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A Bacteriological Survey of Yarmouth Harbour and Yarmouth Sound, 1973, Shellfish Area 16, Nova Scotia

Surveillance Report EPS 5-AR-74-6
Atlantic Region

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A BACTERIOLOGICAL SURVEY OF YARMOUTH HARBOUR AND YARMOUTH SOUND, 1973 SHELLFISH AREA 16, NOVA SCOTIA

by

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for the

WATER POLLUTION CONTROL DIRECTORATE
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ABSTRACT

During July and December 1973 the Environmental Protection Service conducted a bacteriological water-quality survey of Yarmouth Harbour, Yarmouth Sound and adjacent coastal waters to review the closure regulations governing shellfishing in this area.

The results of this survey indicate that the inner harbour is grossly polluted by untreated domestic sewage and industrial effluents, discharged mainly at the Yarmouth waterfront. The effects of this large volume of coliform-rich water extend well into Yarmouth Sound and it is concluded that all of the waters of Yarmouth Harbour as well as Inner False Bay and the western and northern waters of Yarmouth Sound should be closed for shellfishing.

Because of a seasonal variation in water quality the south eastern areas in Yarmouth Sound are only acceptable during fall and winter and it is recommended that a seasonal closure be established accordingly .

The present closure of Kelly cove should be rescinded but no change is advocated for the closure of Outer False Bay.

RÉSUMÉ

Durant les mois de juin et décembre en 1973, le Service de Protection de l'Environnement a conduite un relevé de la qualité bactériologique des eaux du Havre de Yarmouth et Yarmouth Sound ainsi que les eaux adjacentes. Le but de l'étude était de passer en revue les réglements concernant la fermeture présentement en effet dans cette région.

Les résultats du relevé indiquent que l'intérieur de havre est très pollué par les eaux d'égouts qui ne sont pas traitées et par les effluents industriels de Yarmouth. Les effets de ce volume considérable d'eau contaminée peut-être observer dans Yarmouth Sound et il faut donc conclure qu'une fermeture de la pêche coquillière est nécessaire pour les eaux du Havre de Yarmouth, Inner False Bay ainsi que les eaux adjacents de la rive nord et la rive ouest de Yarmouth Sound.

A cause d'une variation saisonnière dans la qualité des eaux des secteurs au sud ouest de Yarmouth Sound, ils sont acceptables seulement en automne et en hiver. Il est donc recommandé qu'une fermeture saisonnière soit etablie.

La presente fermeture de Kelly Cove devrait etre annulé mais la fermeture de Outer False Bay ne doit pas changer.

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1 INTRODUCTION

During July and December 1973, a bacteriological water quality survey was conducted in Yarmouth Harbour and its approaches, Nova Scotia (Shellfish Area 16). The purpose of this survey was to review the adequacy of the existing closures, defined by Schedule G of the Nova Scotia Fisheries Regulations (PC 1970-2189) as follows:

> "16-1 Yarmouth Harbour, Yarmouth County, including Yarmouth Sound (except Sand Bay) from Bunker Island to Sunday Point and Outer False Bay, thus to include John Cove, Inner False Bay, Stanwood Beach, Yarmouth Harbour, Kelly Cove and the unnamed coves on either side of Ship's Stern."
>
> "16-2 Yarmouth Inner Harbour, Yarmouth County, north of a straight line drawn from Bug Light to Johnston's Point."

A sanitary and bacteriological survey was conducted in the area in 1957 (1). The recommendations of that survey report were the origins of Closure 16-1. The origin of Closure 16-2 appears to pre-date the 1957 survey.

The present assessment is part of the continuous review of closure regulations governing shellfish growing areas which is carried out by the Environmental Protection Service in accordance with the procedures described in the National Shellfish Sanitation Program Manual of Operations (2).

The coliform test is the principal bacteriological criterion used in this program although fecal coliform tests provide additional information and are included in this report. With the coliform test, water is considered unacceptable for the harvesting of shellfish when the median of the values exceeds 70 per 100 ml and/or more than ten percent of the results exceed 230 per 100 ml. There is no universally accepted standard for the fecal coliform test but a median of 23 with a 90-percentile of 76 may be used in comparing the two tests.

2 METHODS

2.1 Sampling

Water samples were collected in sterile glass bottles using a rod sampling device to lower the bottles to a depth of about two feet. Samples were not iced but were kept in an insulated container and processed in a mobile laboratory less than six hours after collection.

2.2 Bacteriological Analysis

Coliform and fecal coliform tests were performed on all samples using "most probable number" (MPN) techniques. Three or more five-tube MPN series were inoculated with appropriate aliquots of sample (decimal dilutions). In the first stage of the procedure, Bacto Lauryl Tryptose Broth was the growth medium used and the tubes were incubated at 35°C for about 48 hours, or if gas formation was detectable sooner, for 24 hours. Gas-positive cultures were transferred to Bacto Brilliant Green Bile Broth (BGB) and Bacto-EC medium. Gas formation in BGB after 24 or 48 hours of incubation at 35°C constituted the confirming stage of the coliform test. For the fecal coliform test the EC tubes were examined after 24 hours of incubation at 44.5°C. The incubator in this case was a water bath equipped with a stirring device.

2.3 Additional Data

To facilitate interpretation of the bacteriological data, the salinities of selected samples were determined with a hydrometer. Water temperatures were taken at several stations. The tidal stage was estimated and recorded for each sampling run. In addition, records of daily precipitation at the Yarmouth station of the Atmospheric Environment Service are included.

3 AREA DESCRIPTION

Yarmouth Harbour and its approaches are located at the western end of Nova Scotia. Yarmouth Harbour is a year-round port with an active waterfront area. The town of Yarmouth is located on its eastern shore with a population of approximately 8000. Pollution sources include the municipal waste from Yarmouth and the wastes from a number of industrial sites. Discharges in the extreme northern end of the Harbour occur from a hospital, a dairy, and a textile plant. Pollution sources on the eastern side of the harbour (the waterfront area) include several fish plants. A fish plant is also located in Kelly Cove, and a herring reduction plant is located on Bunker Island. This latter plant was not in operation during the survey period. The bulk of the sanitary and industrial wastes are discharged untreated into the Harbour. The sectors studied during the current survey extend a distance of 5.5 miles from Lake Milo in the northeast to Sunday Point on the southwest, and include Kelly Cove (Figures 1 and 2). There are extensive tidal flats in the Harbour and soft-shell clams are common in these flats.

4 RESULTS

The survey was divided into two parts. The first portion of the survey was carried out from July 10 to July 12. Samples were collected at 60 stations in Yarmouth Harbour and the northern regions of Yarmouth Sound. The results of bacteriological tests performed on these samples are presented in Table 1-A. The second part of the survey was carried out from November 27 to December 6. Samples for bacteriological analyses were collected at 30 stations in Yarmouth Sound and Kelly Cove and the results of these tests are listed in Table 1-B. Figures 1 and 2 show the locations of the sampling stations.

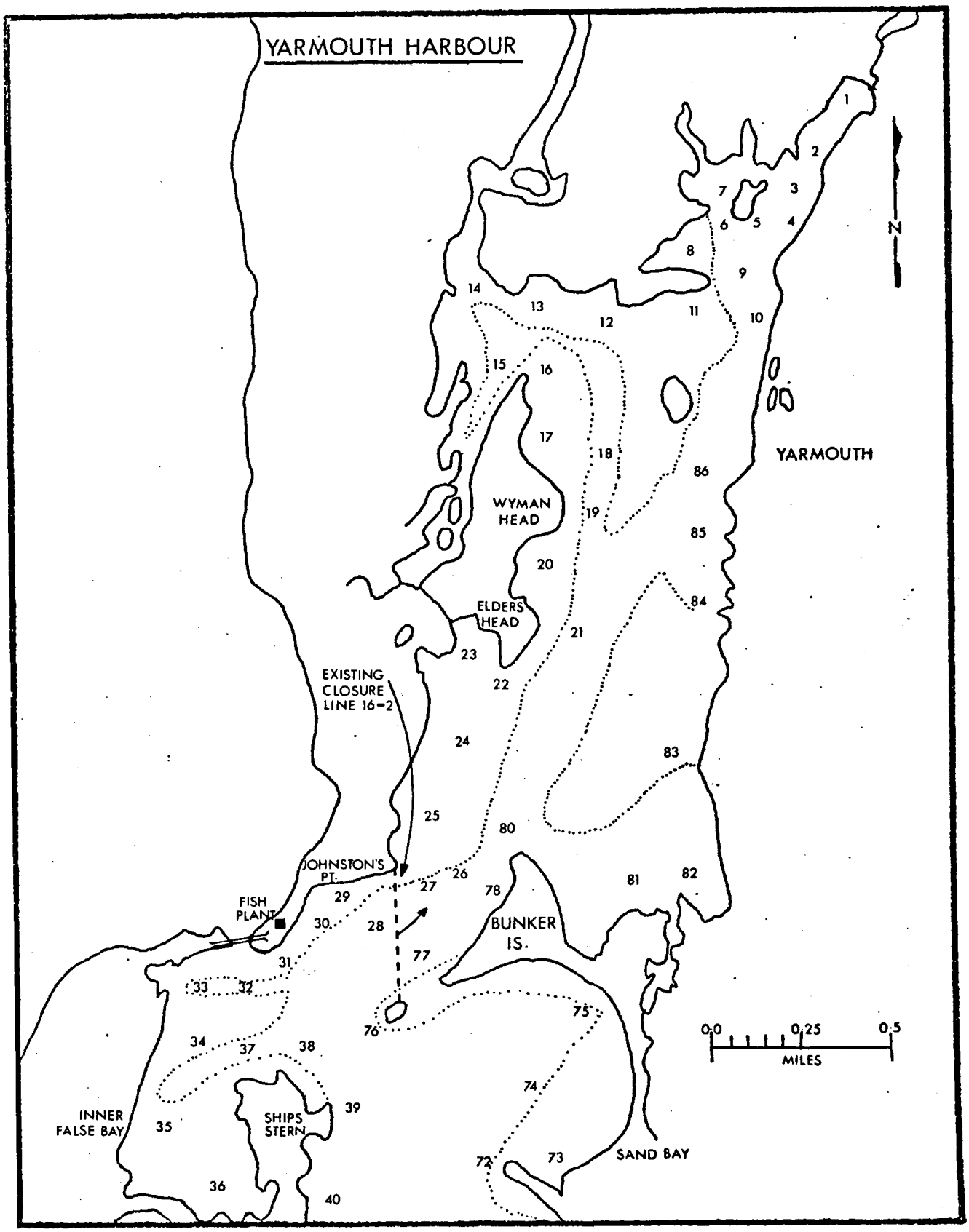

FIGURE 1. .SAMPLING STATIONS IN YARMOUTH HARBOUR, 1973

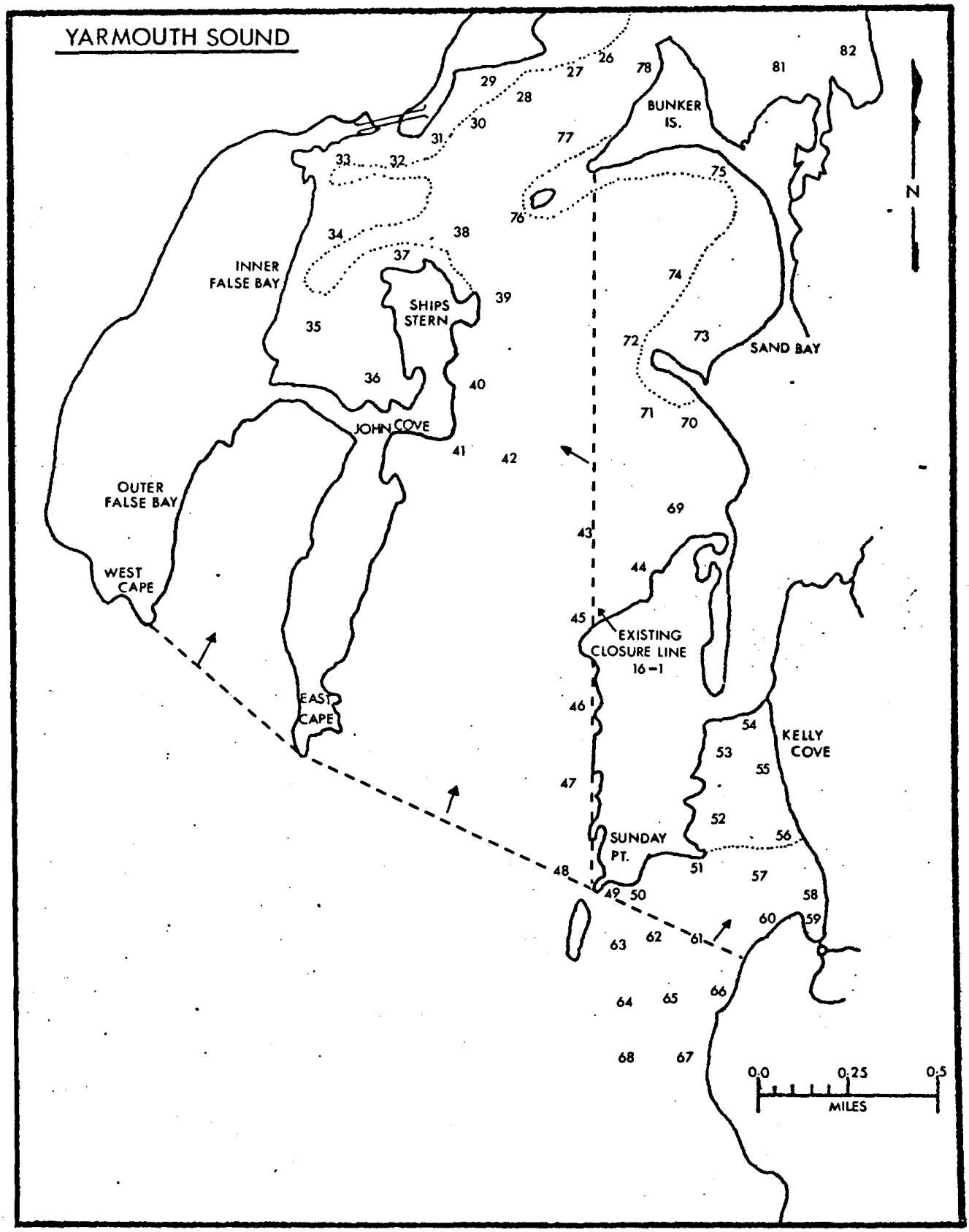

FIGURE 2. SAMPLING STATIONS IN YARMOUTH SOUND, 1973

Tidal stages at the times of sampling are recorded in Table 1-C while in Table 1-D, salinity and temperature data for selected samples are presented.

Extremely high (>2400/100 ml) coliform and fecal coliform densities were detected at almost all stations sampled during the summer survey i.e. the stations in Yarmouth Harbour and the northern regions of Yarmouth Sound (Figures 3 and 4). In the area inland from the boundary of closure 16-2 (Figure 1), the majority of coliform and fecal coliform MPN's were greater than 2400 per 100 ml (or where the three-tube method was used greater than 1100 per 100 ml) regardless of tidal stage. Southwest of this area, between Johnston Point and Inner False Bay, bacterial densities were distinctly higher during rising tides (July 10, PM, and July 12) than at falling tides. Coliform counts greater than 230 per 100 ml were found at all of these stations and all coliform medians were greater than 70. In Inner False Bay (Stations 35 and 36) the highest MPN's were found on July 12 at high rising tide. At these stations, coliform and fecal coliform medians were also greater than 70 and 23 respectively and similar results were found at Stations 39 and 41 between Ship's Stern and John Cove.

In Sand Bay, south of Bunker Island, coliform medians were less than 70 at Stations 72 and 74. The medians of fecal coliform MPN's however, were greater than 23 at these stations. In the northern part of Sand Bay at Station 75, high bacterial densities (including a coliform MPN >2400/100 mls) were detected.

In the fall survey (November 27-December 6), samples were collected only at Stations 45-75 which includes Sand Bay, the eastern shore of the Sound to Sunday Point, and Kelly Cove (Figure 2). The bacteriological results of this survey were much lower than the summer results (Figures 5 and 6).

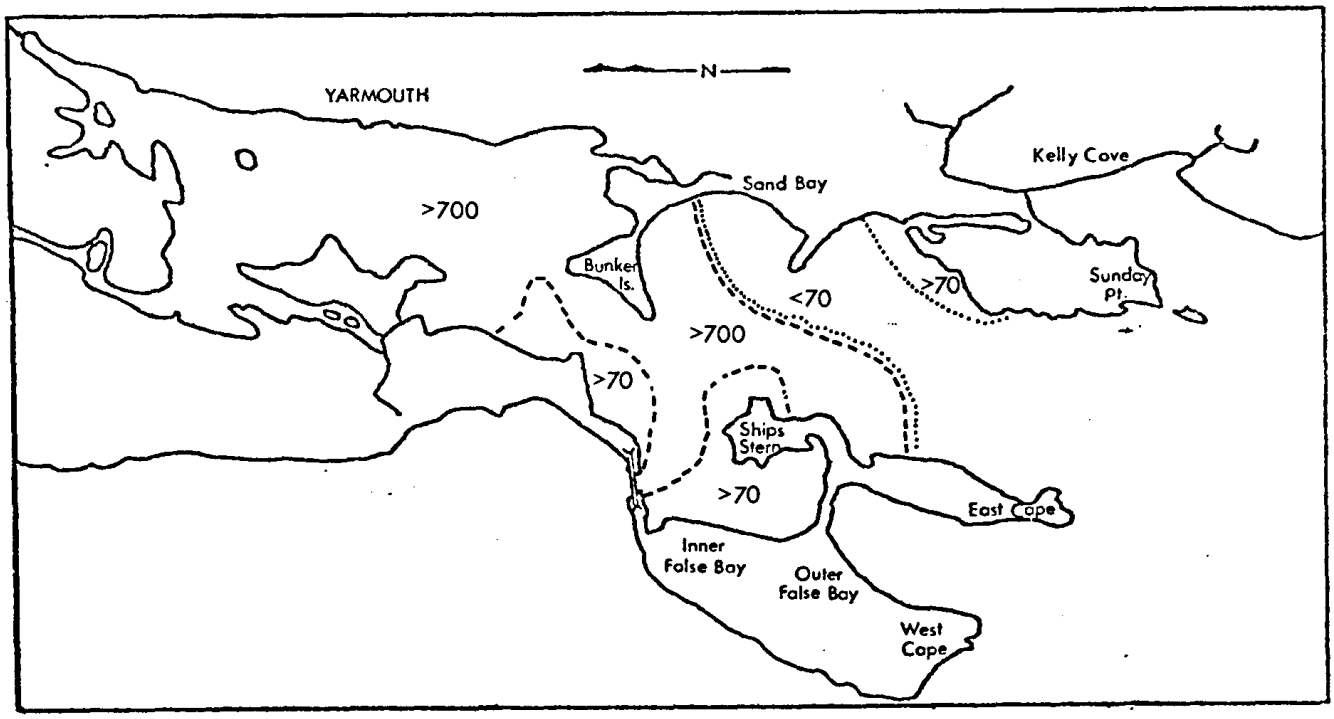

FIGURE 3. DISTRIBUTION OF COLIFORM MEDIANS IN YARMOUTH HARBOUR DURING JULY 1973

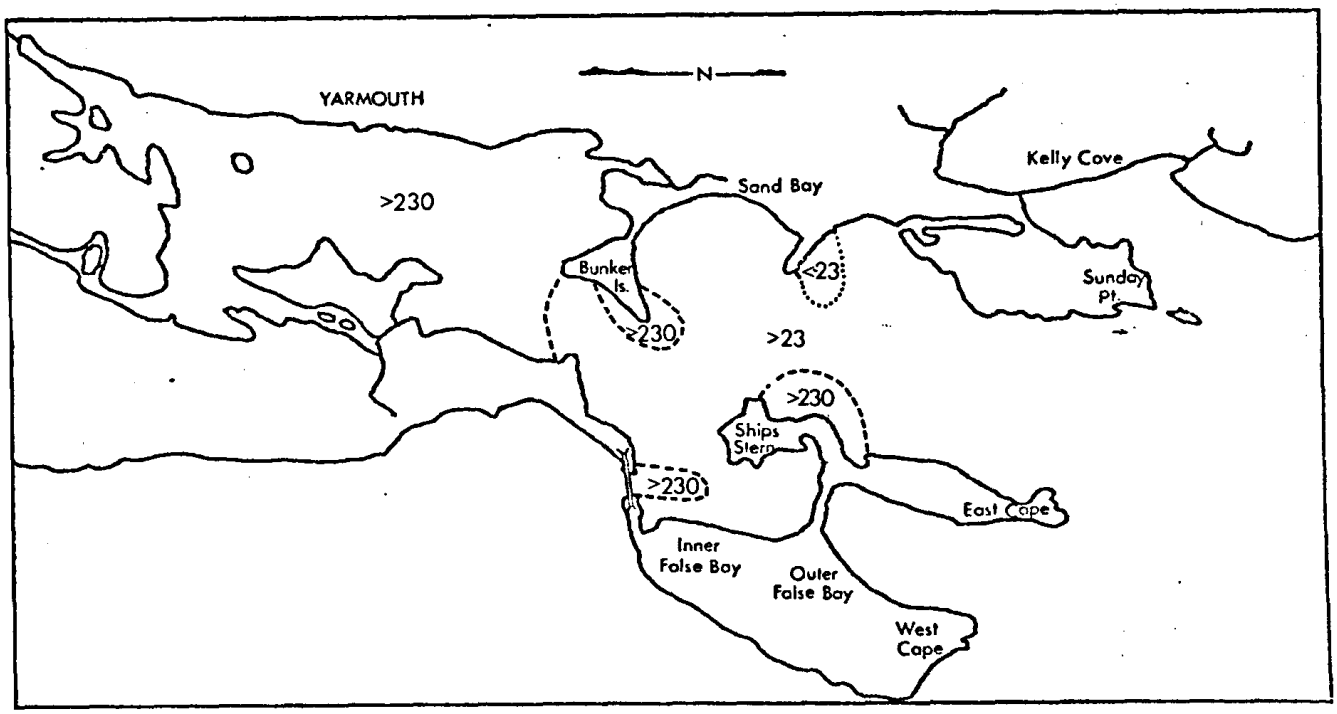

FIGURE 4. DISTRIBUTION OF FECAL COLIFORM MEDIANS IN YARMOUTH HARBOUR DURING JULY 1973

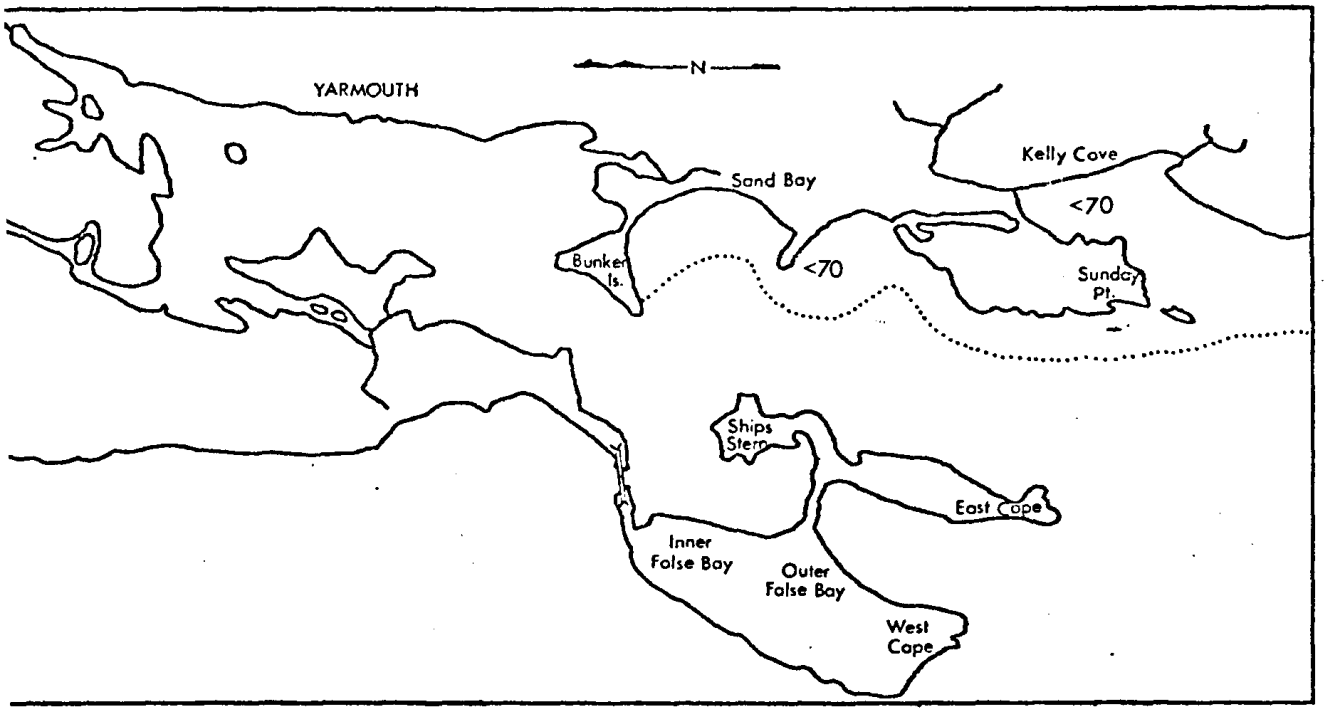

FIGURE 5 DISTRIBUTION OF COLIFORM MEDIANS IN YARMOUTH SOUND DURING NOVEMBER 1973

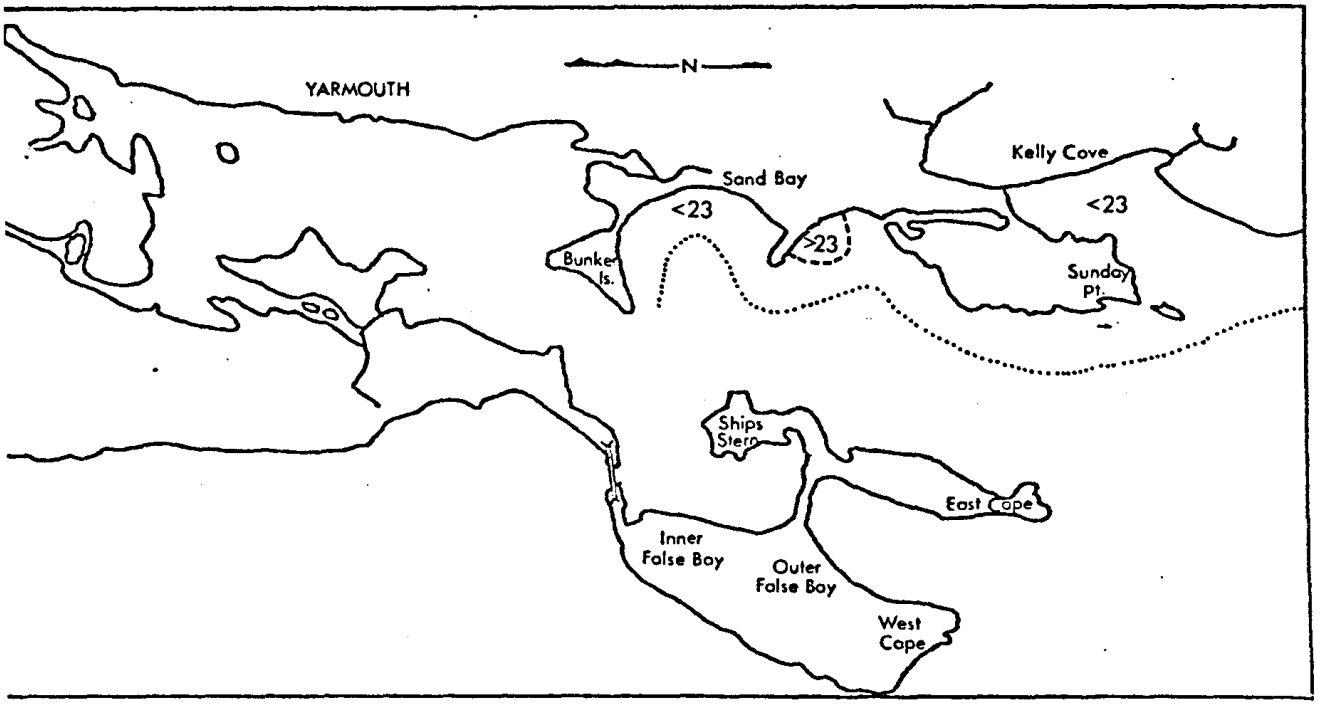

FIGURE 6. DISTRIBUTION OF FECAL COLIFORM MEDIANS IN YARMOUTH SOUND DURING NOVEMBER 1973

Throughout this surveyed area, coliform medians were consistently less than 70. Only a single coliform count taken at Station 70 on December 3 exceeded 230 per 100 ml. All fecal coliform medians were less than 23 with a single exception at Station 70. At this station a fecal coliform median of 42 was noted.

5 DISCUSSION AND CONCLUSIONS

All stations in Yarmouth Harbour were grossly contaminated during the survey period. Yarmouth Sound and Inner False Bay were also affected by fecal contamination. Bacterial levels were highest on the western shore of this area south of Johnston's Point along Yarmouth Bay. Inner False Bay, and the shores of Ship's Stern were also contaminated. In Inner False Bay, coliform counts were very high (220->2400 per 100 ml) on July 12. The Sand Bay area was affected by intermittent fecal contamination, particularly in the summer, due to the entry of polluted waters from the inner Harbour. Coliform counts were well above acceptable limits (240 MPN - >2400 MPN) on July 10. Due to the large volume of grossly contaminated water in the Harbour, it is not surprising that large sectors such as Sand Bay are adversely affected under certain conditions. High bacterial levels occurred on high rising and falling tides on July 10 and 12. These high levels do not appear to be related to rainfall. Significant rainfall did occur on, and prior to, July 12 (total 1.3 inches). However, there was little rainfall prior to the July 10 sampling, yet counts were considerably higher at certain stations on July 10 (Appendix II Figure 1-A). The intermittent pollution in Sand Bay may be related to the eddying of tidal currents or other variable hydrographic conditions.

On the eastern shore, south of Sand Bay to Sunday Point, bacterial levels were marginal, and varied considerably between the summer and fall surveys. Water quality in this southeastern part of the Sound was within acceptable limits for the harvesting of shellfish during the fall survey period. This suggests that a seasonal closure is appropriate in this area.

Water quality in Kelly Cove was consistently within acceptable limits for shellfish but was surveyed only in the fall. The fish plant located in the Cove was not in operation during the survey period. The observation can be made that without fish plant wastes being discharged, this area has acceptable water quality.

Although no samples were collected, a sanitary inspection of the Outer False Bay area revealed no significant sources of fecal contamination. This area, however, is currently closed and as this survey includes no data to define the existing water quality conditions, this Bay should continue to remain under closure.

6 RECOMMENDATIONS

1. The existing closures 16-1 and 16-2, schedule G of the Nova Scotia Fisheries Regulations should be rescinded.
2. A closure should be instituted in Outer False Bay covering the area north of a line drawn between East Cape and West Cape as designated in Figure 7 of this report.
3. A closure should be instituted encompassing all waters north of a line drawn between East Cape and a monument located on the Eastern shore of Sand Bay as shown in figure 7 of this report.

4. In the area south of aforementioned line (3 above) and north of a line between East Cape and Sunday Point a seasonal closure should be implemented between May 1 and September 1.

5. The waters of Kelly Cove should be opened to the harvesting of shellfish.

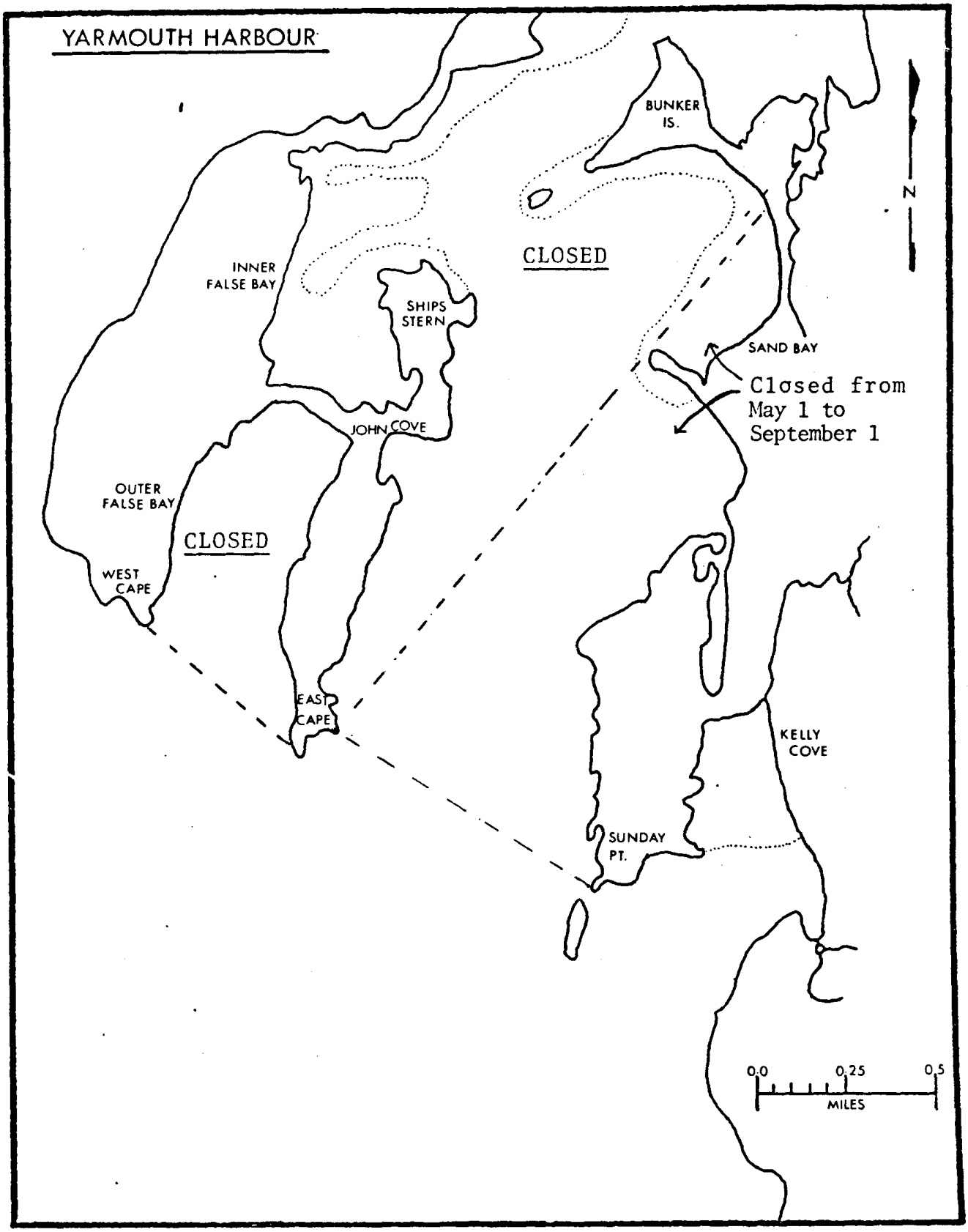

FIGURE 7 RECOMMENDED CLOSURES, YARMOUTH SOUND

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1. Sharpe, W.K. 1957. Shellfish Area N.S. 28 - Chebogue-Yarmouth Harbour Portion. M.S. Report, Public Health Engineering Division, Department of National Health and Welfare.

2. U.S. Department of Health Education and Welfare, National Shellfish Sanitation Program, Manual of Operations, Part I, Sanitation of Shellfish Growing Operations, 1965, Public Health Service. Publication No. 33 (1965 Revision), Washington.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the technical assistance of Messrs. M. Gauvin and B. Cushing. The assistance of Dr. R. H. Cook in reviewing the manuscript is also acknowledged.

APPENDIX I

TABLES

TABLE 1-A COLIFORM AND FECAL COLIFORM DATA, YARMOUTH HARBOUR AND YARMOUTH SOUND; SUMMER 1973.

Station #	COLIFORM MPN's PER 100 ML					FECAL COLIFORM MPN's PER 100 ML				
	July 10, AM	July 10, PM	July 11	July 12	Median	July 10, AM	July 10, PM	July 11	July 12	Median
1	>2400	-	>2400	>1100	>2400	>2400	-	>2400	>1100	>2400
2	>2400	-	>2400	>1100	>2400	>2400	-	>2400	>1100	>2400
3	>2400	>2400	>2400	>1100	>2400	>2400	>2400	>2400	>1100	>2400
4	1600	-	>2400	>1100	1600	350	-	>2400	>1100	>1100
5	>2400	>2400	>2400	>1100	>2400	>2400	>2400	>2400	>1100	>2400
6	>2400	>2400	>2400	>1100	>2400	>2400	>2400	>2400	>1100	>2400
7	>2400	-	-	>1100	>1750	>2400	-	-	>1100	>1750
8	>2400	-	-	>1100	>1750	>2400	-	-	>1100	>1750
9	>2400	>2400	>2400	>1100	>2400	>2400	1600	>2400	>1100	>2000
10	>2400	>2400	>2400	>1100	>2400	>2400	>2400	>2400	>1100	>2400
11	>2400	>2400	>2400	>1100	>2400	>2400	>2400	>2400	>1100	>2400
12	920	240	-	>1100	920	350	240	-	>1100	350
13	>2400	-	-	>1100	>1750	>2400	-	-	460	>1430
14	540	-	-	>1100	> 820	130	-	-	>1100	> 615
15	540	-	-	>1100	> 820	220	-	-	>1100	> 665
16	>2400	-	-	>1100	>1750	350	-	-	>1100	> 725
17	540	>2400	-	>1100	>1100	350	920	-	1100	920
18	540	>2400	240	>1100	> 820	350	1600	240	>1100	> 725
19	>2400	>2400	540	1100	>1750	1920	920	240	>1100	920
20	>2400	920	-	1100	1100	>2400	240	-	1460	460

Cont'd

TABLE 1-A (cont'd)

Station #	COLIFORM MPN's PER 100 ML					FECAL COLIFORM MPN's PER 100 ML				
	July 10, AM	July 10, PM	July 11	July 12	Median	July 10, AM	July 10, PM	July 11	July 12	Median
21	>2400	1600	920	1100	1350	350	920	540	1100	730
22	920	-	-	>1100	>1010	540	-	-	>1100	> 820
23	920	-	-	>1100	>1010	350	-	-	240	295
24	>2400	-	-	>1100	>1750	1600	-	-	1100	1350
25	170	-	-	>1100	> 635	79	-	-	1100	590
26	140	-	920	1600	920	110	-	170	920	170
27	920	920	140	1600	920	170	95	49	240	133
28	280	170	350	350	315	180	23	350	240	210
29	170	33	-	920	170	130	17	-	110	110
30	33	920	-	540	540	23	130	-	110	110
31	70	920	170	920	545	17	140	79	350	110
32	5	1600	540	>2400	1070	2	920	79	920	500
33	46	140	540	350	245	8	96	94	350	70
34	4	-	-	220	112	4	-	-	940	472
35	14	-	-	540	277	14	-	-	110	62
36	7	110	130	>2400	120	7	110	79	>2400	95
37	33	1600	110	920	513	23	540	49	79	64
38	33	1600	79	1600	840	17	350	49	920	200
39	540	1600	46	350	445	70	540	31	240	155
40	1600	>2400	70	350	985	920	350	70	130	240

Cont'd

TABLE 1-A (cont'd)

Station #	COLIFORM MPN's PER 100 ML					FECAL COLIFORM MPN's PER 100 ML				
	July 10, AM	July 10, PM	July 11	July 12	Median	July 10, AM	July 10, PM	July 11	July 12	Median
41	240	>2400	-	>2400	>2400	130	540	-	920	540
42	1600	>2400	79	540	1070	540	540	49	170	355
43	33	70	49	540	60	11	46	49	130	48
44	2	22	130	920	76	2	7	79	350	43
69	8	5	350	240	124	8	2	79	130	44
71	8	2	94	93	51	8	2	70	23	16
72	33	5	94	110	64	11	2	70	460	41
74	240	2	79	43	61	49	2	33	23	28
75	>2400	5	-	1100	1100	920	2	-	93	93
76	1600	2	>2400	210	905	1600	2	>2400	75	838
77	>2400	920	>2400	175	>1660	540	350	>2400	43	445
78	240	540	>2400	1100	820	130	130	>2400	240	185
79	110	-	-	1100	605	49	-	-	1100	575
80	1600	920	>2400	240	1260	540	170	>2400	43	355
81	350	350	>2400	>1100	> 725	110	79	>2400	>1100	> 605
82	2400	110	>2400	>1100	>1750	>2400	79	>2400	>1100	>1750
83	1600	-	>2400	>1100	>1600	920	-	>2400	>1100	>1100
84	>2400	>2400	>2400	>1100	>2400	1600	>2400	>2400	>1100	>1750
85	>2400	>2400	1600	>1100	>1750	1600	920	540	>1100	>1010
86	1600	920	1600	>1100	>1450	350	540	240	>1100	445

TABLE 1-B COLIFORM AND FECAL COLIFORM DATA; YARMOUTH HARBOUR, YARMOUTH SOUND, AND KELLY COVE; FALL 1973.

Station #	COLIFORM MPN's PER 100 ML Nov. 27	Dec. 3	Dec. 4	Dec. 6	Median	FECAL COLIFORM MPN's PER 100 ML Nov. 27	Dec. 3	Dec. 4	Dec. 6	Median
44	23	49	<2	23	23	13	23	<2	5	9
45	<2	23	8	<2	<5	<2	7	2	<2	<2
46	<2	13	<2	13	<7	<2	5	<2	2	<2
47	5	8	<2	13	7	<2	5	<2	2	<2
48	13	<2	<2	<2	<2	<2	<2	<2	<2	<2
49	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
50	2	21	11	<2	7	<2	2	<2	<2	<2
51	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
52	<2	7	17	<2	<4	<2	<2	5	<2	<2
53	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
54	23	<2	<2	<2	<2	13	<2	<2	<2	<2
55	<2	2	<2	13	<2	<2	<2	<2	5	<2
56	5	13	13	8	11	<2	5	<2	2	<2
57	<2	<2	2	21	<2	<2	<2	<2	11	<2
58	8	<2	23	2	5	<2	<2	8	<2	<2
59	23	49	70	13	36	8	13	49	2	11
60	<2	11	8	<2	<5	<2	2	<2	<2	<2
61	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
62	<2	8	<2	<2	<2	<2	2	<2	<2	<2
63	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2

Cont'd

TABLE 1-B (cont'd)

Station #	COLIFORM MPN's PER 100 ML					FECAL COLIFORM MPN's PER 100 ML				
	Nov. 27	Dec. 3	Dec. 4	Dec. 6	Median	Nov. 27	Dec. 3	Dec. 4	Dec. 6	Median
64	<2	<2	23	<2	<2	<2	<2	8	<2	<2
65	5	<2	<2	8	<3	<2	<2	<2	<2	<2
66	<2	<2	2	7	<2	<2	<2	2	2	<2
67	8	8	<2	<2	<5	2	<2	<2	<2	<2
68	2	<2	28	49	15	<2	<2	2	8	<2
69	23	70	31	23	27	8	49	23	8	16
70	2	240	70	49	60	<2	79	70	13	42
72	49	90	49	70	60	8	23	8	23	16
73	23	23	49	31	27	8	23	23	8	16
75	11	5	8	23	10	5	8	13	23	11

TABLE 1-C DATE AND TIDE AT TIME OF SAMPLING

DATE	TIME	TIDE
July 10 AM	09:00 - 11:00	High Falling
July 10 PM	14:30 - 16:30	Low Rising
July 11	09:00 - 11:00	Low Falling
July 12	08:00 - 10:00	High Rising
November 27	14:30 - 15:30	High
December 3	13:30 - 14:30	Low Falling
December 4	15:30 - 16:30	Low Rising
December 6	09:30 - 10:30	High

TABLE 1-D SALINITY & TEMPERATURE AT SELECTED SAMPLING STATIONS

DATE	STATION	SALINITY (PPT)	TEMP. (°C)
July 10 AM	1	23.3	
	15	24.6	
	30	27.2	
	45	28.5	
July 10 PM	15	28.5	
	45	27.2	
July 12	5		18°C
	45		14°C
November 27	2	33.5	8°C
	15	33.5	8°C
December 3	2	28.5	7°C
	15	30.0	7°C
December 4	2	31.5	8°C
	15	32.5	8°C
December 6	2	33.5	7°C
	15	33.5	7°C

APPENDIX II

FIGURE

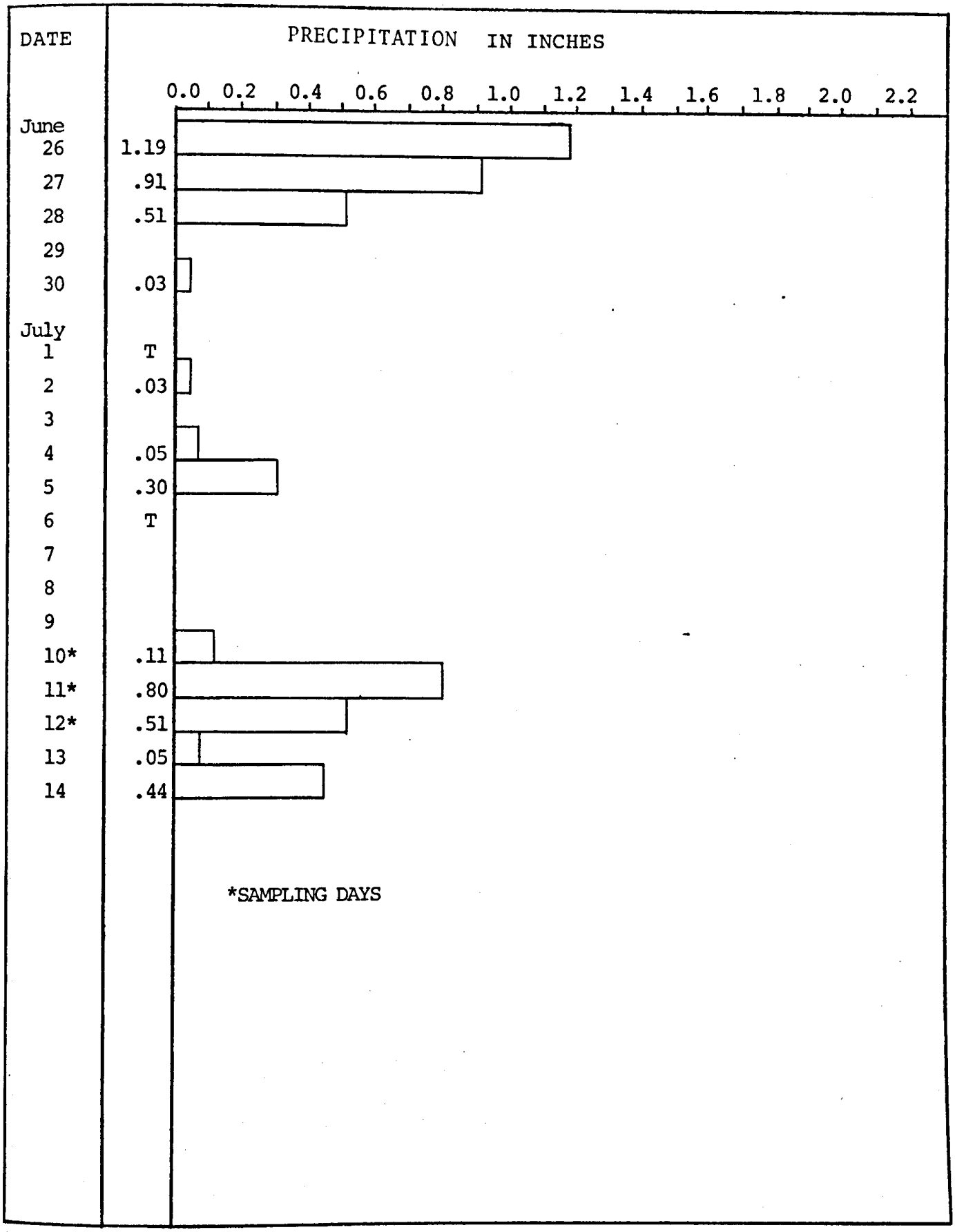

FIGURE 1-A DAILY PRECIPITATION DATA FOR THE SURVEY PERIOD AT YARMOUTH, N. S.