INVESTIGATION OF WATER QUALITY IN THE LEAMINGTON AREA OF WESTERN LAKE ERIE

1973 - 1976

Ontario

Ministry
of the
Environment

The Honourable
George R. McCague,
Minister

K.H. Sharpe,
Deputy Minister

INVESTIGATION OF WATER QUALITY IN THE LEAMINGTON AREA OF WESTERN LAKE ERIE

1973 - 1976

Y. S. Hamdy and J. D. Kinkead
Great Lakes Surveys Unit
Planning and Co-ordination Section
Water Resources Branch

May 1978

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

ACKNOWLEDGEMENTS

The authors thank K. Raudoja and J. Luyt of the Windsor District Office for their assistance in providing information regarding the abatement measures and for the review of the report. Thanks are also forwarded to the Laboratory Services, Southwestern Region for the water quality data analysis; and to O. Moore and S. Agnew of the Water Resources Branch for the graphics and data reduction.

1. SUMMARY

The findings of an August 1976 investigation of water quality in Pigeon Bay indicated a general improvement consistent with that observed in Western Lake Erie.

The remedial measures undertaken at the Leamington sewage treatment plant have resulted in a significant reduction of nutrients, bacteria, and solids discharged to Pigeon Bay waters.

A comparison with observations made in 1973 shows the effect of these measures to be most pronounced in the vicinity of the outfall. Total phosphorus levels have declined by about 60 percent and dissolved oxygen concentrations in the bottom waters have recovered to levels sufficient for the protection of fish and aquatic life.

Bacteriological water quality has also shown a marked improvement as bacterial densities in the study area were well within the Ministry criteria for recreational use with the exception of areas close to the Sturgeon Creek and Selkirk drain outlets.

In light of these findings, the Ministry is further investigating sources of bacterial contamination in the Sturgeon Creek and Selkirk Drain watersheds and will be exploring possible remedial measures that would ensure the suitability of Pigeon Bay waters for recreational activities. Additionally, the Ministry will monitor the waters of Pigeon Bay as part of its continuing assessment of the overall improvement in western Lake Erie water quality resulting from remedial action initiated under the Great Lakes Water Quality Agreement.

2. BACKGROUND

An assessment of Pigeon Bay waters by the Ministry in 1973 indicated localized degradation attributed to the discharge of inadequately treated municipal and industrial wastes and to land drainage (1). These inputs were responsible for bacterial levels in nearshore areas which exceeded recreational use criteria, dissolved oxygen depletion in the vicinity of the outfall (combined discharge from the municipal and H.J. Heinz Company treatment facilities) to a level below that required for the protection of the fishery and aggravation of the nutrient enrichment problem which was already prevalent in the Western Basin.

These problems were most pronounced during the peak canning season (August) when the treatment systems were overloaded. The bacterial contamination which was also observed during the June survey was attributed to inadequate disinfection of the combined Leamington - Heinz wastes and to inputs from Sturgeon Creek and Selkirk Drain.

Following this investigation, it was recommended that the municipality explore treatment alternatives to eliminate bacterial contamination and reduce loadings of oxygen-consuming waste. Further, the inclusion of phosphorus removal became a requirement under terms of the Canada-Ontario Water Quality Agreement.

Since the presentation of these recommendations the Town of Leamington has completed improvements which included expansion of the sewage treatment plant to twice its former capacity (now 0.22 m^3/s - 4.2 MGD), upgrading from primary to secondary treatment (extended aeration) and provision of phosphorus removal. These modifications became fully operational in May 1976.

This report compares the findings of a follow-up investigation in August 1976 with the conditions existing in 1973.

3. DESCRIPTION OF STUDY AREA

3.1 GENERAL DESCRIPTION

Pigeon Bay is located in the northeast corner of the Western Basin of Lake Erie. The adjacent land area is primarily committed to agricultural uses (Figure 1).

The moderately-shallow nearshore reach of the bay is characterized by a gentle lakeward bottom slope of 2.4 m/km. Water depths in the bay range from 2 m in areas close to the shore to 10 m in offshore areas. The surficial sediments are semi-consolidated till covered with sand and/or gravel deposits.

The average water temperatures are 22°C in summer, 4-5°C in spring and 1°C in winter.

3.2 WATER USES

3.2.1 Municipal and Industrial Water Supply

The Town of Leamington and Pyramid Canners obtain their water supply from the Union Water Treatment Plant located at Ruthven, 6 km west of Leamington. This plant, which has an average output of 0.3 m^3/s (9.9 cfs), also supplies process waters to the H.J. Heinz Company at a rate of 0.087 m^3/s (3.1 cfs). Heinz also utilizes cooling water from an intake located 0.2 km east of the Leamington Harbour pier at a rate of about 0.1 m^3/s (3.6 cfs).

3.2.2 Commercial Fishing

Pigeon Bay is an important commercial fishing area as is most of the Western Basin of Lake Erie. The prevalent fish species in the area are yellow perch, smelt, walleye and white bass. The principal impounding net area extends from Leamington southward to the tip of Pelee Point. Fishing tugs from the nearby towns of Kingsville and Wheatley frequent this area. The commercial fishing ban on walleye and white bass imposed in 1970, because of mercury contamination, was lifted in 1975 subject to length limitations. Continued mercury testing by the Department of Fisheries and the Environment has indicated that walleye up to 19" in length and white bass up to 13" in length may currently (1977) be marketed (2).

3.2.3 Recreation

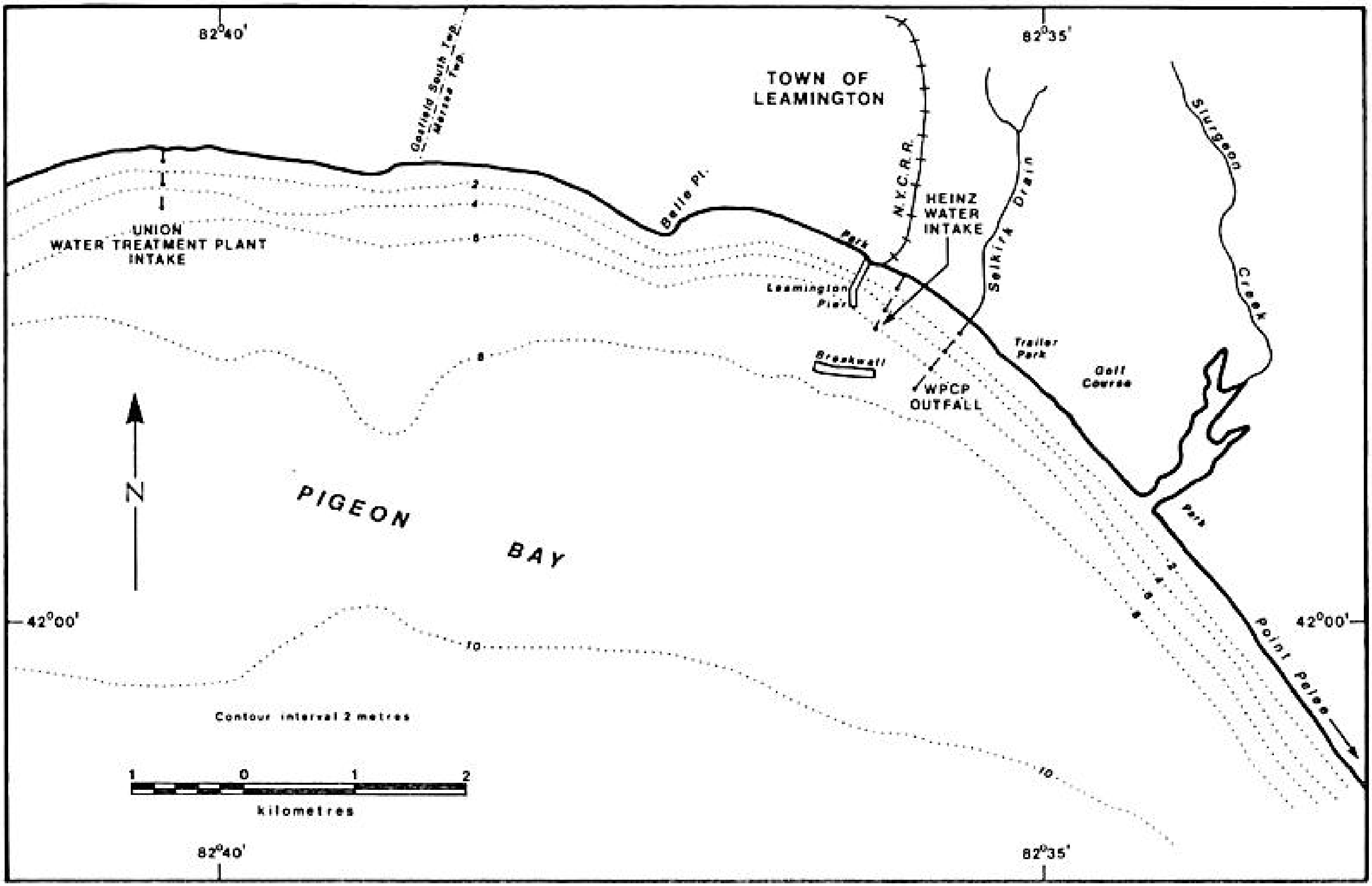
Swimming and bathing are popular water uses in the area, especially along the beach and cottage areas of the Point Pelee shoreline.

3.3 MUNICIPAL AND INDUSTRIAL WASTE TREATMENT

Presently, secondary treatment with phosphorus removal is given to the Town of Leamington municipal waste as well as to the waste input from Pyramid Canners. Treatment efficiency for BOD_5 and suspended solids removal is now on the order of 95%. Total phosphorus in the final discharge within the objective of 1 mg P/L.

During the canning season, the Heinz process wastes are pretreated at the company's own secondary treatment facility (an extended aeration system utilizing nutrient inoculation, an aerated lagoon and clarification system) prior to chlorination and common discharge with the Leamington sewage treatment plant treated effluent. Outside of canning season, they can be treated at either facility. The combined effluent streams are discharged via a common outfall located 1 km east of the Leamington pier and extending to about 0.8 km offshore (Figure 1).

The area is also affected by drainage from the Sturgeon Creek and Selkirk Drain watersheds. The latter receives cooling waters from the H.J. Heinz Company.



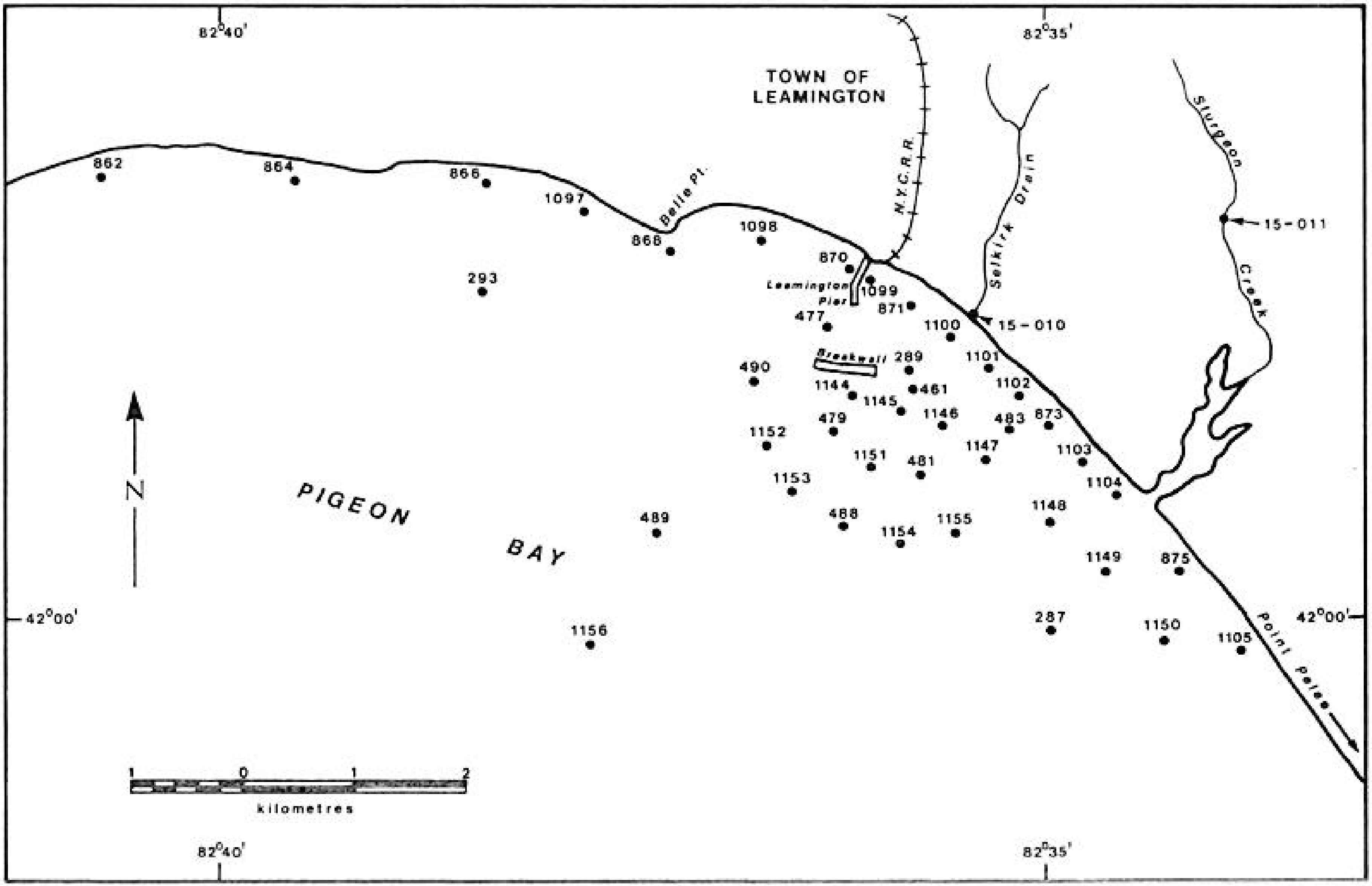
82°40'
82°35'
TOWN OF LEAMINGTON
Gosfield South Twp.
Mersea Twp.
N.Y.C.R.R.
HEINZ WATER INTAKE
Selkirk Drain
Sturgeon Creek
Belle Pt.
Park
Leamington Pier
Breakwall
WPCP OUTFALL
Trailer Park
Golf Course
UNION WATER TREATMENT PLANT INTAKE
N
PIGEON BAY
42°00'
Point Pelee
Contour interval 2 metres
kilometres

Figure 1

4. SURVEY OUTLINE

The 1976 investigation was based on the same sampling grid used in 1973. The grid extends 4 km east and 7 km west of Leamington and about 3.5 km into Pigeon Bay (Figure 2). Water quality conditions were monitored over three consecutive days in August coinciding with the peak of the canning season. Stations were selected to best measure the impact of the Leamington-Heinz discharge on offshore waters and the effect of land drainage on recreational areas close to shore.

Samples were also obtained concurrently from the Leamington-Heinz outfall, Selkirk Drain and Sturgeon Creek. Water quality analyses included nutrients, dissolved oxygen, and bacterial indicators.



82°40'
82°35'
TOWN OF LEAMINGTON
N.Y.C.R.R.
Selkirk Drain
Sturgeon Creek
Belle Pt.
Leamington Pier
Breakwall
15-011
15-010
862
864
866
1097
868
1098
870
1099
871
293
477
1100
490
289
1101
1144
461
1102
1145
1146
479
483
873
1152
1147
1151
481
1103
1153
1104
1148
488
1154
1155
489
PIGEON
BAY
N
1149
875
42°00'
1156
287
1150
1105
Point Pelee
1
0
1
2
kilometres

Figure 2

5. DISCUSSION

5.1 WASTE LOADINGS

The concentrations and loadings of key constituents in the combined effluent as measured during the 1973 and 1976 canning seasons are illustrated in Table 1. A reduction of about 76% was realized in total phosphorus, BOD_5, and total suspended solids loadings in 1976. Bacterial densities in the effluent also declined since 1973, however, levels at the outlets of Sturgeon Creek and Selkirk Drain exhibited a significant increase (Table 2).

Selkirk Drain is an important source of nutrient loadings to the immediate nearshore area. As the flow in the drain during the summer months is essentially limited to that contributed by the cooling water from Heinz (0.13 m^3/s - 4.5 cfs) , total phosphorus levels at the drain outlet resembled those of the cooling water (Figure 3).

The average flow of Sturgeon Creek is approximately 0.03 m^3/s (1 cfs). It does not contribute a significant nutrient loading to the nearshore, however, it appears to be a source of bacterial contamination (Table 2).

5.2 WATER QUALITY

The study area has been divided into two zones (based on bathymetry) to facilitate discussion of water quality:

<u>Zone 1:</u> Includes stations situated along the 2 m (6 feet) depth contour line (Table 3).

<u>Zone 2:</u> Includes offshore sampling points located on a radial grid from the Leamington STP discharge point (Table 4). Results were averaged for stations at the same distance from the outfall.

These zones are felt to best differentiate between the effects of land drainage in areas close to shore from those of the Leamington-Heinz discharge on Pigeon Bay waters.

5.2.1 <u>Microbiology</u>

Bacterial densities in the vicinity of the outfall and at offshore stations in 1976 were well within recreational use criteria (Table 3) indicating significant improvement since 1973. The reduction in bacterial densities is attributed to more effective disinfection made possible with the addition of secondary treatment.

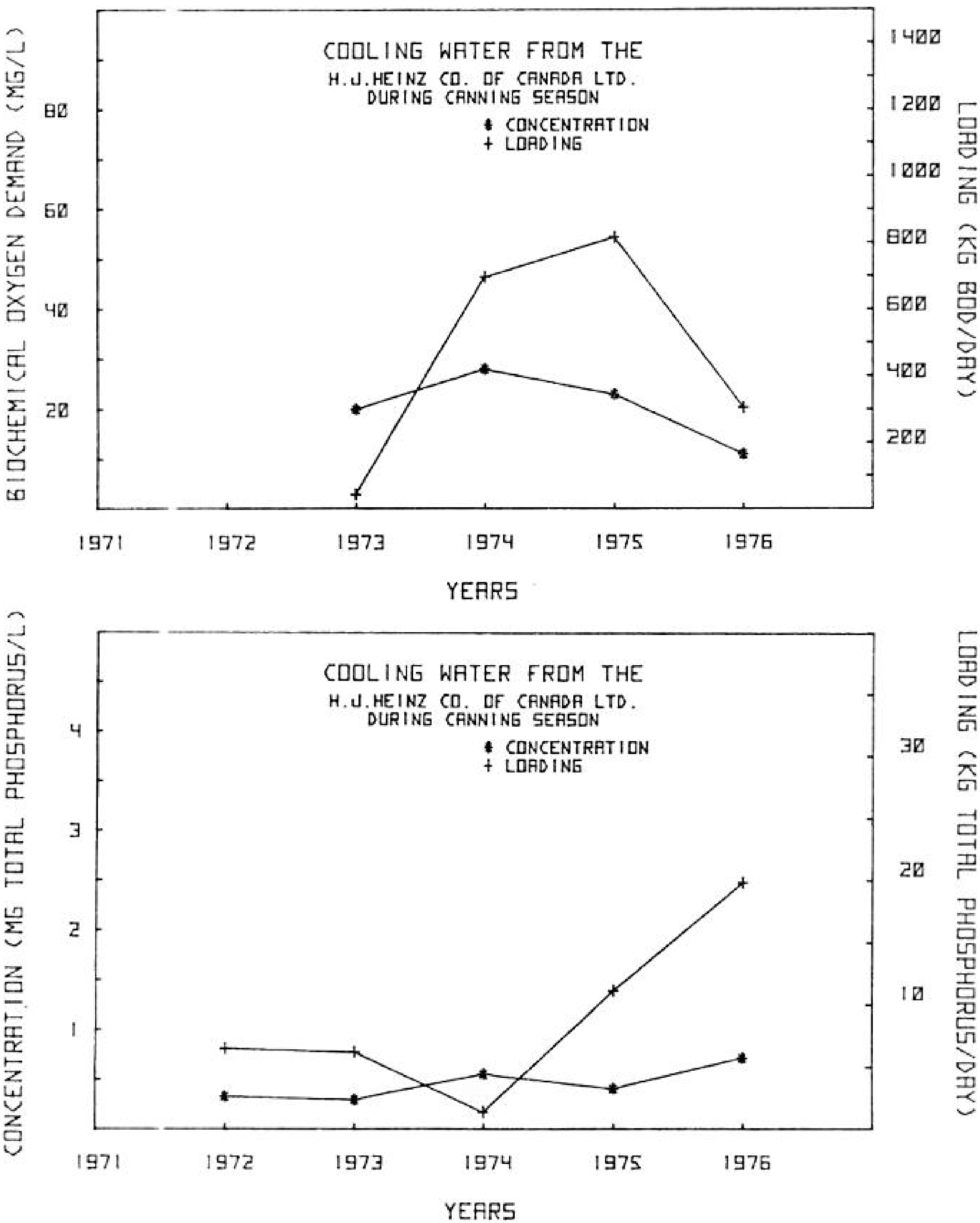

COOLING WATER FROM THE
H.J.HEINZ CO. OF CANADA LTD.
DURING CANNING SEASON
CONCENTRATION
LOADING
BIOCHEMICAL OXYGEN DEMAND (MG/L)
LOADING (KG BOD/DAY)
20
40
60
80
200
400
600
800
1000
1200
1400
1971
1972
1973
1974
1975
1976
YEARS
COOLING WATER FROM THE
H.J.HEINZ CO. OF CANADA LTD.
DURING CANNING SEASON
CONCENTRATION
LOADING
CONCENTRATION (MG TOTAL PHOSPHORUS/L)
LOADING (KG TOTAL PHOSPHORUS/DAY)
1
2
3
4
10
20
30
1971
1972
1973
1974
1975
1976
YEARS

Figure 3

Localized bacterial contamination in the nearshore zone was observed near the Selkirk drain and Sturgeon Creek outlets. The impairment of nearshore waters at these locations was more pronounced during the study period as evidenced by higher levels of fecal streptococci in 1976 than those in 1973 (Figure 4). *P. aeruginosa* which is a pathogen and the causal organism of many upper respiratory infections in swimmers was found at levels ranging from 1 to 7 counts/100 ml in nearshore waters. These levels as described by Hoadley (3) reflect the presence of a low but definite source of contamination.

Samples from the Selkirk Drain and Sturgeon Creek suggest that they both may be contributing to this localized problem. The fecal coliform to fecal streptococci ratio for Sturgeon Creek ranged from 1.3 to 4 during the survey period indicative of mixed pollution from human and animal sources (4). In Selkirk Drain, the ratio (0.7) suggests that contamination is due mainly to animal wastes. Agricultural land drainage and malfunctioning private septic tank systems in the Selkirk drain and Sturgeon Creek watershed areas are possible causes.

5.2.2 Dissolved Oxygen

Dissolved oxygen concentrations in surface waters were generally above the 5 mg/L criterion suggested for the protection of warm water biota in both 1973 and 1976.

Severe oxygen depletion did however exist in the bottom waters of the offshore stations in 1973, as average dissolved oxygen concentrations of 1.7, 2.8, 4.9 and 5.6 mg/L were observed at 0.1, 0.5, 1.0 and 2.5 kilometers respectively, from the outfall. In August 1976, dissolved oxygen levels in the bottom waters were much improved particularly in the vicinity of the outfall. Average concentrations at the same distances were 5.7, 5.4, 4.9 and 5.1 mg/L respectively. This represents an increase in oxygen saturation from 44% in 1973 to 60% in 1976. This indicates a return to levels characteristic of the Western Basin bottom waters during calm weather conditions (Figure 5).

The improvement in oxygen levels, particularly near the outfall, can be attributed to the decrease in the amount of oxygen consuming wastes contained in the Leamington-Heinz discharge. The average BOD_5 of the effluent declined to 17 mg/L in 1976 from 260 mg/L found during the 1973 survey.

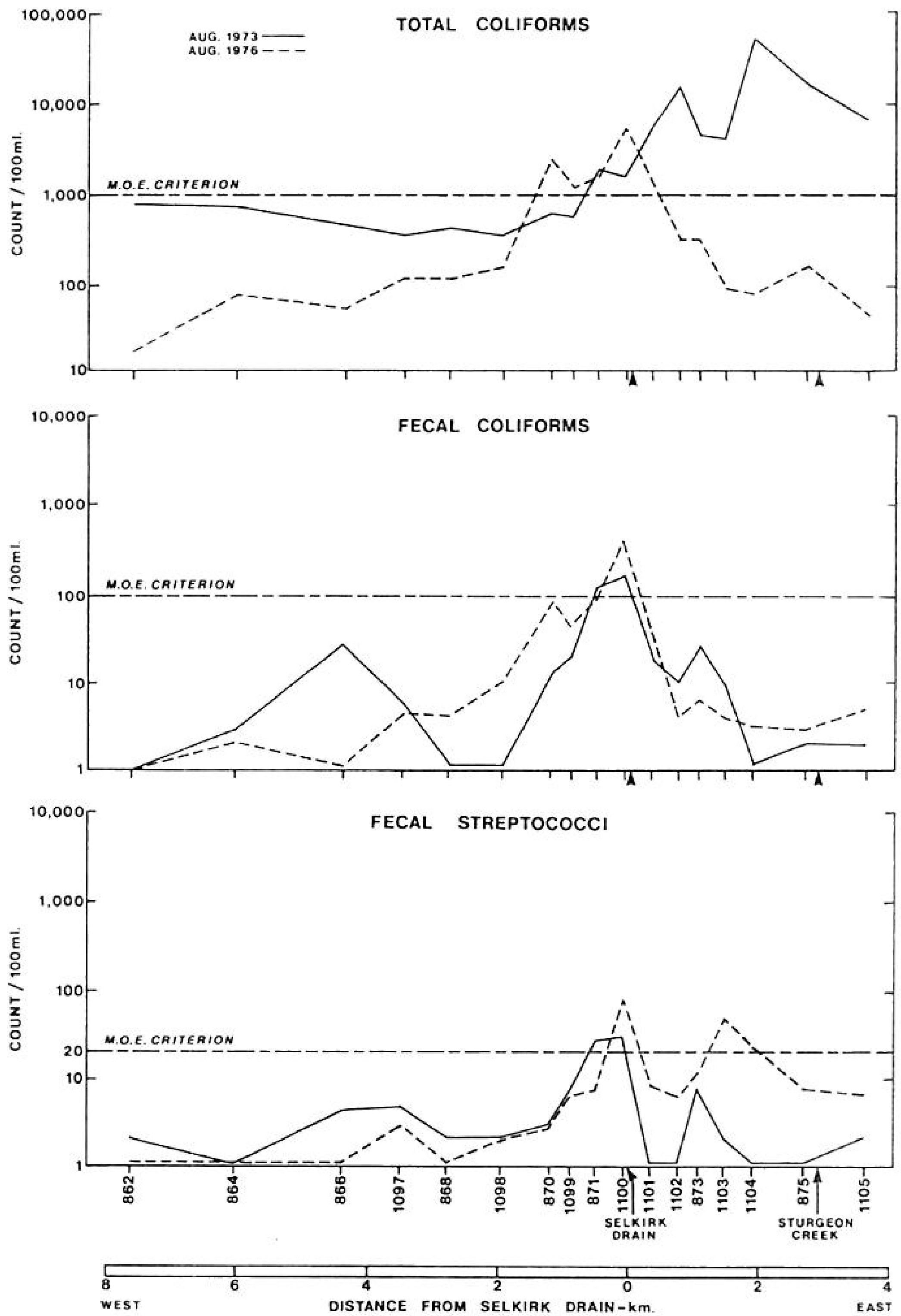


Figure 4: Bacterial Densities for Nearshore Zone.

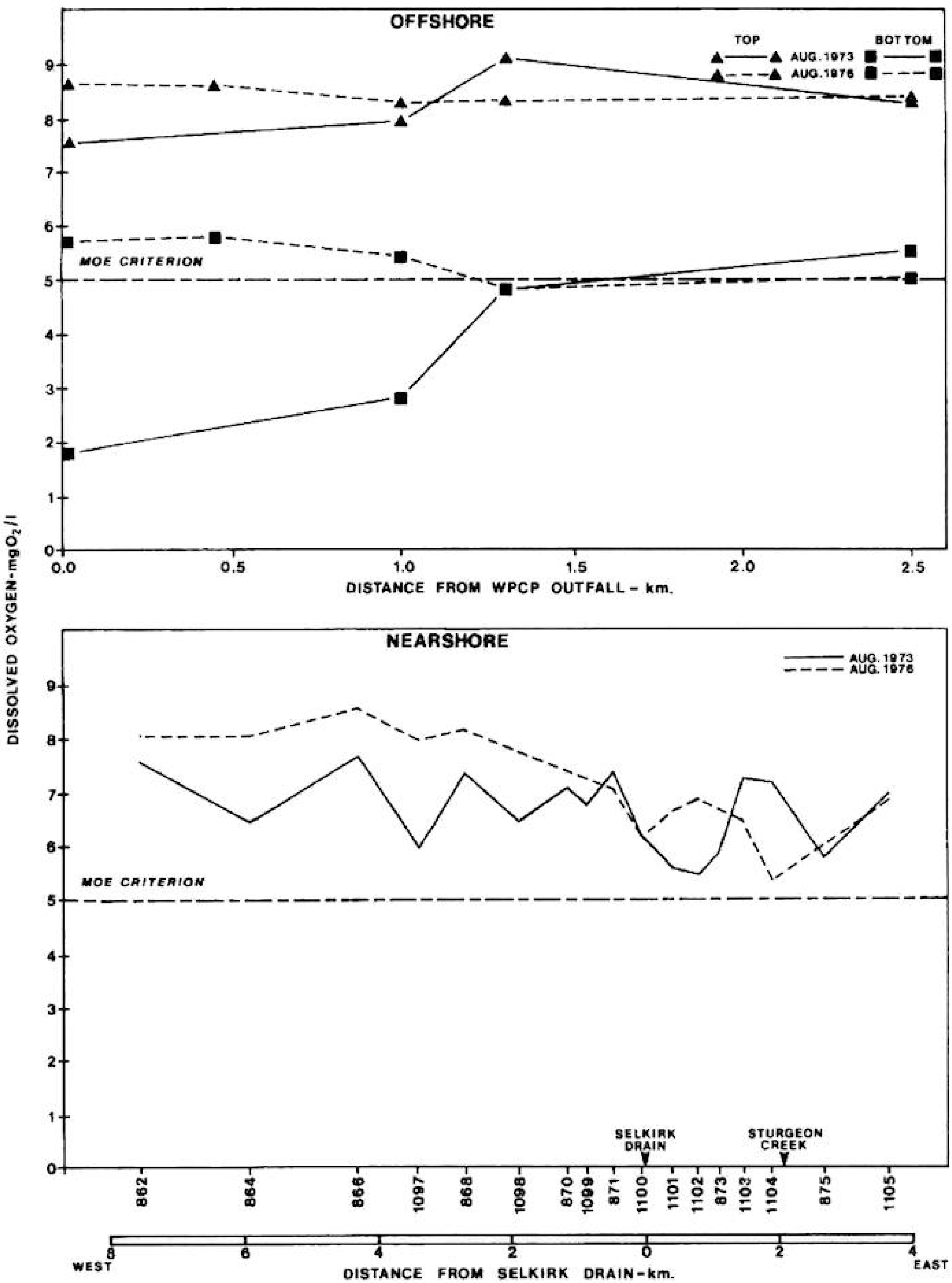


Figure 5: Dissolved Oxygen Levels for Nearshore and Offshore Zones.

5.2.3 Enrichment

Levels of total phosphorus have generally decreased in the Western Basin of Lake Erie and contributed to a significant decline in phytoplankton biomass (5).

In the vicinity of the Leamington-Heinz outfall average total phosphorus levels in 1976 decreased to 20 µg/L which represents a decline of 60% from the average 1973 level of 50 µg/L (Figure 6). The rate of decline corresponds to that observed in the Western Basin of Lake Erie during the period from 1970 to 1976 (6).

Mean chlorophyll a levels in the vicinity of the outfall decreased to about 8 µg/L from average levels of 14 µg/L observed in 1973 (Figure 7). In areas close to shore, both total phosphorus and chlorophyll a levels decreased, but exhibited peaks near the Selkirk Drain and Sturgeon Creek outlets.

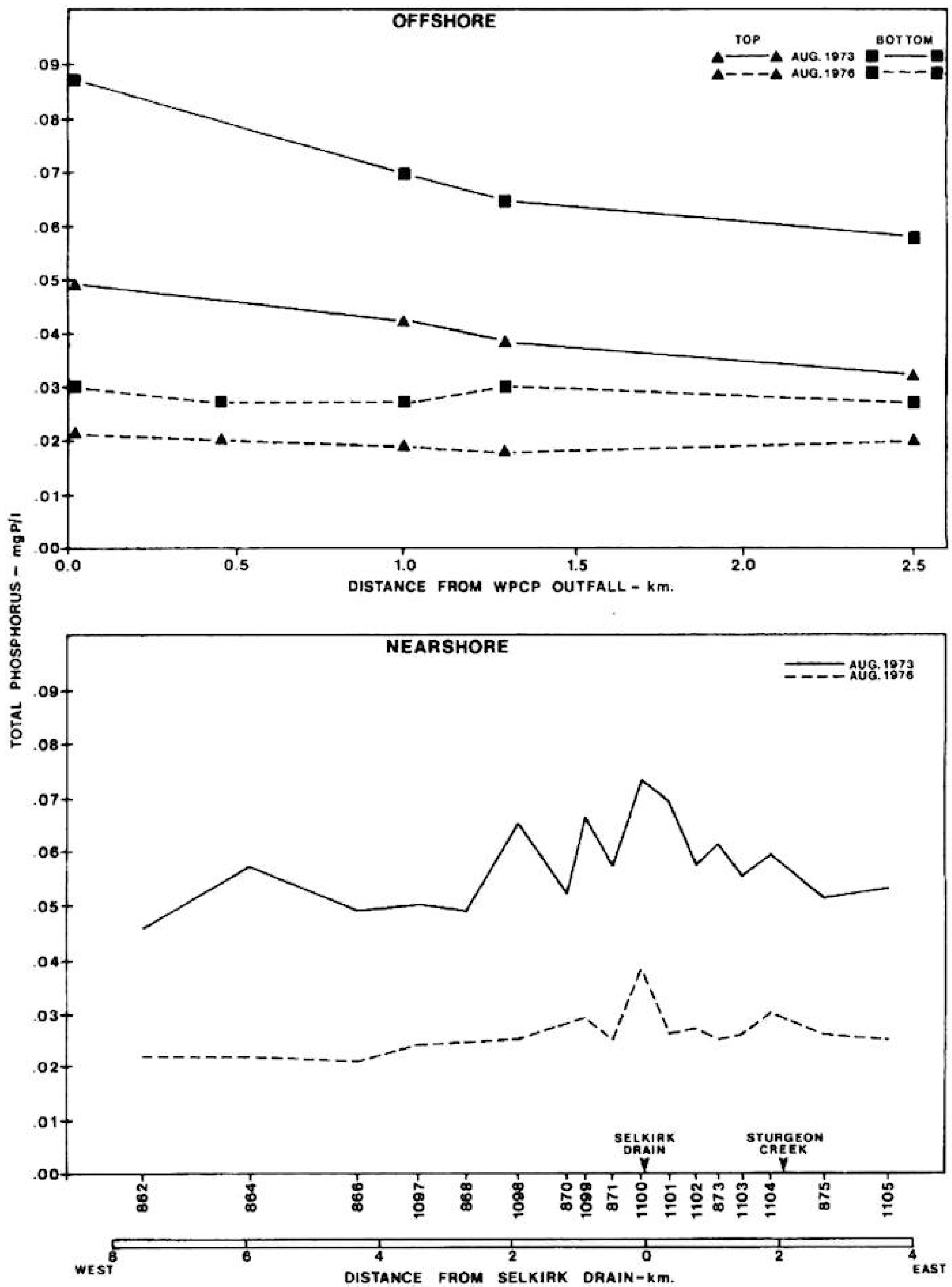


Figure 6: Total Phosphorus Levels for Nearshore and Offshore Zones.

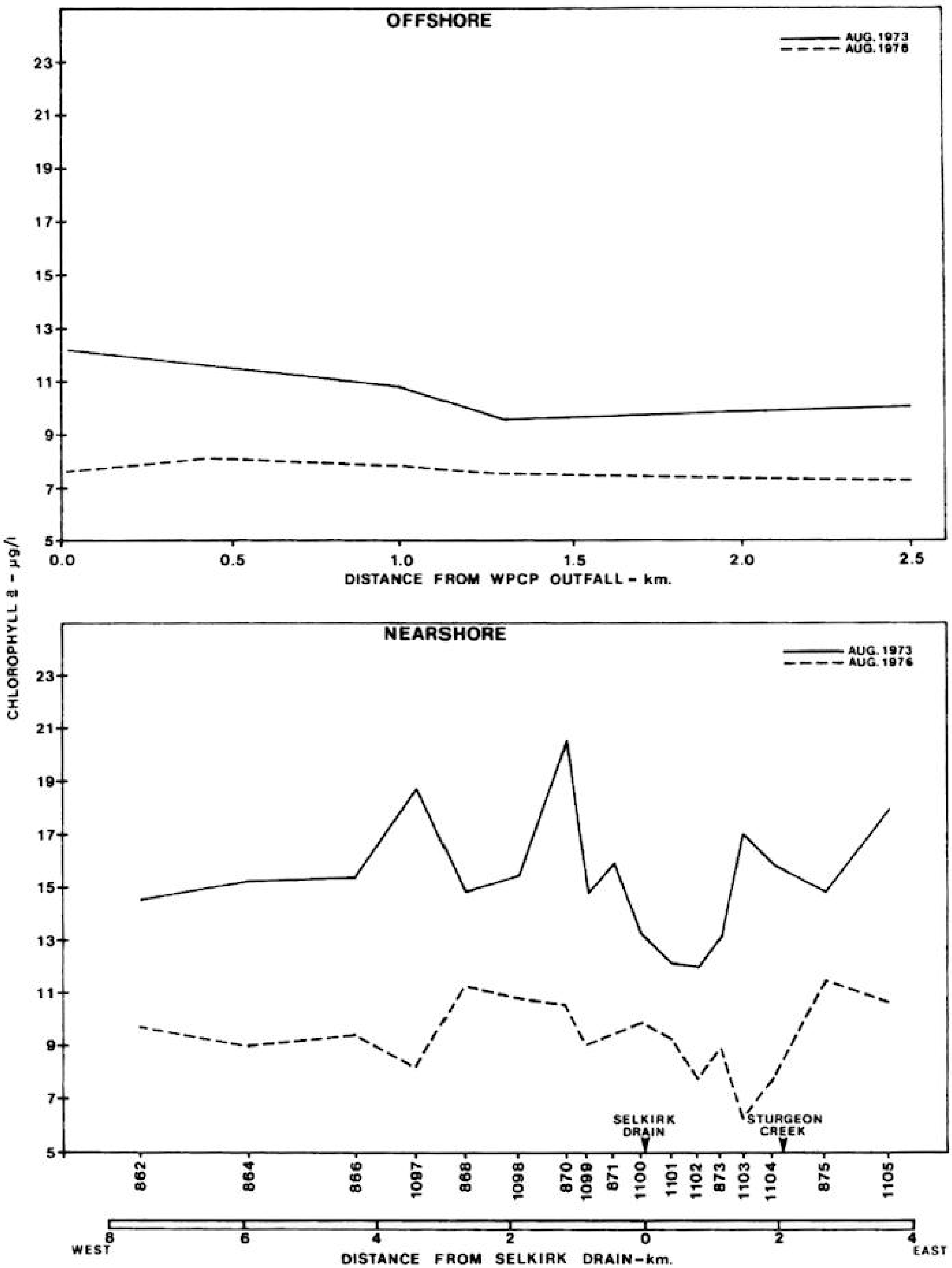


Figure 7: Chlorophyll a Levels for Nearshore and Offshore Zones.

REFERENCE LIST

1. Hamdy, Y. and Moore, O., "Leamington - Impact of Municipal and Canning Wastes on Western Lake Erie", Ontario Ministry of the Environment, unpublished, 1975.

2. Personal communication from J. Leach, Ontario Ministry of Natural Resouces, Wheatley Research Station, May 17, (1977).

3. Hoadley, A.W., "On the Significance of *Pseudomonas aeruginosa* in Surface Waters", N.Eng. Water Works Assoc. (1968).

4. Lin, S., Evans, R., and Beuscher, D., "Bacteriological Assessment of Spoon River Water Quality", Applied Microbiology, Vol. 28, p. 288-297 (1974).

5. Nicholls, K.H., Standeu, D.W., Hopkins, G.J. and Carney, E.C., "Decline in the Nearshore Phytoplankton of Lake Erie's Western Basin since 1971", J. of Great Lakes Res., Vol. 3, No. 1-2 (1977).

6. Olijnyk, M.S., "Phosphorus Levels Along the Canadian Shore of Western Lake Erie", presented at the 20th Great Lakes Res. Conf., Ann Arbor (1977).

TABLE 1. Waste loadings from the combined discharge of the Leamington STP and the H. J. Heinz Company Waste Treatment Plant.

	August1973		August 1976	
Chemical	mg/L [1]	kg/d	mg/L [2]	kg/d
Total Phosphorus as P	3.2	34	0.4	8
Total Nitrogen as N	13.4	144	2.4	50
Total Suspended Solids	700	7544	16	334
BOD_5	260	2802	17	355
COD	-		109	2268
Flow	10.8 ML/d	(2.4 MIGD)	11.3 ML/d	(2.5 MIGD)
Bacteriological	(organisms/100 ml)[3]		(organisms/100 ml)[4]	
Total Coliforms	84,450		3,515	
Fecal Coliforms	588		51	
Fecal Streptococci	2699		681	
Pseudomonas aeruginosa			6	

1. Arithmetic mean of 3 daily samples (each sample consisting of 7 hourly composite sub-samples)
2. Arithmetic mean of 4 daily samples (each sample consisting of 7 hourly composite sub-samples)
3. Geometric mean of 15 samples
4. Geometric mean of 3 samples

TABLE 2. Summary of Water Quality Data - Source Stations.

Parameters	Selkirk Drain		Sturgeon Creek	
	Aug 73	Aug 76	Aug 73	Aug 76
a) Chemical/Physical [1] (mg/L except as noted)				
BOD	16.7	8.0	5.0	3.6
Total Solids	263	-	550	-
Total Phosphorus as P	0.57	0.74	0.52	0.41
Total Nitrogen as N	0.64	1.73	3.86	0.90
b) Bacteriological (org/100 ml)				
Total Coliforms	699	23,757	127,500	57,334
Fecal Coliforms	3	818	1,148	4,419
Fecal Streptococci	12	744	2,699	3,220
Pseudomonas Aeruginosa	-	30	-	52

[1] Mean of three determinations

[2] Geometric mean of 15 results in 1973 and of 18 results in 1976.

TABLE 3. Summary of Water Quality Data, Nearshore Stations, Pigeon Bay August 1973 and August 1976.

Station Number	Total P. mg/L 1973	Total P. mg/L 1976	Reactive P. mg/L 1973	Reactive P. mg/L 1976	T. Kjeld. N. mg/L 1973	T. Kjeld. N. mg/L 1976	T. Inorg. N. mg/L 1973	T. Inorg. N. mg/L 1976
862	.045	.022	.009	.008	.05	.44	.13	.12
864	.057	.022	.016	.006	.49	.40	.15	.13
966	.049	.021	.012	.006	.59	.38	.16	.11
1097	.050	.024	.011	.006	.47	.40	.17	.14
868	.049	.024	.009	.007	.48	.42	.15	.13
1098	.065	.024	.011	.006	.48	.42	.16	.15
870	.052	.027	.010	.006	.53	.42	.13	.15
1099	.067	.028	.018	.008	.54	.43	.19	.15
871	.057	.025	.012	.007	.53	.40	.17	.18
1100	.073	.038	.020	.010	.55	.45	.19	.17
1101	.069	.025	.020	.007	.56	.38	.19	.15
1102	.057	.027	.014	.009	.54	.39	.18	.15
873	.061	.025	.015	.008	.55	.48	.19	.15
I103	.055	.026	.013	.005	.51	.41	.17	.15
1104	.059	.030	.020	.009	.52	.55	.15	.11
875	.052	.027	.013	.009	.52	.51	.17	.17
1105	.053	.025	.015	.007	.53	.40	.16	.15

Station Number	T. Coliform org/100 ml 1973	T. Coliform org/100 ml 1976	F. Coliform org/100 ml 1973	F. Coliform org/100 ml 1976	F. Strep. org/100 ml 1973	F. Strep. org/100 ml 1976	P. Aeruginosa org/100 ml 1973	P. Aeruginosa org/100 ml 1976	Diss. O_2 mg/L 1973	Diss. O_2 mg/L 1976
862	789	14	1	1	2	1	-	1	7.6	8.1
864	723	69	3	2	1	1	-	1	6.5	8.2
866	230	50	15	1	4	2	-	1	7.7	8.6
1097	385	110	5	4	5	3	-	1	6.0	8.1
868	453	110	1	4	2	1	-	1	7.4	8.2
1098	250	135	1	11	2	2	-	3	6.5	7.8
870	689	2759	11	80	3	3	-	6	7.1	7.5
1099	600	1191	20	44	6	6	-	3	6.9	7.3
871	1820	1474	113	102	28	7	-	2	7.4	7.1
1100	1505	5599	188	411	32	77	-	7	6.4	6.3
1101	6316	1185	17	43	1	9	-	1	5.7	6.8
1 102	13420	221	10	4	1	6	-	2	5.5	6.9
873	4932	234	25	6	8	12	-	2	6.0	6.7
1103	4347	98	11	4	2	50	-	2	7.4	6.6
1104	60000	7	1	3	1	28	-	2	7.3	5.5
875	12460	179	2	3	1	7	-	2	5.8	6.1
1105	6510	51	2	5	2	5	-	1	7.1	6.9

TABLE 4. Summary of Water Quality Data, Offshore Stations, Pigeon Bay August 1973 and August 1976.

Station Number	Depth (m)	Total P mg/L 1973	Total P mg/L 1976	Reactive P mg/L 1973	Reactive P mg/L 1976	TKN mg/L 1973	TKN mg/L 1976	T. Inorg. N. mg/L 1973	T. Inorg. N. mg/L 1976	Diss. O_2 mg/L 1973	Diss. O_2 mg/L 1976
289	1.5	.051	.023	.008	.007	.470	.372	.160	.115	7.5	8.4
	7.0	.086	.025	.035	.007	.540	.393	.330	.185	1.3	6.4
461	1.5	.045	.018	.012	.006	.420	.355	.150	.102	7.6	8.5
	7.5	.085	.035	.039	.008	.500	.412	.270	.182	2.0	4.7
1144	1.5	-	.020	-	.006	-	.375	-	.107	-	8.5
	7.5	-	.021	-	.006	-	.373	-	.137	-	7.1
1145	1.5	-	.019	-	.006	-	.328	-	.102	-	8.5
	8.0	-	.030	-	.007	-	.408	-	.223	-	5.8
1146	1.5	-	.021	-	.007	-	.328	-	.117	-	8.7
	7.5	-	.030	-	.007	-	.417	-	.212	-	4.3
477	1.5	.041	.020	.009	.006	.430	.380	.140	.118	8.0	8.6
	6.5	.078	.021	.033	.007	.510	.377	.280	.160	2.5	6.7
479	1.5	.038	.017	.010	.006	.460	.323	.120	.115	7.9	8.4
	8.0	.065	.022	.028	.007	.480	.380	.290	.173	3.9	5.5
1151	1.5	-	.019	-	.006	-	.307	-	.100	-	8.5
	8.5	-	.026	-	.015	-	.388	-	.195	-	5.6
481	1.5	.034	.019	.009	.006	.400	.345	.120	.102	9.3	8.4
	8.5	.054	.032	.023	.008	.440	.427	.270	.222	3.4	4.0
1147	1.5	-	.019	-	.005	-	.363	-	.108	-	8.5
	8.0	-	.037	-	.010	-	.443	-	.225	-	4.3
483	1.5	.054	.023	.012	.008	.500	.413	.160	.153	7.3	7.5
	7.0	.083	.042	.048	.007	.540	.405	.320	.183	1.2	6.1
490	1.5	.040	.015	.012	.007	.430	.338	.140	.112	9.4	8.3
	8.0	.086	.024	.041	.007	.490	.372	.270	.188	2.9	6.3
1152	1.5	-	.018	-	.004	-	.357	-	.122	-	8.5
	9.0	-	.030	-	.009	-	.415	-	.205	-	5.1
1153	1.5	-	.018	-	.007	-	.300	-	.130	-	8.6
	9.0	-	.026	-	.008	-	.392	-	.278	-	4.9
488	1.5	.035	.019	.009	.007	.470	.382	.140	.103	9.0	8.5
	9.0	.043	.031	.015	.009	.430	.413	.200	.227	6.9	4.5
1154	1.5	-	.018	-	.006	-	.325	-	.102	-	8.6
	9.0	-	.029	-	.009	-	.387	-	.217	-	4.5
1155	1.5	-	.019	-	.006	-	.318	-	.153	-	8.5
	8.5	-	.039	-	.012	-	.465	-	.198	-	3.7
1148	1.5	-	.023	-	.006	-	.375	-	.133	-	8.1
	8.0	-	.028	-	.008	-	.435	-	.212	-	5.4
489	1.5	.032	.018	.011	.006	.390	.368	.150	.113	8.9	8.9
	9.5	.057	.022	.029	.006	.410	.368	.220	.177	7.7	7.2
287	1.5	-	.021	.010	.006	.400	.353	.120	.105	8.1	9.1
	9.0	-	.028	.020	.009	.490	.448	.260	.265	5.4	4.1
1149	1.5	-	.024	.006	-	.410	-	-	.157	-	7.5
	8.0	-	.033	-	.009	-	.470	-	.247	-	4.0
1156	1.5	-	.018	-	.005	-	.330	-	.102	-	8.4
	10.0	-	.035	-	.011	-	.422	-	.205	-	4.7
1150	1.5	-	.024	-	.008	-	.378	-	.152	-	7.2
	8.0	-	.035	-	.009	-	.487	-	.237	-	3.3

TABLE 4 (continued)

Station Number	Total Coliform		Fecal Coliform		Fecal Streptococci	
	1973	1976	1973	1976	1973	1976
289	400	20	5	3	1	1
461	2,065	48	2	2	1	1
1144	--	65	-	2	-	1
1145	--	28	-	1	-	1
1146	--	37	-	1	-	1
477	670	67	1	3	1	1
479	91	53	1	2	1	1
1151	-	49	-	1	-	1
481	52	38	1	1	1	1
1147	-	45	-	3	-	1
483	3,624	27	30	1	1	1
490	81	47	1	2	1	1
1152	-	11	-	3	-	1
1153	-	4	-	2	-	1
488	83	4	1	1	2	1
1154	-	21	-	1	-	1
1155	-	20	-	1	1	1
1148	-	7	-	2	-	1
489	39	4	1	1	1	1
287	116	6	1	1	1	1
1149	-	17	-	1	-	1
1156	-	7	-	1	-	1
1150	-	12	-	2	-	1