2.41			3.25	2.21		0.28	
45-50														0.62	1.56				2.17	1.43		0.09	
50-55															1.16				1.28				
55-60																							
60-65																							
65-70																							

* Malfunction of the CTD probe

Table 3. Mean water salinity by depth interval (m) for the stations sampled during the capelin and Atlantic herring larval survey of July 2008.

DEPTH	STATION																						
(m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
0-2	27.55	27.02	28.90	31.21	29.71	30.61	31.04	29.96	31.18	31.01	31.07	30.95	31.04	31.02	31.14	31.04	31.07	31.05	31.10	31.19	31.09	31.05	31.04
2-4	29.29	27.76	29.18	31.21	30.12	30.78	31.05	30.71	31.18	31.01	31.07	31.09	31.02	31.02	31.15	31.05	31.08	31.05	31.06	31.19	31.10	31.05	31.09
4-6	30.18	28.96	29.59	31.15	30.79	31.00	31.07	31.09	31.18	31.01	31.07	31.11	31.02	31.03	31.15	31.05	31.08	31.05	31.06	31.19	31.10	31.05	31.09
6-8	30.89	30.77	30.24	31.14	30.90	31.03	31.10	31.10	31.19	31.02	31.09	31.09	31.02	31.04	31.17	31.05	31.08	31.07	31.07	31.17	31.10	31.06	31.09
8-10	30.99	30.98	30.89	31.14	30.97	31.04	31.10	31.10	31.20	31.03	31.12	31.09	31.02	31.06	31.17	31.06	31.08	31.09	31.06	31.21	31.09	31.06	31.09
10-12	31.00	31.09	31.03	31.15	31.00	31.02	31.10	31.11	31.20	31.04	31.12	31.09	31.02	31.06	31.20	31.06	31.08	31.10	31.07	31.22	31.08		31.09
12-14	31.03	31.10	31.05	31.15	31.03	31.00	31.11	31.13	31.21	31.04	31.12	31.09	31.02	31.07	31.22	31.06	31.07	31.10	31.08	31.27	31.07		31.09
14-16	31.05	31.09	31.07	31.13	31.04	31.00	31.11	31.13	31.22	31.05	31.12	31.09	31.02	31.08	31.23	31.07	31.06	31.11	31.10	31.34	31.07		31.09
16-18	31.06	31.09	31.07	31.13	31.06	31.02	31.11	31.17	31.22	31.06	31.13	31.09	31.03	31.07	31.23	31.06	31.06	31.11	31.10	31.38	31.08		31.09
18-20	31.06	31.09	31.07	31.14	31.07	31.04	31.11	31.18	31.21	31.06		31.10	31.05	31.08	31.14	31.08	31.06	31.11	31.10	31.46			31.10
20-25	31.07	31.11	31.08	31.16	31.09	31.06	31.11	31.25	31.19	31.07		31.11	31.09	31.09	31.15	31.09	31.06	31.12	31.10				31.06
25-30	31.10	31.12	31.15	31.17	31.84	31.10	31.12	31.39	31.26	31.13		31.14	31.12	31.16	31.41	31.16		31.22	31.26				
30-35	31.13	31.17	31.68	31.20	32.43	31.16	31.16		31.48	31.23				31.28	31.75				31.42				
35-40	31.15	31.22		31.31	32.81	31.26	31.31		31.60	31.32				31.63	31.80				31.66				
40-45		31.35		31.54		31.53			31.80					31.88	31.84								
45-50		31.56		32.03		31.82			31.77					32.04	31.86								
50-55		31.84				31.99								32.15									
55-60		31.96				32.06																	
60-65		31.95				32.21																	
65-70		31.96																					

Table 3. (Continued).

DEPTH	STATION																						
(m)	24	25	26*	27	28	29*	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
0-2	31.20	31.18		31.04	31.07		31.00	30.99	30.94	30.68	30.31	30.04	30.18	31.00	30.78	30.80	30.97	30.93	30.87	31.10	31.08	31.13	30.86
2-4	31.19	31.18		31.04	31.08		31.00	30.98	30.93	30.75	30.33	30.10	30.20	31.02	30.73	30.88	30.98	30.98	30.89	31.08	31.08	31.13	31.02
4-6	31.20	31.18		31.03	31.08		31.01	30.97	30.92	30.96	30.64	30.50	30.45	31.06	30.74	31.02	31.05	31.05	30.94	31.08	31.11	31.13	31.09
6-8	31.20	31.19		31.03	31.08		31.02	30.96	30.92	31.08	31.00	30.94	30.81	31.07	30.76	31.11	31.10	31.08	30.95	31.09	31.13	31.08	31.10
8-10	31.20	31.17		31.03	31.09		31.02	30.96	30.92	30.95	31.11	31.02	30.99	31.08	30.81	31.13	31.14	31.09	30.97	31.08	31.13	31.07	31.10
10-12	31.19	31.15		31.03	31.09		31.02	30.95	30.93	30.97	31.13	31.04	31.02	31.12	30.83	31.14	31.15	31.09	30.98	31.10	31.14	31.08	31.10
12-14	31.23	31.19		31.03	31.08		31.02	30.97	30.94	31.01	31.16		31.05	31.13	30.89	31.14	31.18	31.10	31.07	31.16	31.13	31.08	31.10
14-16	31.26	31.25		31.04	31.09		31.02	30.98	30.94	31.06	31.18		31.03	31.14	31.03	31.21	31.18	31.14	31.09	31.17	31.18	31.08	31.10
16-18	31.26				31.10			31.01	30.95	31.11	31.22		31.13	31.13	31.12	31.24	31.19	31.13	31.17	31.18	31.19	31.09	
18-20	31.15				31.14			31.01	30.95	31.18	31.22		31.13	31.13	31.16	31.33	31.21	31.18	31.16	31.21	31.23	31.11	
20-25					31.18			31.07	30.95	31.26	31.29			31.15	31.25	31.34	31.27	31.21	31.23	31.25	31.26	31.19	
25-30					31.47				31.01	31.39	31.46			31.47	31.43	31.39	31.40	31.31	31.37	31.34		31.70	
30-35									31.35	31.67	31.68			31.92	31.60	31.52			31.52	31.55		32.05	
35-40										31.93	31.85			32.06	31.79	31.73			31.66	31.77		32.13	
40-45										32.03				32.09	31.91	31.84			31.82	31.93		32.17	
45-50														32.12	32.06				31.93	32.00		32.19	
50-55															32.21				32.04				
55-60																							
60-65																							
65-70																							

* Malfunction of the CTD probe

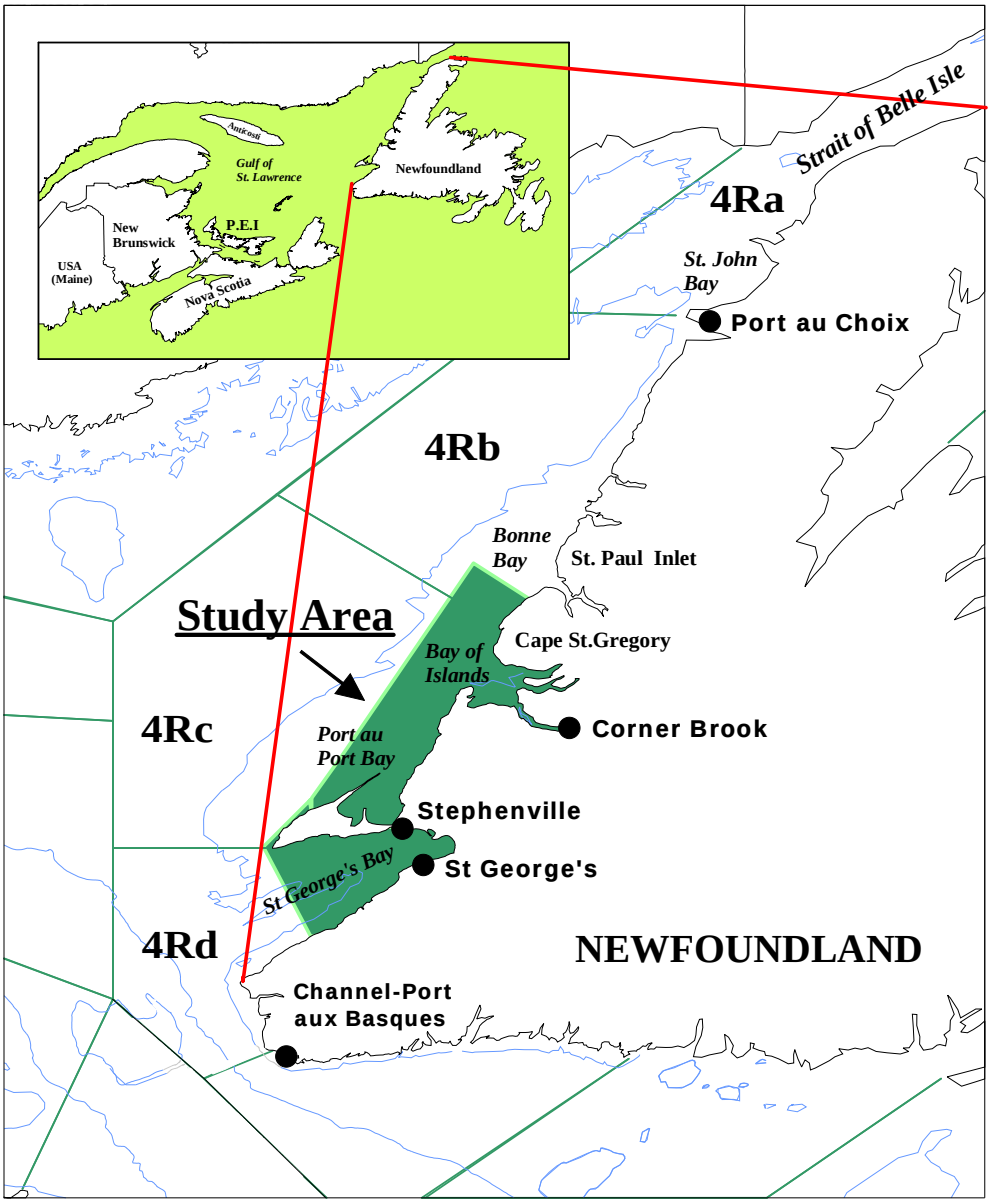


Figure 1. Map of the west coast of Newfoundland showing the study area and the other locations mentioned in the document.

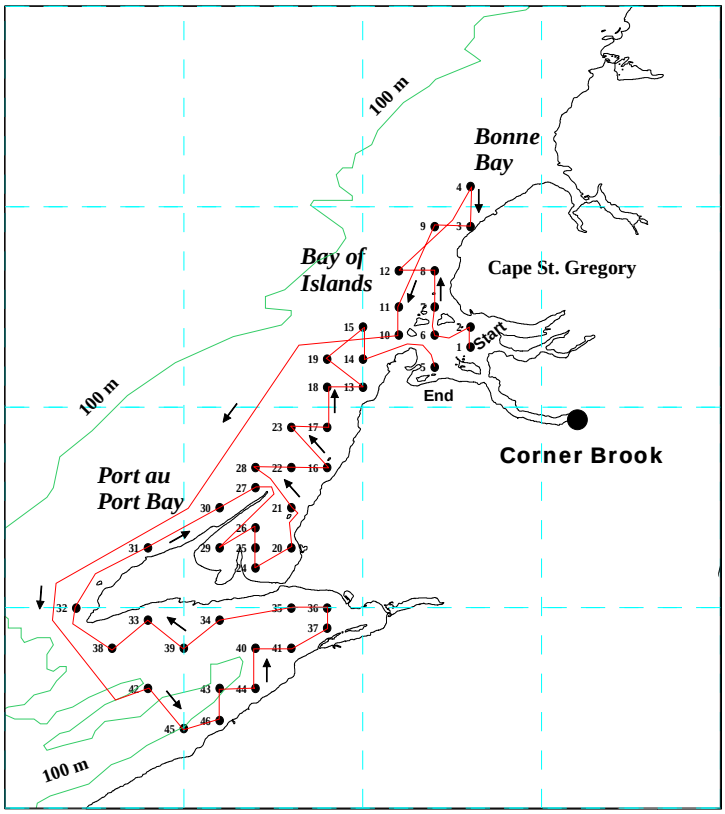


Figure 2. Map of the 46-station sampling grid of the capelin and Atlantic herring larval survey of July 2008.

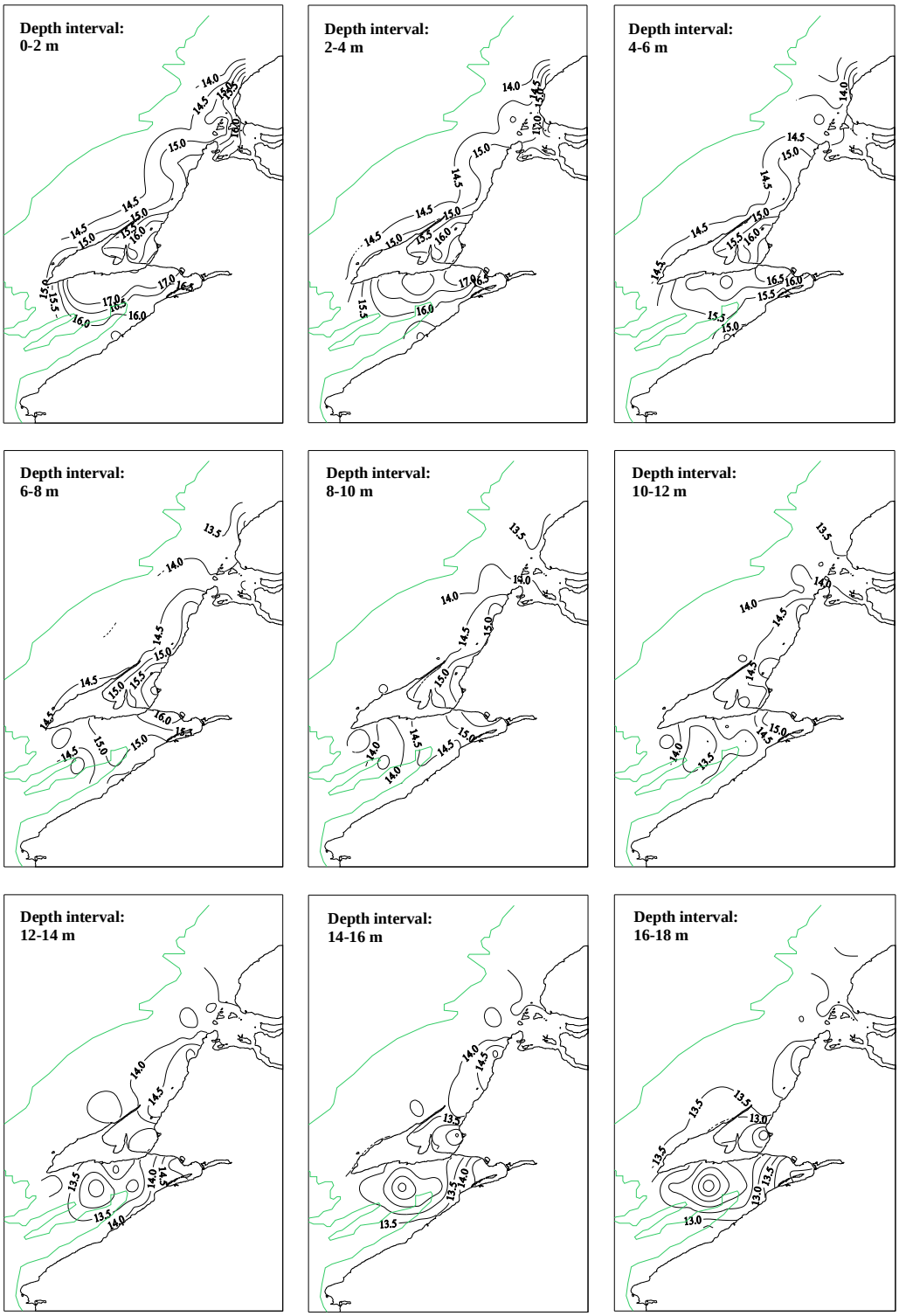


Figure 3. Mean water temperature (°C) by depth intervals of 2 m from 0 m to 20 m and intervals of 5 m between 20 m and 55 m.

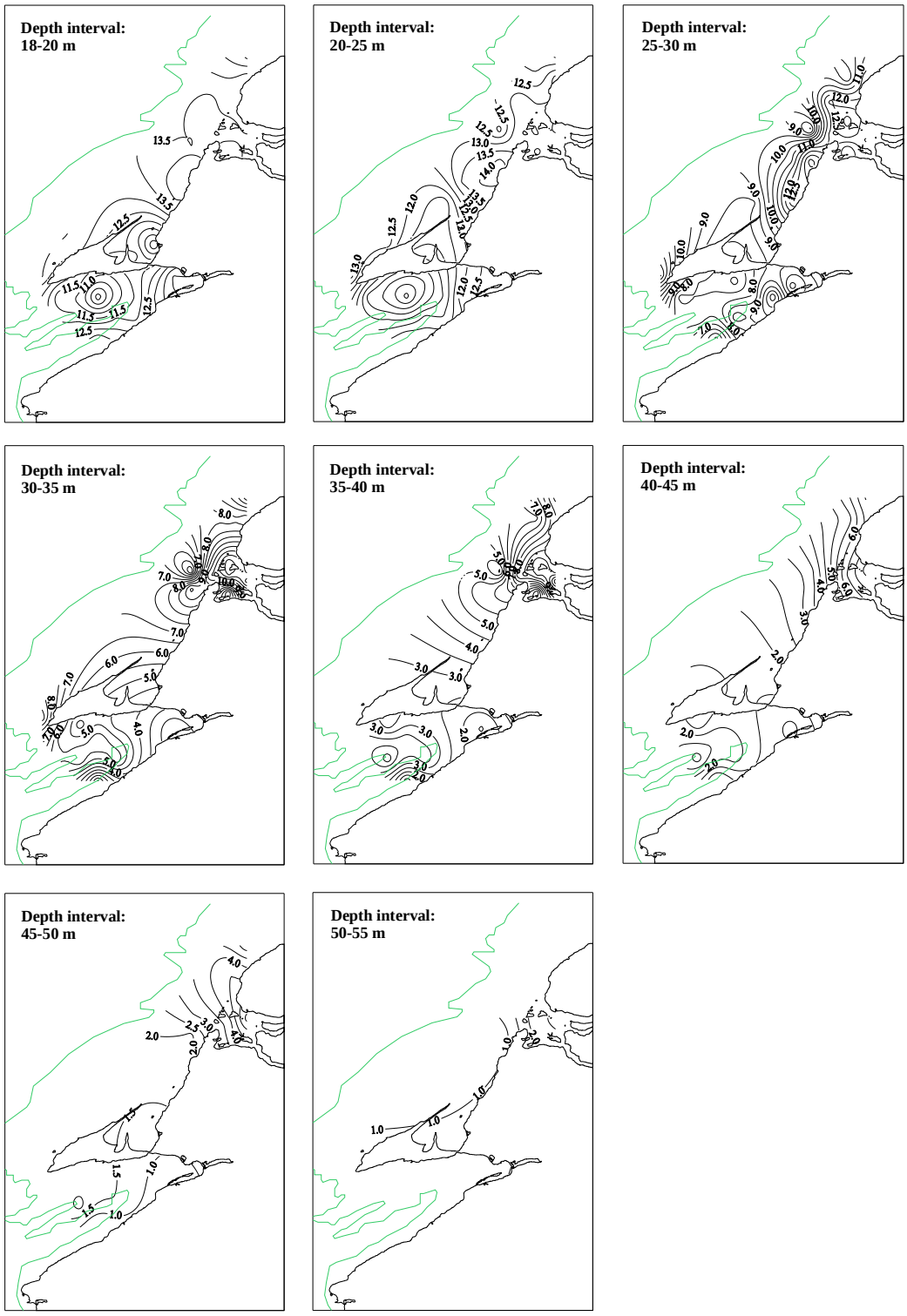
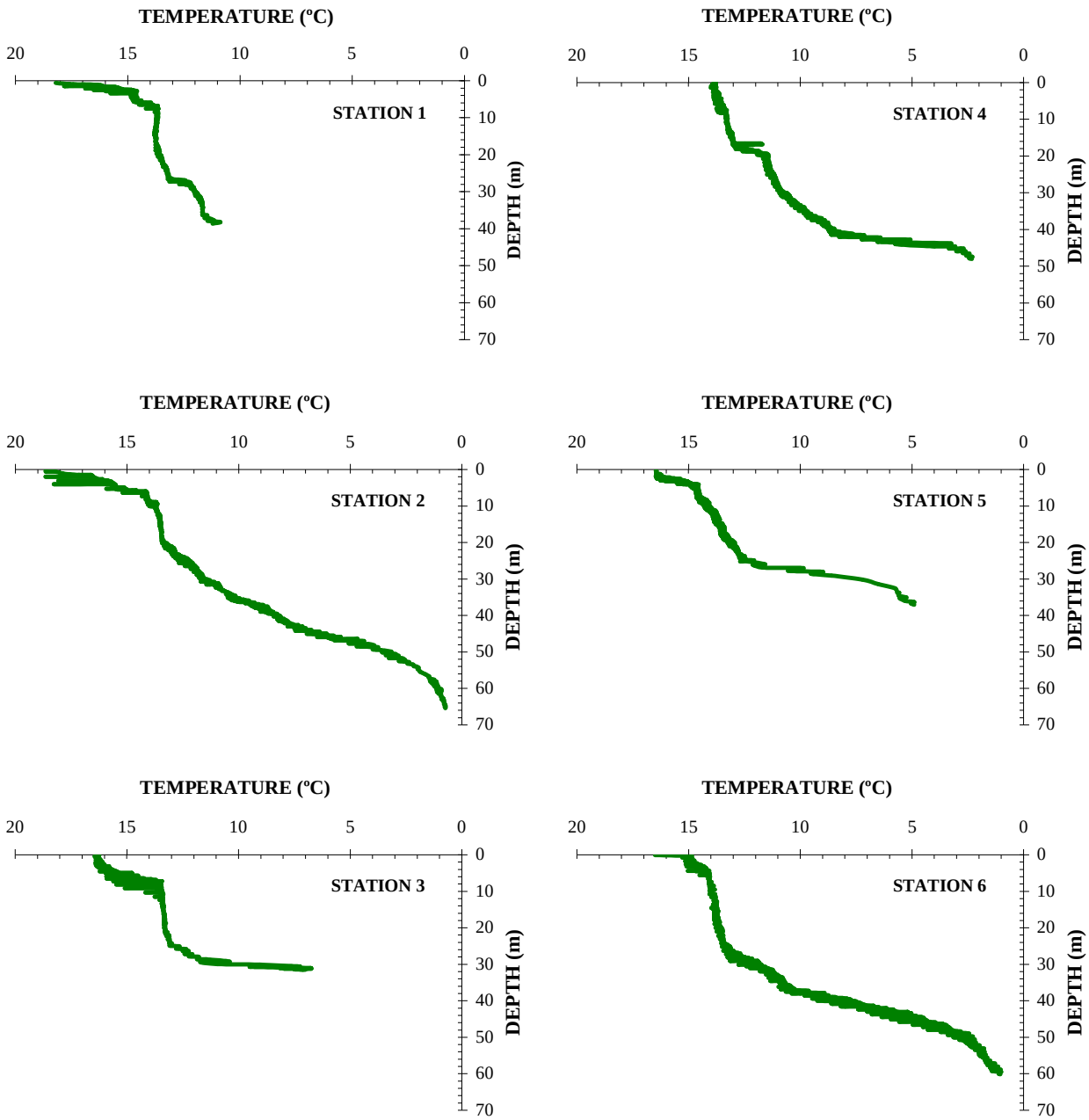
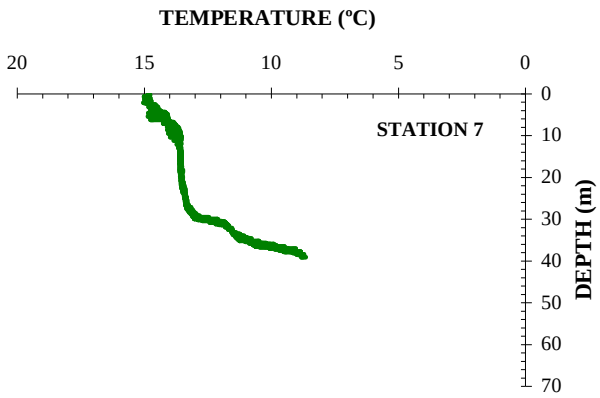
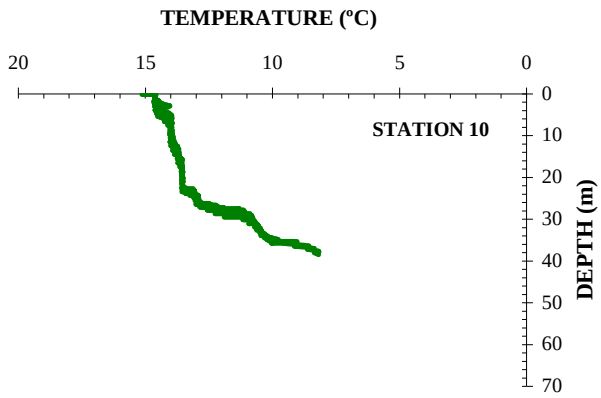


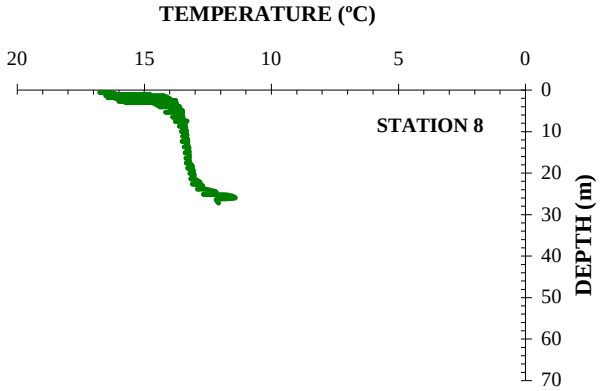
Figure 3. (Continued).

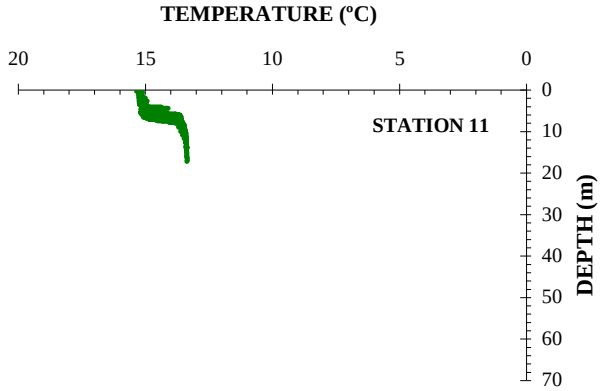
Appendix 1. Temperature profiles for stations sampled during the capelin and Atlantic herring larval survey of July 2008 on the west coast of Newfoundland.

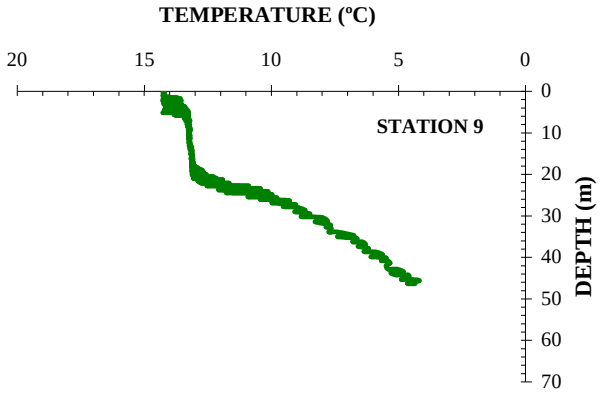

TEMPERATURE (ºC)
20 15 10 5 0
STATION 1
STATION 2
STATION 3
STATION 4
STATION 5
STATION 6
0 10 20 30 40 50 60 70
DEPTH (m)

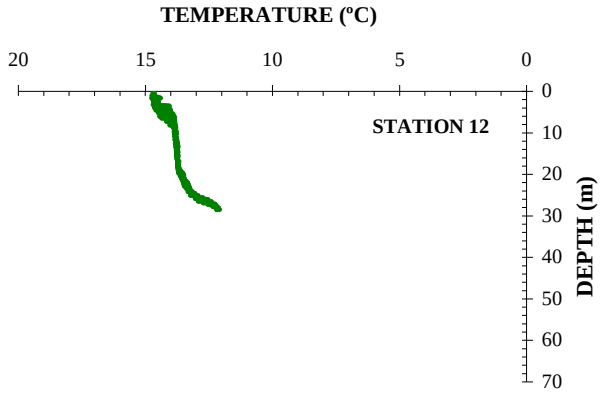

TEMPERATURE (ºC)
20
15
10
5
0
STATION 7
0
10
20
30
40
50
60
70
DEPTH (m)

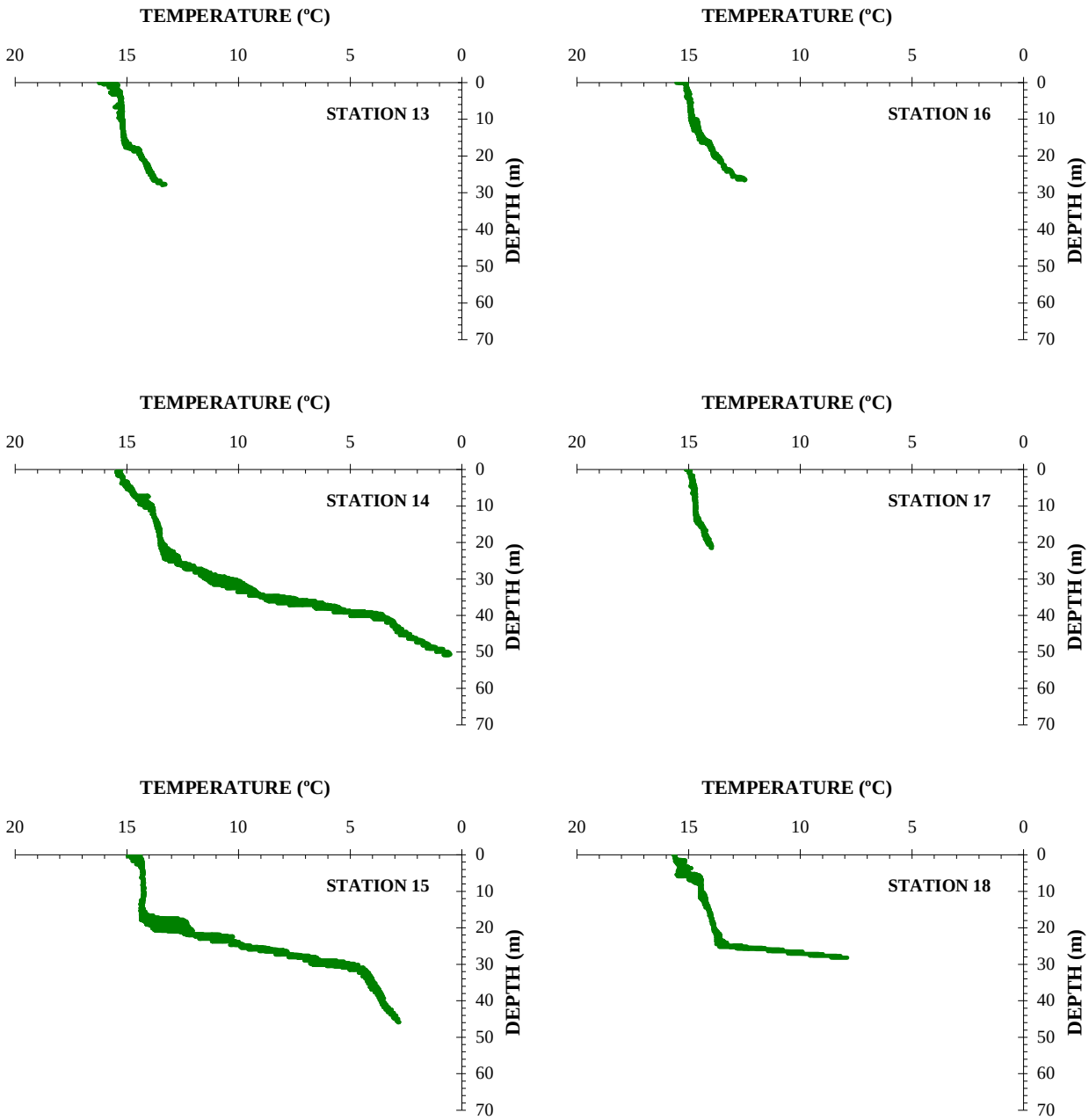

TEMPERATURE (ºC)
20
15
10
5
0
STATION 10
0
10
20
30
40
50
60
70
DEPTH (m)

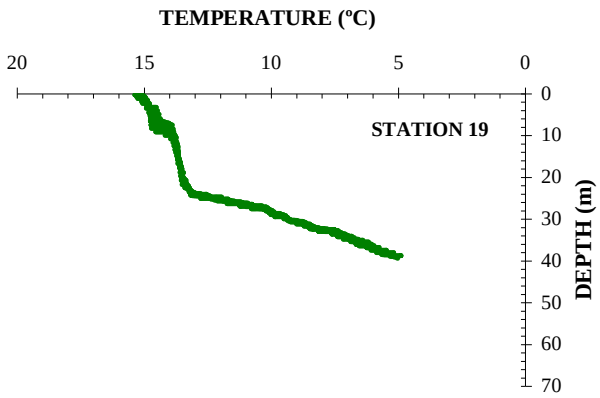

TEMPERATURE (ºC)
20
15
10
5
0
STATION 8
0
10
20
30
40
50
60
70
DEPTH (m)

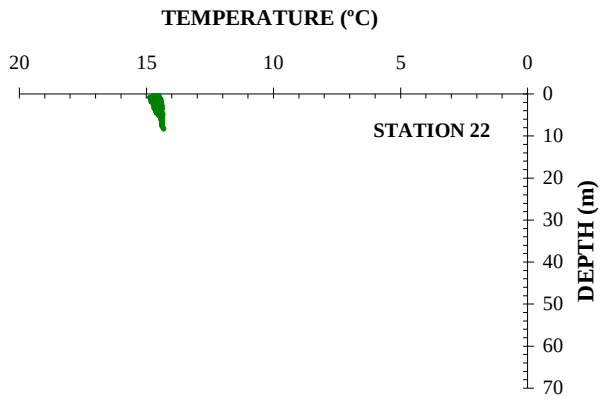

TEMPERATURE (ºC)
20
15
10
5
0
STATION 11
0
10
20
30
40
50
60
70
DEPTH (m)

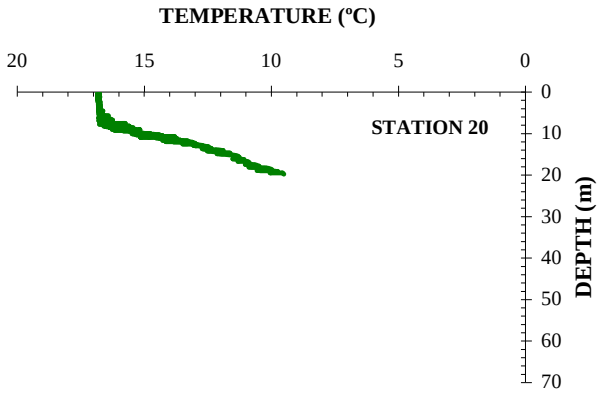

TEMPERATURE (ºC)
20
15
10
5
0
STATION 9
0
10
20
30
40
50
60
70
DEPTH (m)

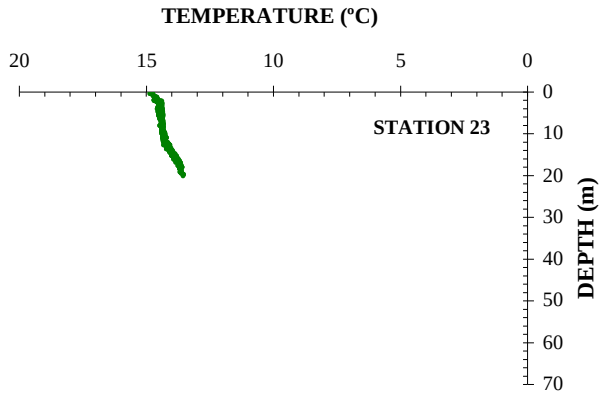

TEMPERATURE (ºC)
20
15
10
5
0
STATION 12
0
10
20
30
40
50
60
70
DEPTH (m)

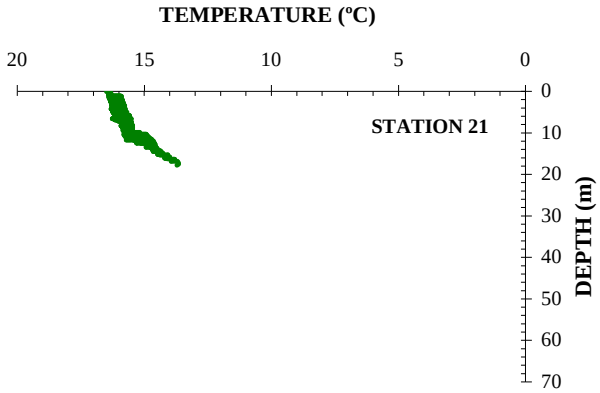

TEMPERATURE (ºC)
20 15 10 5 0
STATION 13
STATION 14
STATION 15
STATION 16
STATION 17
STATION 18
0 10 20 30 40 50 60 70
DEPTH (m)

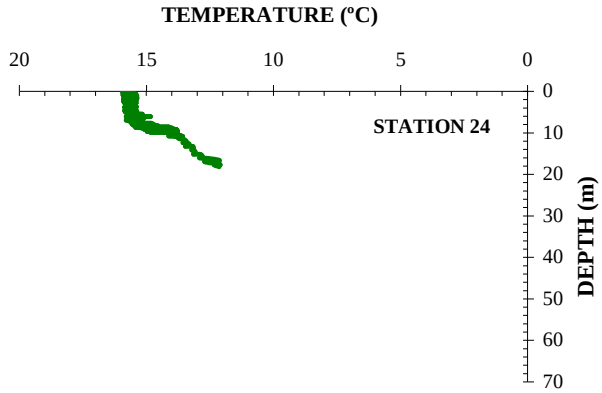

TEMPERATURE (ºC)
20
15
10
5
0
STATION 19
DEPTH (m)
0
10
20
30
40
50
60
70

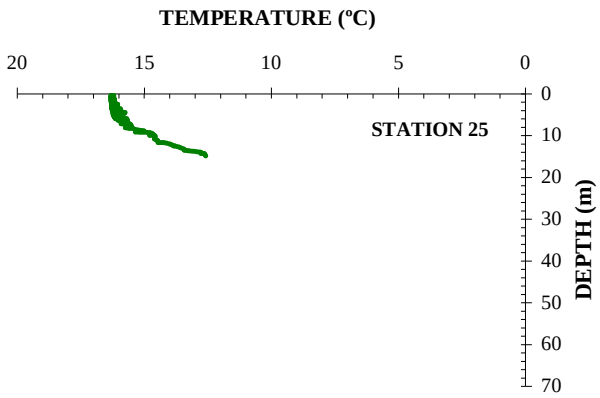

TEMPERATURE (ºC)
20
15
10
5
0
STATION 22
DEPTH (m)
0
10
20
30
40
50
60
70

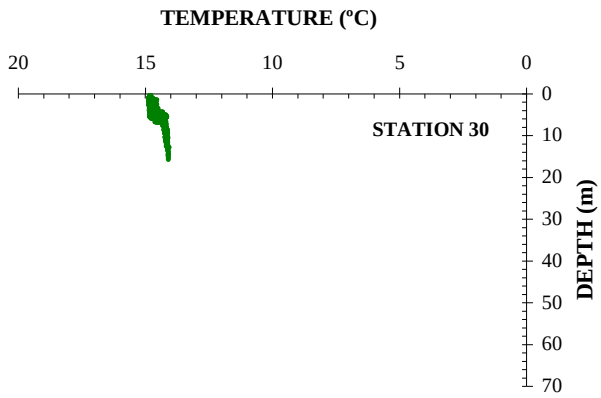

TEMPERATURE (ºC)
20
15
10
5
0
STATION 20
DEPTH (m)
0
10
20
30
40
50
60
70

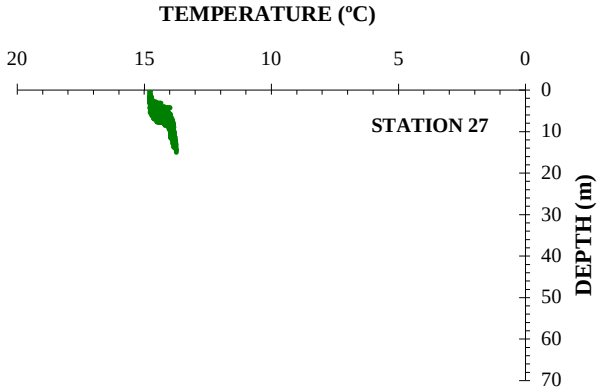

TEMPERATURE (ºC)
20
15
10
5
0
STATION 23
DEPTH (m)
0
10
20
30
40
50
60
70

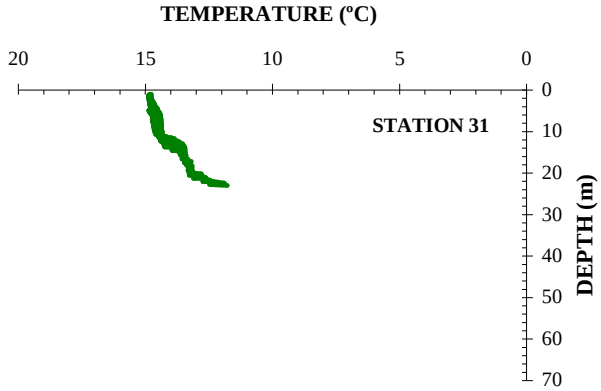

TEMPERATURE (ºC)
20
15
10
5
0
STATION 21
DEPTH (m)
0
10
20
30
40
50
60
70

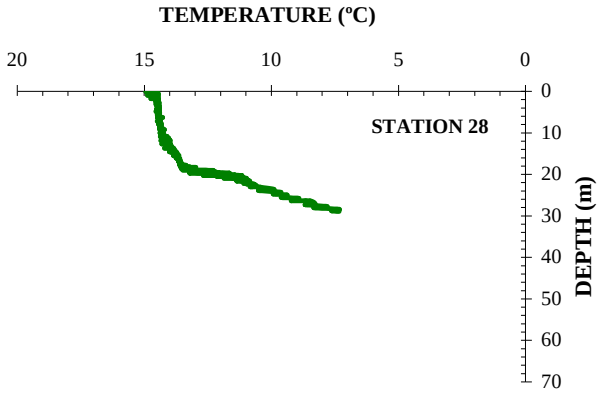

TEMPERATURE (ºC)
20
15
10
5
0
STATION 24
DEPTH (m)
0
10
20
30
40
50
60
70

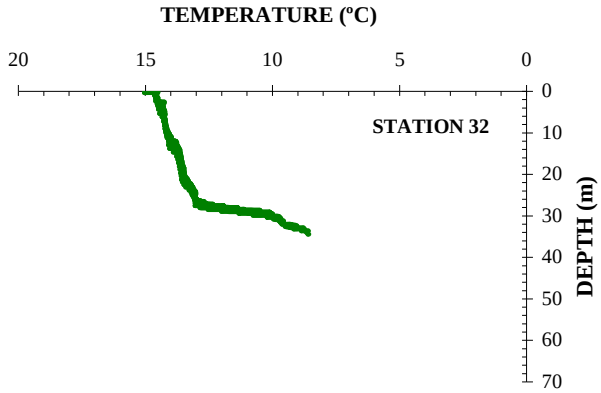

TEMPERATURE (ºC)
20
15
10
5
0
STATION 25
0
10
20
30
40
50
60
70
DEPTH (m)

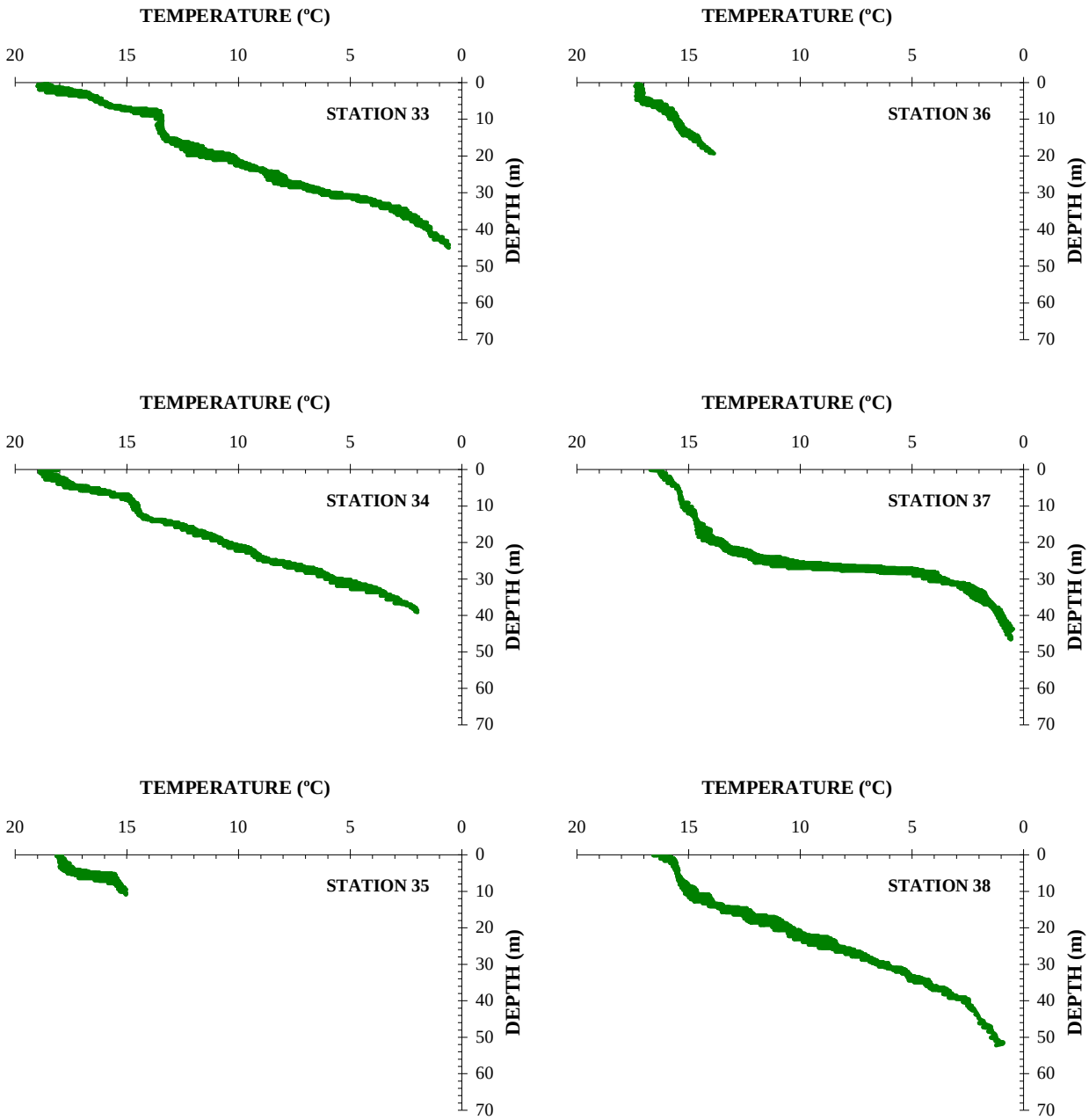

TEMPERATURE (ºC)
20
15
10
5
0
STATION 30
0
10
20
30
40
50
60
70
DEPTH (m)

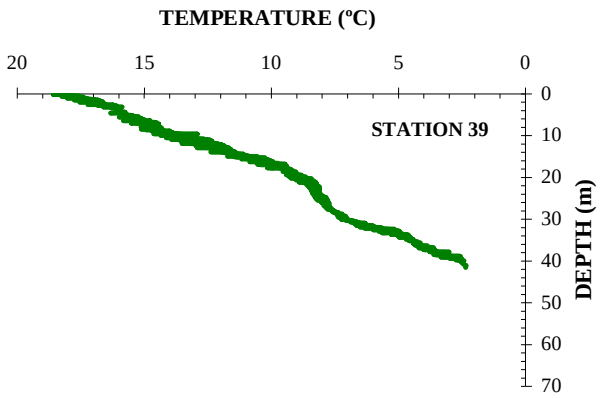

TEMPERATURE (ºC)
20
15
10
5
0
STATION 27
0
10
20
30
40
50
60
70
DEPTH (m)

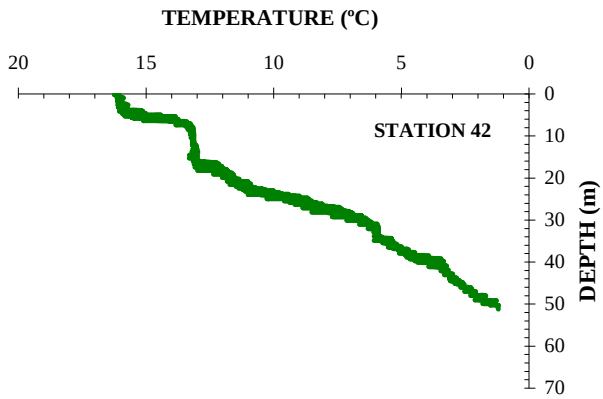

TEMPERATURE (ºC)
20
15
10
5
0
STATION 31
0
10
20
30
40
50
60
70
DEPTH (m)


TEMPERATURE (ºC)
20
15
10
5
0
STATION 28
0
10
20
30
40
50
60
70
DEPTH (m)


TEMPERATURE (ºC)
20
15
10
5
0
STATION 32
0
10
20
30
40
50
60
70
DEPTH (m)


TEMPERATURE (ºC)
20 15 10 5 0
STATION 33
STATION 36
STATION 34
STATION 37
STATION 35
STATION 38
0 10 20 30 40 50 60 70
DEPTH (m)


TEMPERATURE (ºC)
20
15
10
5
0
STATION 39
0
10
20
30
40
50
60
70
DEPTH (m)


TEMPERATURE (ºC)
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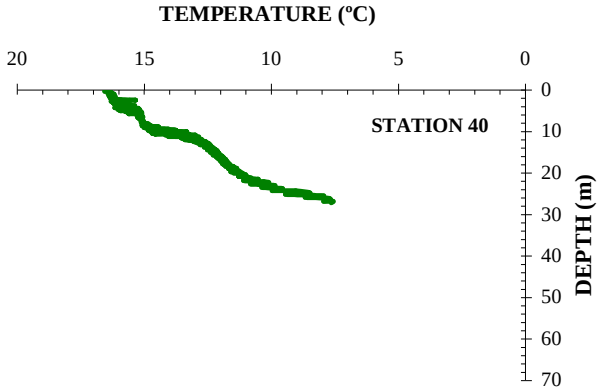
15
10
5
0
STATION 42
0
10
20
30
40
50
60
70
DEPTH (m)


TEMPERATURE (ºC)
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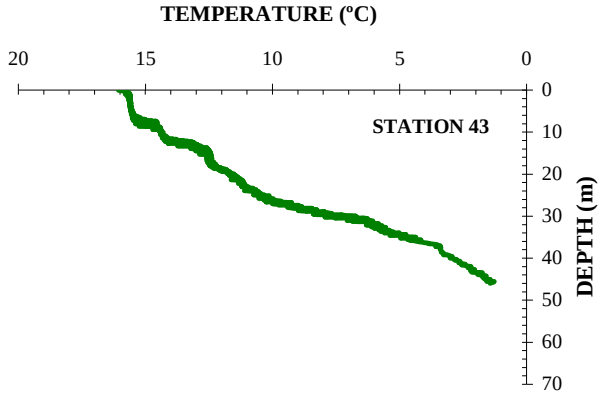
15
10
5
0
STATION 40
0
10
20
30
40
50
60
70
DEPTH (m)


TEMPERATURE (ºC)
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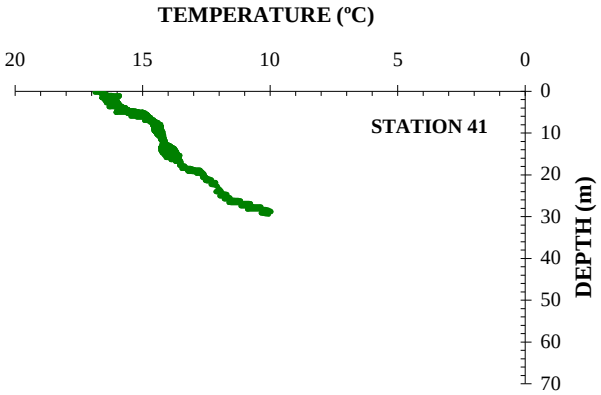
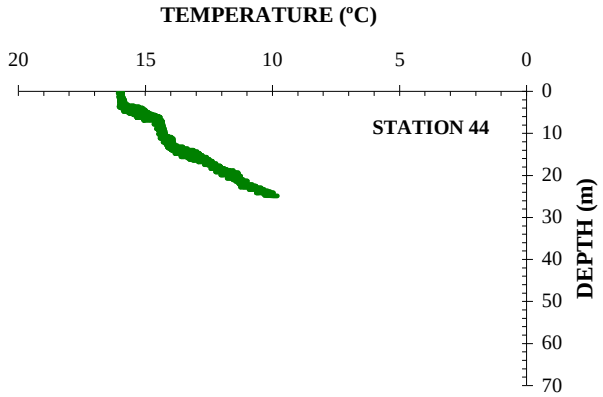
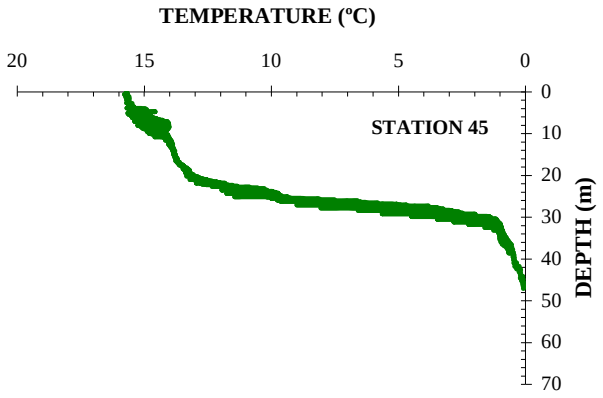
15
10
5
0
STATION 43
0
10
20
30
40
50
60
70
DEPTH (m)


TEMPERATURE (ºC)
20
15
10
5
0
STATION 41
0
10
20
30
40
50
60
70
DEPTH (m)


TEMPERATURE (ºC)
20
15
10
5
0
STATION 44
0
10
20
30
40
50
60
70
DEPTH (m)


TEMPERATURE (ºC)
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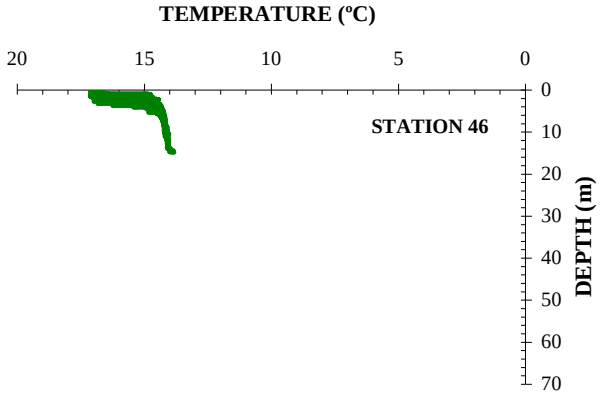
15
10
5
0
STATION 45
0
10
20
30
40
50
60
70
DEPTH (m)


TEMPERATURE (ºC)
20
15
10
5
0
STATION 46
0
10
20
30
40
50
60
70
DEPTH (m)

Appendix 2. Volume of the plankton sample (mL) and number of eggs sorted and identified from samples collected during the capelin and Atlantic herring larval survey of July 2008 on the west coast of Newfoundland. Egg codes are as follows: H4B = hake (*Urophycis* spp.), fourbeard rockling (*Enchelyopus cimbrius*), and butterfish (*Peprilus triacanthus*); CHW = cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus)*, and witch flounder (*Glyptocephalus cynoglossus*); CYT = cunner (*Tautogolabrus adspersus*) and yellowtail flounder (*Limanda ferruginea*).

Descriptions and pictures of mackerel eggs are found in Girard (2000).

Station	Sample volume (mL)	Eggs (n)									
		Mackerel					H4B	CHW	CYT	American plaice	Windowpane flounder
		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5				*(Hippoglossoides platessoides)*	*(Scophthalmus aquosus)*
1	275	28	40	236	44	52	0	24	4 864	4	0
2	350	28	48	124	48	28	0	36	1 656	0	0
3*	---	---	---	---	---	---	---	---	---	---	---
4	180	45	2	7	0	7	4	400	4	0	0
5	240	17	2	26	21	5	20	32	7 680	6	2
6	160	24	0	104	96	8	32	104	2 584	0	0
7	140	120	88	152	88	56	0	40	7 168	0	0
8	150	108	8	34	20	8	64	184	1 248	2	0
9	70	93	5	2	1	0	0	496	0	0	0
10	180	18	16	54	48	8	0	24	776	0	0
11	150	104	2	78	80	0	6	122	108	0	0
12	80	146	10	66	38	4	4	160	40	0	0
13	110	336	360	704	112	160	40	0	4 664	0	0
14	130	3	15	18	7	3	2	180	4	2	0
15	170	2	0	4	1	0	0	148	6	0	0
16	100	44	44	132	48	16	14	54	6 656	0	2
17	170	388	24	28	40	4	60	12	960	0	4
18	160	36	36	228	152	16	16	84	3 216	0	0
19	120	19	10	49	31	3	0	384	280	8	0
20	130	5	1	15	26	1	1 168	0	1 088	0	32
21	130	92	24	66	44	0	10	12	8 256	0	0
22	260	94	20	64	72	2	56	144	44 800	0	0
23	110	22	5	2	0	0	4	54	132	0	0
24	200	4	2	20	18	0	912	0	2 336	0	0
25	130	9	1	11	23	4	920	0	1 072	0	40
26	180	30	2	7	3	6	792	0	11 520	0	0
27	100	54	26	102	36	6	72	320	4 448	0	0
28	170	17	7	8	1	1	2	93	93	0	0

Station	Sample volume (mL)	Eggs (n)									
		Mackerel					H4B	CHW	CYT	American plaice	Windowpane flounder
		Stage 1	Stage 2	Stage 3	Stage 4	Stage 5				*(Hippoglossoides platessoides)*	*(Scophthalmus aquosus)*
29	310	22	0	24	0	0	608	4	892	0	0
30	160	115	13	147	69	11	29	64	8 672	0	0
31	210	29	19	75	18	0	5	293	2 824	0	0
32	200	3	0	0	0	0	0	176	0	0	0
33	190	5	1	9	5	0	0	212	20	4	0
34	120	26	18	112	70	0	10	76	166	0	0
35	90	320	120	152	384	48	72	0	2 320	0	0
36	90	616	24	496	160	16	8	32	2 032	0	208
37	90	186	32	136	24	8	28	138	1 784	2	0
38	110	7	2	20	8	0	0	154	112	0	0
39	220	2	4	6	2	2	0	296	20	0	0
40	120	7	3	47	23	0	0	1 032	60	0	0
41	100	120	38	104	96	6	40	200	2 616	0	0
42	140	6	7	7	0	0	0	70	15	0	0
43	160	4	2	4	3	4	4	172	156	2	0
44	50	270	22	86	22	4	4	230	3 256	0	0
45	40	80	19	30	13	2	0	260	52	0	0
46	30	104	0	138	80	10	4	170	2 424	0	0

* Damaged nets

Appendix 3. Number of larvae sorted and identified from samples collected during the capelin and Atlantic herring larval survey of July 2008 on the west coast of Newfoundland. Scientific names are as follows: mackerel (*Scomber scombrus*), sand lance (*Ammodytes* spp.), herring (*Clupea harengus harengus*), cod (*Gadus morhua*), snailfish (*Liparis* spp.), capelin (*Mallotus villosus*), redfish (*Sebastes* spp.), arctic shanny (*Stichaeus punctatus*), radiated shanny (*Ulvaria subbifurcata*), fourbeard rockling (*Enchelyopus cimbrius*), witch flounder (*Glyptocephalus cynoglossus*), yellowtail flounder (*Limanda ferruginea*), winter flounder (*Pseudopleuronectes americanus*), righteye flounder (Pleuronectidae), cunner (*Tautogolabrus adspersus*), and windowpane flounder (*Scophthalmus aquosus*). Also included are counts of broken and other unidentified larvae.

Station	Mackerel	Sand Lance	Herring	Cod	Snailfish	Capelin	Redfish	Arctic shanny	Radiated shanny	Fourbeard rockling	Witch flounder	Yellowtail flounder	Winter flounder	Righteye flounder	Cunner	Windowpane flounder	Broken larvae	Other larvae not identified
1	12	24	128	0	0	56	0	0	8	8	8	0	0	0	116	0	12	0
2	20	0	48	8	24	372	0	0	24	8	12	4	16	0	268	0	24	0
3*	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4	4	4	14	1	2	45	0	0	1	0	9	0	32	0	27	0	0	0
5	13	0	28	1	0	392	0	0	20	18	0	8	4	6	368	6	0	6
6	0	0	0	16	0	552	0	0	0	40	40	0	0	0	120	8	0	0
7	16	0	48	0	0	4 544	0	0	1 088	64	0	0	24	0	96	0	0	0
8	0	0	48	0	0	304	0	0	0	0	0	0	0	80	48	0	0	0
9	0	0	46	0	0	29	0	0	11	0	0	0	0	52	1	0	0	0
10	34	0	64	6	0	448	0	0	0	0	8	0	16	0	320	0	8	0
11	0	0	34	0	0	358	0	0	32	20	0	0	0	22	180	0	0	0
12	6	6	50	10	2	36	0	0	24	6	0	0	0	52	1 208	4	0	0
13	176	0	24	0	0	3 664	0	0	40	8	80	16	0	0	712	8	8	0
14	0	0	2	1	2	1 456	0	0	6	1	5	3	0	0	6	0	0	0
15	0	0	16	1	0	232	3	0	6	0	0	0	0	14	0	0	0	0
16	2	0	6	0	0	6 592	2	0	14	4	0	0	0	4	6	0	0	0
17	4	0	0	0	0	636	0	0	24	4	0	0	0	4	8	0	0	4
18	0	0	12	0	0	4 600	0	0	24	16	0	0	0	24	720	0	0	0
19	0	0	0	0	0	2 592	0	0	6	12	0	0	0	20	24	0	2	0
20	37	0	0	0	0	80	0	0	15	101	0	0	0	0	816	0	8	0
21	0	0	4	0	0	4 672	0	0	76	256	0	0	0	0	0	0	0	4
22	12	0	6	0	0	10 112	0	0	62	4	14	0	0	0	0	0	0	0
23	2	1	1	0	0	133	3	0	11	0	1	16	0	0	0	0	0	0
24	4	0	0	0	88	456	0	0	10	0	0	0	0	4	48	0	0	4
25	4	0	1	0	0	928	0	0	16	248	0	0	0	16	1 528	16	0	0
26	15	0	5	0	0	49	0	0	16	36	3	0	2	0	65	4	0	0
27	4	0	8	0	0	204	2	0	0	0	44	0	0	0	20	0	0	0
28	0	0	8	2	0	11	19	0	0	0	0	0	0	11	0	0	0	0

Station	Mackerel	Sand Lance	Herring	Cod	Snailfish	Capelin	Redfish	Arctic shanny	Radiated shanny	Fourbeard rockling	Witch flounder	Yellowtail flounder	Winter flounder	Righteye flounder	Cunner	Windowpane flounder	Broken larvae	Other larvae not identified
29	0	0	4	0	0	80	0	0	6	6	0	0	0	4	4	0	0	0
30	21	0	11	0	0	203	3	0	64	5	11	0	0	0	37	0	0	0
31	6	0	0	2	2	664	3	0	2	0	0	0	0	3	0	0	0	0
32	1	1	1	0	0	8	34	0	1	0	0	0	0	0	0	0	0	0
33	5	0	20	0	0	3	2	0	1	0	0	5	3	0	4	0	1	0
34	22	0	48	0	0	34	0	0	2	2	2	16	0	0	0	4	0	0
35	304	0	64	0	0	8	0	0	0	0	8	8	8	0	224	0	32	0
36	48	0	40	0	0	32	0	40	0	0	0	0	0	8	144	16	0	0
37	0	0	8	4	0	28	0	0	2	0	0	0	0	22	0	0	0	0
38	15	0	10	0	0	4	4	0	1	0	0	0	0	4	4	0	0	0
39	0	0	24	2	0	0	68	0	8	0	0	0	0	12	0	0	0	0
40	11	0	12	0	3	8	0	0	49	0	0	0	0	33	3	0	0	4
41	2	0	12	0	0	22	0	0	28	0	10	0	6	0	2	0	0	2
42	0	0	0	0	0	0	1	0	2	0	0	0	0	1	0	0	0	0
43	0	1	8	4	3	5	0	0	12	1	13	0	0	0	0	0	0	1
44	0	0	6	2	2	12	0	0	6	0	0	0	0	12	0	0	0	2
45	0	0	24	2	36	32	0	0	36	0	0	0	0	12	0	0	0	0
46	0	0	8	0	0	56	0	0	6	0	0	0	0	0	0	0	0	0

* Damaged nets