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DISTRIBUTION OF LARVAL FISH IN THE NEARSHORE WATERS OF WESTERN LAKE HURON, APRIL-AUGUST 1975, AND AN OVERVIEW OF 3 SUCCESSIVE YEARS OF SAMPLING

by

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Summary of DISTRIBUTION OF LARVAL FISH IN THE NEARSHORE WATERS OF WESTERN LAKE HURON, APRIL-AUGUST 1975, AND AN OVERVIEW OF 3 SUCCESSIVE YEARS OF SAMPLING

The Great Lakes Fishery Laboratory extensively sampled larval fish in the nearshore waters of western Lake Huron in 1973-75 to determine the species composition, distribution, and abundance, and to identify and delineate major spawning and nursery areas. Ichthyoplankton collections were made with a 1/2-m plankton net of 350-u mesh towed off the side of the R/V Kaho at a speed of about 99 m/min.

The 1975 survey determined that larval rainbow smelt were dominant in the nearshore waters of Saginaw Bay and southern Lake Huron during the spring and throughout western Lake Huron in early summer whereas during mid and late summer alewives were the most abundant species of larval fish in the littoral zone.

From data collected during 1973-75 the sequence of seasonal changes in the species composition of the nearshore ichthyoplankton was determined; the general lakewide distributions of larval rainbow smelt, alewife, and yellow perch were described; St. Martin Bay, Thunder Bay, Saginaw Bay and the small bays and inlets among Les Cheneaux Islands were identified as important nursery areas; and for each of five areas of the lake the approximate dates were established for the first appearance and maximum abundance of larval rainbow smelt, alewife, and yellow perch.

DISTRIBUTION OF LARVAL FISH IN THE NEARSHORE WATERS OF WESTERN LAKE HURON, APRIL-AUGUST 1975, AND AN OVERVIEW OF 3 SUCCESSIVE YEARS OF SAMPLING

The Great Lakes Fishery Laboratory extensively sampled larval fish in the nearshore waters of western Lake Huron in 1973-75 to determine the species composition, distribution, and abundance, and to identify and delineate major spawning and nursery areas. This investigation was prompted by the need for information with which to determine the possible impact that the operation of existing and proposed power plants may have on larval fish exposed to thermal effluents and to entrainment in cooling systems.

The previous annual surveys (May-June 1973 and June-July 1974) revealed seasonal changes and regional differences in the species composition of ichthyoplankton in the nearshore waters of western Lake Huron. Larval rainbow smelt (hereafter designated as smelt) were dominant from late May through June in northern and central Lake Huron and during early June in southern Lake Huron. Larval alewives comprised the largest portion of the ichthyoplankton during mid-July in the southern part of the lake and from mid-June through early July in Saginaw Bay. In early June, yellow perch (hereafter designated as perch) was the dominant species of larval fish in Saginaw Bay. Generally, larval alewives and perch were most abundant in Saginaw Bay and larval smelt were most abundant in northern Lake Huron.

Method and Materials

The 1975 survey for larval fish, conducted between late April and mid-August at 12 locations in western Lake Huron, included two new sampling sites, Rockport and Ossineke (Fig. 1). Rockport was added to the 1975 sampling schedule

because of its potential as a power plant site, and Ossineke, along the south shore of Thunder Bay, was included to complement the sampling station at Alpena, along the north shore of Thunder Bay. Ichthyoplankton samples were collected during 26 April-11 May, 29 May-4 June, 17-23 July, and 13-19 August. During the first period, only Hammond Bay, Alpena, Harbor Beach, and Pt. Au Gres were sampled; all 12 locations were visited once during the remaining three sampling periods. Using the same method employed in the 1973 and 1974 surveys, larval fish were collected with a 1/2-m plankton net of 350-u mesh towed at a speed of about 99 m/min (O'Gorman 1975, 1976). At each sampling site (except the one near Bay City), the following two series of tows were made at 1-m depth intervals in the water column: (1) from the surface to a depth of 4 m along the 5.5-m bottom contour, and (2) from the surface to a depth of 6 m along the 9.2-m bottom contour. Samples near Bay City were collected only along the 5.5-m contour, the maximum depth in that area. Vessel direction was usually reversed after each tow, although two tows were sometimes made before reversing the direction of travel. Tows along the 5.5-m contour were always completed before beginning tows along the 9.2-m contour. Standard sampling speed was maintained during deployment and retrieval of the sampling gear.

Towing time in each depth stratum was usually 5 min although it was reduced occasionally to 2 1/2 min or rarely to 1 1/4 min in areas were dense algae quickly clogged the net. Clogging occurred and towing times were reduced when the pressure waves near the net mouth increased in size and numbers during the initial (near surface) tow. The pressure waves were observed from the vessel's port side near the stern, a position nearly directly above the gear as it was being towed through the water. When a tow was completed, the contents of the net were washed into a pint jar attached to the end of the net. Depending on their

volume, samples were either left in the jar or transferred to a smaller bottle, and then preserved in 10% formalin.

In the laboratory, larval fish were separated from the plankton and debris in the samples, and then identified and counted. Sample processing was extremely slow due to the small size of some larval fish (4 mm) and to the large quantity of plankton. Each larval fish was examined using a binocular dissecting scope to insure accurate identification.

The abundance of larval fish at each stratum was calculated on the basis of numbers per 1,000 m^3 of water filtered (assuming that the net filtered 97 m^3 during a 5-min tow). No attempt was made to correct for variation in the net's filtering efficiency, or in the different gear avoidance capabilities of the various sizes of fish. Consequently, the figures derived underestimate the actual numbers of fish larvae present in the water column, with the disparity increasing as the fish increased in size and swimming ability, thus becoming less vulnerable to the sampling gear. Because the net lacked an opening-closing device, I made minor corrections for larval fish collected during net retrieval, which usually was very brief. I calculated the corrections by first determining the volume of water filtered for each stratum through which the net was retrieved (from the average rate of ascent, I estimated the time the gear was in each stratum) and then determining the number of larval fish expected to be contained in the filtered volume. Estimates of the number and species of larval fishes on or close to the bottom are entirely lacking since the gear could not effectively sample this area.

The abundance of larval fish during mid-August was only estimated for the Port Austin, Pt. Au Gres, and Bay City sites. Sampling was hindered at all other locations by a combination of filamentous algae and Holopedium gibberum (a

zooplankter with a gelatinous sheath) that rapidly clogged the net. Under these conditions, estimating larval fish abundance accurately was impossible.

Larval Fish Distribution

Larval smelt were predominant in the nearshore waters of Saginaw Bay and southern Lake Huron during the spring and throughout western Lake Huron in early summer. Whereas, during mid- and late summer alewives were the most abundant species of larval fish in the littoral zone.

For ease of presentation, the lakewide distribution of larval fish is summarized relative to five major areas of the lake (Fig. 1).

Northern Lake Huron (Area I)

In northern Lake Huron, larval fish were sampled in Hammond Bay on 26 April, 4 June, 22 July, and 14 August and off St. Vital Pt. on 4 June, 23 July, and 13 August (Fig. 1). Six identifiable species of larval fish were captured: smelt, alewives, perch, fourhorn sculpins, bloaters, and burbot (Table 1). One other larval species that could not be identified was also collected.

Catches of larval smelt were larger in northern Lake Huron than in any other area of the lake. Smelt were the most common larval fish in the nearshore waters of northern Lake Huron on 4 June, being somewhat more abundant off St. Vital Pt. than in Hammond Bay. Most were caught in the 3-m depth stratum along the 5.5-m bottom contour and in the 4-m (Hammond Bay) and 5-m (St. Vital Pt.) depth strata along the 9.2-m bottom contour. None were taken in late April in Hammond Bay. A few large smelt fry were caught during late July at each sampling site and during mid-August off St. Vital Pt.

Alewives were the most abundant larval fish in northern Lake Huron during late July. They were more abundant in Hammond Bay than off St. Vital Pt. Generally, the greatest numbers of larval alewives were in the 2-m depth stratum. Because of the

net-clogging problems encountered in mid-August, the relative abundance of larval alewives during that period could not be estimated; however, they were caught in nearly every tow.

Larval perch were collected in northern Lake Huron only during the 4 June survey. They were most abundant in the 3-m depth stratum at both stations, while overall abundance was greatest in Hammond Bay. Mature perch usually spawn during early June in Hammond Bay and consequently, perch larvae are not commonly caught until mid-June. Nearshore water temperatures, however, were uncommonly warm during the spring of 1975 and probably advanced spawning/hatching activity.

A few larval fourhorn sculpin were caught in Hammond Bay during late April along the 5.5-m depth contour and larval bloater, unidentified coregonids, and burbot were collected off St. Vital Pt. in June.

During mid-August, a few larval fish that could not be identified were caught off St. Vital Pt.

Central Lake Huron (Area II)

Larval fish samples were collected in central Lake Huron at Alpena on 7 May and during 1-3 June, 20-22 July, and 14-16 August at Rockport, Alpena, Ossineke, and Harrisville (Fig. 1). Including the samples collected during May, six species of larval fish were identified from this area of the lake (Table 2).

Larval smelt made up the bulk of the ichthyoplankton in central Lake Huron during early June with the largest catches off Ossieke and Harrisville. Some larval smelt were caught during July at all sampling sites except Harrisville.

Larval alewives were the most frequently encountered species of larval fish in the littoral zone during the July sampling period. They were more abundant off Rockport than they were off Ossineke. Tows near Alpena and Harrisville during July were made in upwelled water. Few larval fish were caught at these sampling sites because upwellings disperse nearshore surface waters containing fish larvae

to offshore areas. Alewife were concentrated in the near surface stratum along the 9.2-m depth contour. However, along the 5.5-m depth contour, they were concentrated in the 1-m stratum near Ossineke and in the 3-m stratum near Rockport. During mid-August, larval alewives were present at all sampling sites in central Lake Huron except Harrisville.

Larval perch were collected during early June off Alpena and Ossineke. Most were caught near Ossineke. The perch appeared to prefer the deepest and shallowest sampling strata.

A few larval lake whitefish were taken off Alpena in May and off Rockport in June. Small numbers of larval burbot and fourhorn sculpins were also caught near Alpena in May. A larval fish that could not be identified was captured near Rockport in August.

Outer Saginaw Bay (Area III)

Au Sable Pt. and Port Austin were the only locations sampled for ichthyoplankton in outer Saginaw Bay (Fig. 1). Larval fish collections were made off Au Sable Pt. on 1 June, 20 July, and 16 August, and off Port Austin on 30 May, 18 July, and 18 August. Alewife, smelt, perch, and burbot were the only species of larval fish caught in this area of the lake (Table 3).

Smelt dominated the larval fish catches in outer Saginaw Bay on 30 May and 1 June. The number of smelt caught off Port Austin was nearly double that caught off Au Sable Pt. and at both locations the largest concentrations were at the deeper sampling strata. During mid-July, a few larval smelt were collected off Au Sable Pt. Most were taken over the 5.5-m bottom contour where an upwelling was in progress.

Larval alewives were captured off Port Austin on all sampling dates and off Au Sable Pt. on all sampling dates except 1 June. They were scarce in late

May (only one specimen was caught) and abundant during mid-July. More were caught near Port Austin on 18 July than at any other sampling site. Largest numbers were collected in the 1-m stratum along both the 5.5-m and 9.2-m contours. An upwelling off Au Sable Pt. in mid-July was responsible for the small catches of larval alewives over the 5.5-m contour. However, along the 9.2-m bottom contour warmer surface waters overlaid the cold upwelled water and good catches of larval alewives were made at and above the 2-m depth stratum. By mid-August only small numbers of larval alewives were caught off Port Austin (plankton did not inhibit sampling at this location).

On 30 May, a larval burbot and moderate numbers of larval perch were caught near Port Austin. The majority were collected in the 1-m depth stratum.

Southern Lake Huron (Area IV)

In southern Lake Huron, populations of ichthyoplankton were sampled off Harbor Beach on 10 May and off Harbor Beach and Richmondville on 29 May, 17 July, and 19 August (Fig. 1). Larval alewives, smelt, perch, and one fish that could not be identified were caught (Table 4).

Small numbers of smelt larvae were caught during May and July in southern Lake Huron. Sampling off Harbor Beach on 10 May yielded the most larval rainbow smelt.

Larval alewives were more abundant off Harbor Beach than off Richmondville during mid-July. Generally, tows in the 2-m depth stratum yielded the largest numbers of alewives in July. Small numbers were collected at both sampling sites in August.

Some larval perch were captured over the 9.2-m bottom contour off Harbor Beach in July and over the 5.5-m contour off Richmondville in May. A larval fish that could not be identified was caught in August off Harbor Beach.

Inner Saginaw Bay (Area V)

Sites near Pt. Au Gres and Bay City in inner Saginaw Bay were sampled on 31 May, 19 July, and 17 August (Fig. 1). Collections were also made off Pt. Au Gres on 11 May. In addition to larval alewives, smelt, and perch which were caught at both sampling sites; burbot, fourhorn sculpins, members of the catostomidae and cyprinidae families, and some species of larval fish that could not be identified were caught off Pt. Au Gres (Table 5).

Larval smelt were collected in inner Saginaw Bay during May and July (Pt. Au Gres only) but peak numbers occurred on 31 May.

Alewife larvae were present, in small numbers, off Pt. Au Gres on 31 May and off Bay City and Pt. Au Gres in August. Substantial catches were made at both sampling sites in mid-July. Larval alewives were usually most abundant in the shallower sampling strata.

Larval perch were encountered in inner Saginaw Bay during May only. More were caught near Pt. Au Gres on 11 May than were caught at any of the other sampling sites. On 31 May, larval perch were more abundant off Bay City than off Pt. Au Gres. Generally this species of larval fish preferred the intermediate depth strata (2 m and 3 m) during early May and the near surface stratum during late May.

As for the other species of larval fish caught off Pt. Au Gres; Catostomids were present on 31 May and 19 July, but they were most abundant in July. The greatest numbers were taken along the 5.5-m bottom contour. Cyprinids were caught, mostly near the surface along the 5.5-m depth contour, on 19 July. One burbot and two fourhorn sculpins were collected during late May and early May respectively. Several species of larval fish that could not be identified were caught on 31 May and 17 August.

Summary of the 1975 Larval Survey

During the spring of 1975 larval fish were scarce in northern and central Lake Huron but were more abundant in southern Lake Huron and in inner Saginaw Bay. The scarce species were fourhorn sculpin, burbot, and lake whitefish, and the more abundant species were smelt and perch (inner Saginaw Bay only). In all areas of Lake Huron in early summer smelt were the dominant larval fish and perch were commonly taken in small numbers. During mid- and late summer larval fish samples were composed almost entirely of alewives. Larval alewives were abundant in midsummer and commonly encountered during late summer. The largest numbers of smelt, alewives, and perch were in northern Lake Huron, outer Saginaw Bay, and inner Saginaw Bay, respectively.

Overview of the 1973-75 Larval Investigation

To define the seasonal succession and to assess the relative seasonal abundance of larval fish species, ichthyoplankton was sampled in the nearshore waters of western Lake Huron from late April to mid-August during 1973-75. Comparisons of larval fish abundance between years were not made because of the differences in sampling location, time of sampling, and the lake's rate of warming. However, information was obtained on the seasonal succession of larval fish species in the nearshore waters and on the general and in some cases specific distributions of larval fish in western Lake Huron.

Larval fish distribution in the nearshore waters of western Lake Huron was inferred from samples collected at very few locations along the enormously long shoreline. Intensive sampling in one area was not possible because of the extended periods of time needed to travel from one region of the lake to another, the relatively long time needed to collect samples at each station (2 h), and the short time periods during which samples had to be collected. Undoubtedly,

many small nursery areas were not detected because of the widely spaced sampling sites. Consequently, this report gives a general overview of the distributional pattern of larval fish in the nearshore waters of western Lake Huron rather than a precise description of larval fish distribution in all areas of the lake.

The sequence of seasonal changes in the species composition of the nearshore ichthyoplankton was the same each year throughout western Lake Huron. Larval burbot, fourhorn sculpins, and coregonids (lake whitefish, bloater, and lake herring) were occasionally encountered in the nearshore water column before and during the emergence of larval smelt. Smelt were dominant during spring and early summer while alewives predominated during mid and late summer. Perch, the only other species of larval fish regularly encountered, were captured during late spring and early summer and only once, in Saginaw Bay, were larval perch more abundant than larval smelt. For each area of the lake, the approximate dates were established for the first appearance and maximum abundance of larval smelt, alewife, and perch (Table 6). These dates may vary by 1 or 2 weeks depending on the rates at which water temperatures rise during spring and early summer.

Generally, larval alewives, smelt, and perch are most abundant in bays that have: (1) large areas of shallow water ($\leq$ 9.2 m); (2) rivers or streams flowing into them; (3) infrequent or no upwellings. These features affect the abundance of ichthyoplankton by attracting large numbers of spawning fish (shallow water and rivers and streams) or by slowing the dispersal of larval fish from spawning sites (lack of or infrequent upwellings). Spawning fish are attracted to the shallow bays because their waters warm faster than those of the main lake and they contain preferred spawning grounds for perch. The rivers and streams attract smelt and alewives because they are the preferred spawning sites for these species. The infrequent or lack of upwellings causes the larvae to disperse slowly from

the spawning grounds whereas along the open lakeshore where upwellings are more common larval fish frequently are dispersed from nearshore spawning grounds.

I believe that some of the most important larval fish nursery areas in western Lake Huron are located in bays similar to those described above, specifically St. Martin Bay, Thunder Bay, Saginaw Bay, and in the small bays and inlets among Les Cheneaux Islands (Fig. 2).

St. Martin Bay, a shallow, well protected inlet in northwestern Lake Huron, consistently produced good catches of larval smelt. Large schools of immature smelt also frequent the bay. For example a 2-min drag with a 39-foot (headrope) bottom trawl during mid-June 1973 produced nearly 2,800 yearling and 2-year old smelt. Although sampling was never conducted in St. Martin Bay during midsummer, larval alewives probably utilize the area extensively also. This bay is not, however, an important rearing ground for perch. Larval perch as well as the adults are scarce in St. Martin Bay.

The shoreline east of St. Martin Bay is very irregular, forming coves and bays which are protected from Lake Huron by Les Cheneaux Islands. Shallow water and reefs prevented sampling between the islands and the mainland. However, the topography of the region is similar to that of St. Martin Bay and I believe that some of the coves and bays aroung Les Cheneaux Islands are important rearing grounds for alewife and smelt. Larval perch are also thought to be abundant in this region. A large population of adult perch inhabit the waters surrounding the islands and no evidence of extensive numbers of their young were found to the east (St. Vital Pt.), west (St. Martin Bay), or south (Pt. Fuyards) of Les Cheneaux Islands

The southern and western portions of Thunder Bay are important larval fish nurseries. Alewives, smelt, and perch spawn in the bay. However, their young are

not abundant along the north shore of Thunder Bay or south of the bay off Harrisville where both areas are subject to upwellings. Consequently there is a good possibility that young-of-the-year fish produced in the bay are congregating in the extensive shallows of southern and western Thunder Bay (the 5.5-m and 9.2-m contours are approximately 1 1/2 and 3 mi, respectively, from shore) where upwellings are infrequent. Sampling for ichthyoplankton in these parts of the bay was not possible because of extensive shoals. The samples collected some distance off the south shore (Ossineke) during 1975 indicated that larval fish were at least moderately abundant.

The Au Gres area, between Pt. Au Gres and Pt. Lookout, is an important rearing ground for many fish species. Ichthyoplankton sampling has shown that substantial numbers of larval fish are present during May, June, and July. Larval catostomids, cyprinids, and many fish that could not be identified were captured off Au Gres in addition to alewives, smelt, and perch.

Other regions of inner Saginaw Bay besides Au Gres are undoubtedly important nursery areas. Massive spawning runs of alewives enter the bay and adult perch are abundant throughout Saginaw Bay. Smelt also spawn in the bay. Shallow water prevented nearshore sampling in inner Saginaw Bay, however, tow netting at an offshore sampling site (7 mi off the mouth of the Saginaw River) consistently produced moderate numbers of larval fish.

In addition to delineating major nursery areas in western Lake Huron the general distributions of the three dominant species of larval fish were determined. The smallest numbers of larval smelt and perch were captured in nearshore waters off relatively featureless sections of shoreline, such as those found in southern Lake Huron, and central Lake Huron south of Thunder Bay. Along the slightly irregular shoreline between Thunder Bay and St. Ignace, larval smelt are

moderately abundant and perch are scarce although on occasion, larval smelt are very abundant and perch moderately abundant in some of the bays and harbors. Generally, densities of larval smelt and perch are greater along the southern shore of outer Saginaw Bay than along the northern shore, although the difference is more pronounced for perch than it is for smelt. The distribution of larval alewives in western Lake Huron cannot be described as accurately as the distribution of larval smelt and perch because relatively few samples were taken during seasonal periods of peak alewife abundance. But the limited data available suggest that larval alewives are more evenly distributed than larval smelt or perch along the shore of western Lake Huron.

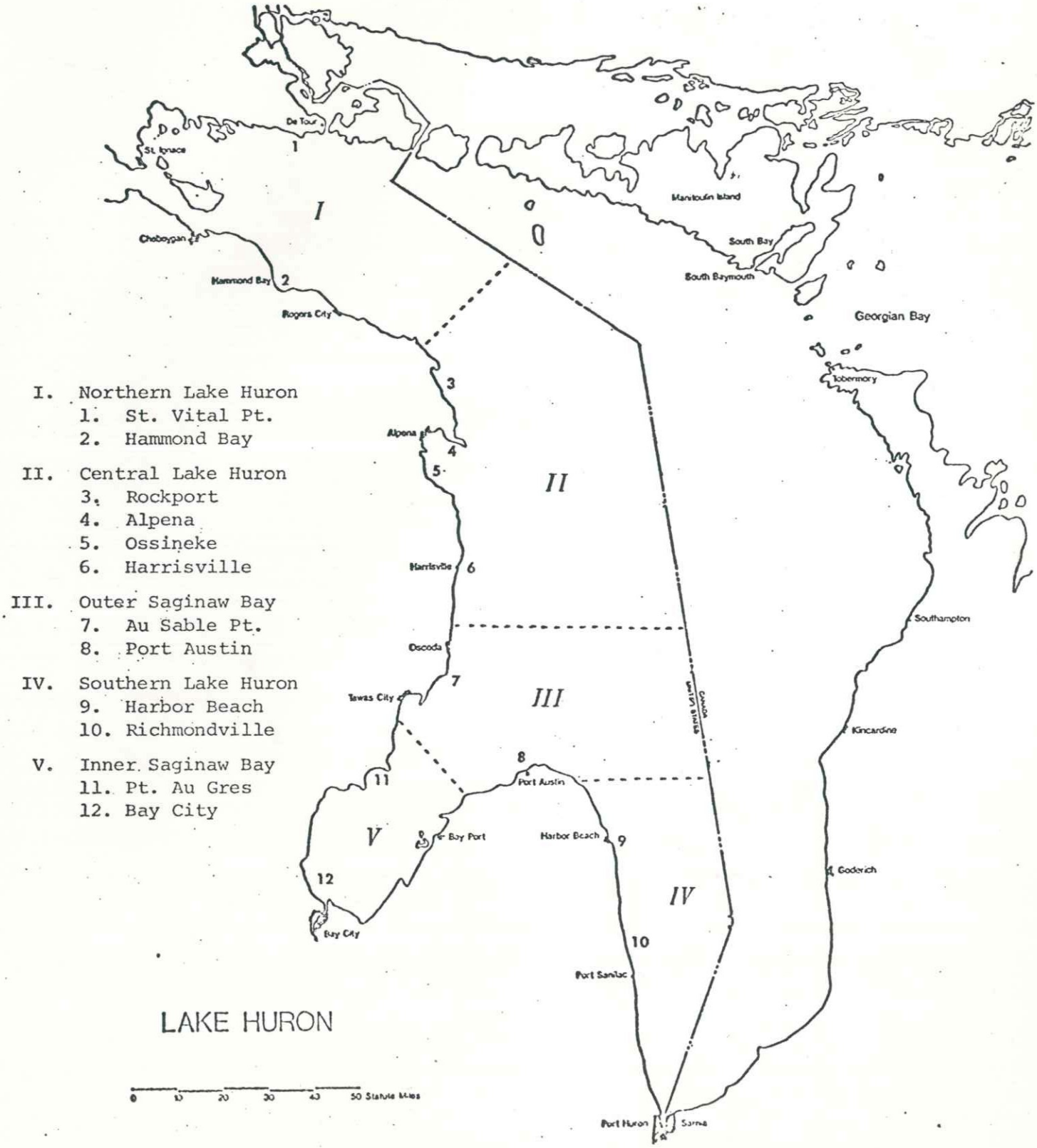

Figure 1. Lake Huron, showing major areas of the lake (Roman numerals) and sampling locations (Arabic numerals).

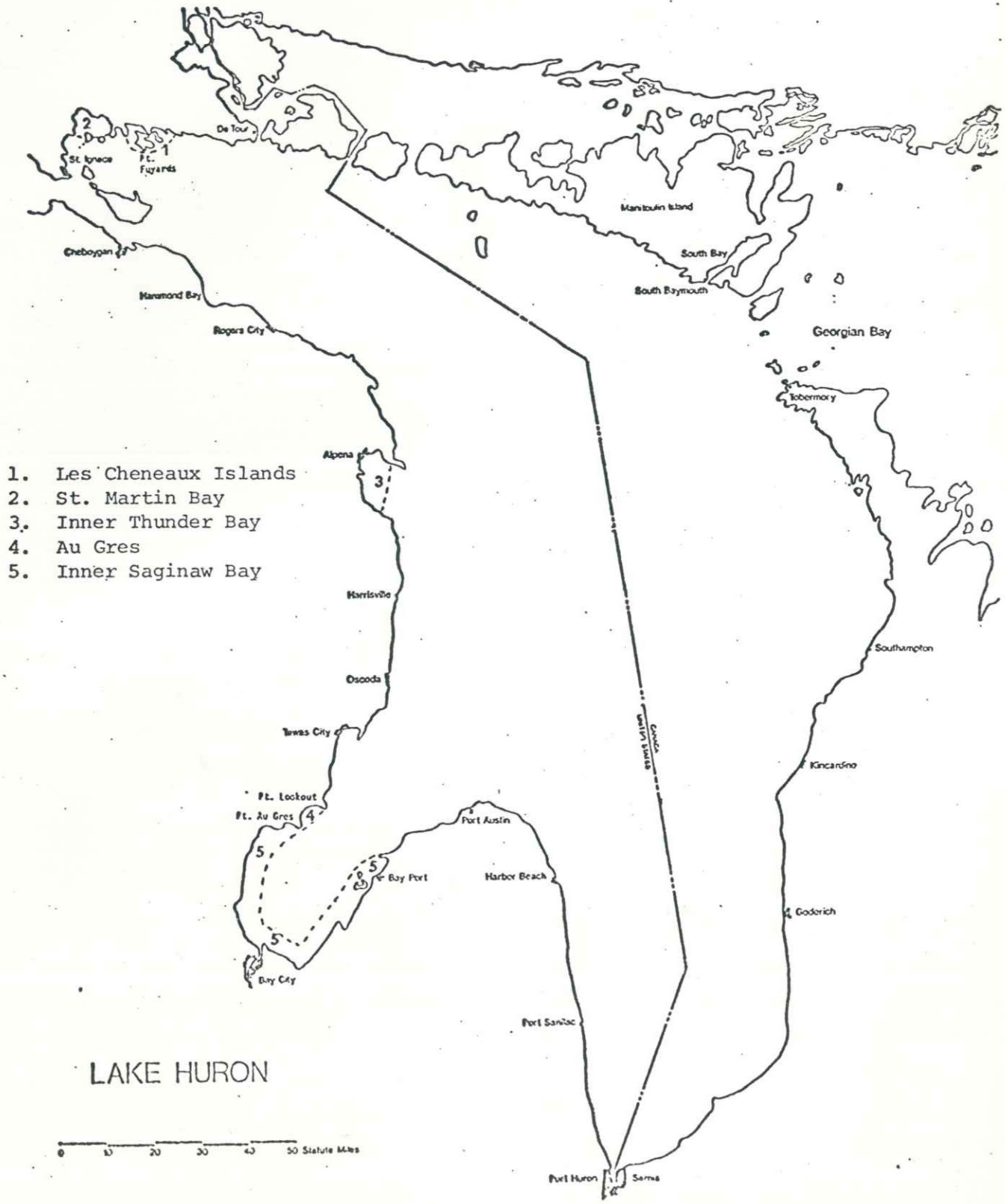

Figure 2. Major known (even numbers) and suspected (odd numbers) larval fish nursery areas.

Table 1. Distribution and density (numbers/1,000 m^3) of larval fish in nearshore waters of northern Lake Huron (Area I), April-July 1975.

Station / Date / Species	Bottom Contour and Sampling Depth											
	5.5m					9.2m						
	Surface	1m	2m	3m	4m	Surface	1m	2m	3m	4m	5m	6m
St. Vital Pt.												
June 4												
Bloater	0	0	21	0	0	0	0	0	0	0	0	0
Burbot	0	0	0	0	0	0	0	0	0	0	10	0
Rainbow smelt	51	61	645	1,747	3,781	0	226	665	1,346	1,876	2,360	1,690
Yellow perch	0	0	0	10	0	0	0	0	10	0	0	10
Unidentified	0	0	0	0	0	0	10	0	0	0	0	10
July 23												
Alewife	61	286	304	147	43	0	133	378	46	87	4	45
Rainbow smelt	0	0	41	0	0	0	0	10	0	0	0	0
Hammond Bay												
April 26												
Fourhorn sculpin	0	0	10	20	0	0	0	0	0	0	0	0
June 4												
Rainbow smelt	122	141	1,874	2,492	3,760	31	41	112	993	995	430	364
Yellow perch	10	41	51	71	0	0	0	10	82	20	0	0
July 22												
Alewife	31	194	470	475	316	143	377	404	154	121	38	58
Rainbow smelt	0	0	10	0	0	10	0	10	0	0	10	0

Table 2. Distribution and density (numbers/1,000 m^3) of larval fish in nearshore waters of central Lake Huron (Area II), May-July, 1975.

Station / Date / Species	Bottom Contour and Sampling Depth											
	5.5m					9.2m						
	Surface	1m	2m	3m	4m	Surface	1m	2m	3m	4m	5m	6m
Rockport												
June 3												
Lake Whitefish	0	0	0	10	0	0	0	0	10	10	0	0
Rainbow smelt	0	10	0	174	224	0	0	0	113	71	101	172
July 22												
Alewife	275	498	534	949	273	132	131	89	98	15	97	65
Rainbow smelt	0	0	0	0	0	0	0	0	0	0	10	0
Alpena												
May 7												
Burbot	0	0	0	0	31	0	0	0	0	0	10	10
Fourhorn sculpin	0	10	0	10	10	0	0	0	10	0	0	0
Lake whitefish	0	0	10	0	0	0	0	0	0	0	10	0
June 2												
Rainbow smelt	0	81	78	0	0	0	162	75	31	30	69	26
Yellow perch	0	0	0	0	40	0	0	0	0	0	0	0
July 21[a]												
Alewife	0	0	0	40	39	0	0	0	0	0	0	0
Rainbow smelt	0	0	81	0	0	0	0	0	0	0	0	0
Ossineke												
June 2												
Rainbow smelt	603	264	136	11	62	221	359	618	483	65	207	37
Yellow perch	40	19	0	0	34	40	39	18	18	0	0	29
July 21												
Alewife	193	299	212	105	226	60	39	18	17	0	17	0
Rainbow smelt	10	0	0	0	0	0	0	0	0	0	0	0
Harrisville												
June 1												
Rainbow smelt	20	71	194	602	268	0	21	10	205	500	444	399
July 20[a]												
Alewife	0	0	0	0	0	0	0	0	31	0	20	0

a/ Samples collected in upwelled water

Table 3. Distribution and density (numbers/1,000 m^3) of larval fish in nearshore waters of outer Saginaw Bay (Area III); Lake Huron, May-August 1975.

Station / Date / Species	Bottom Contour and Sampling Depth											
	5.5m					9.2m						
	Surface	1m	2m	3m	4m	Surface	1m	2m	3m	4m	5m	6m
Au Sable Pt.												
June 1												
Rainbow smelt	20	61	59	99	117	0	20	40	244	157	215	313
July 20[a]												
Alewife	0	0	41	81	0	998	361	584	0	0	0	0
Rainbow smelt	0	0	0	0	40	0	0	10	0	0	0	0
Port Austin												
May 30												
Alewife	0	0	0	0	0	0	0	0	0	20	0	[b]
Burbot	0	20	0	0	0	0	0	0	0	0	0	
Rainbow smelt	60	100	16	16	342	20	326	34	94	194	1,065	
Yellow perch	60	100	0	0	37	20	122	0	0	17	0	
July 18												
Alewife	583	4,532	1,543	1,002	533	3,174	3,887	1,645	796	1,250	408	319
August 18												
Alewife	31	41	9	9	30	51	0	0	0	19	18	0

a/ Samples collected in upwelled water except for the samples collected at the surface, 1-meter, and 2-meters.

b/ Formaldehyde was not added to the sample collected on May 30.

Table 4. Distribution and density (numbers/1,000 m^3) of larval fish in nearshore waters of Southern Lake Huron (Area IV), May-July 1975.

Station	Bottom Contour and Sampling Depth											
Date	5.5m					9.2m						
Species	Surface	1m	2m	3m	4m	Surface	1m	2m	3m	4m	5m	6m
Harbor Beach												
May 10												
Rainbow smelt	502	125	0	0	0	0	0	0	0	0	0	0
May 29												
Rainbow smelt	0	0	0	0	0	0	0	0	0	0	121	116
July 17												
Alewife	0	246	1,783	770	752	0	0	780	1,367	584	250	668
Rainbow smelt	0	0	0	0	0	0	0	0	0	10	0	0
Yellow perch	0	0	0	0	0	0	0	0	21	0	0	0
Richmondville												
May 29												
Rainbow smelt	0	10	0	0	0	0	0	0	0	0	0	0
Yellow perch	71	40	0	0	19	0	0	0	0	0	0	0
July 17												
Alewife	20	277	315	45	27	0	31	359	78	32	113	8
Rainbow smelt	0	0	0	0	0	0	0	0	0	0	61	19

Table 5. Distribution and density (numbers/1,000 m^3) of larval fish in nearshore waters of Inner Saginaw Bay (Area V), Lake Huron, May-August 1975.

Station	Bottom Contour and Sampling Depth											
Date	5.5m					9.2m						
Species	Surface	1m	2m	3m	4m	Surface	1m	2m	3m	4m	5m	6m
Pt. Au Gres												
May 11												
Fourhorn sculpin	0	0	0	0	0	0	10	0	10	0	0	0
Rainbow smelt	10	102	225	253	394	0	0	10	10	0	0	0
Yellow perch	10	82	102	101	69	0	10	31	30	0	0	0
May 31												
Alewife	0	163	17	138	14	0	82	0	0	0	0	0
Burbot	0	0	0	0	20	0	0	0	0	0	0	0
Catostomidae	20	0	0	0	0	0	0	0	0	0	0	0
Rainbow smelt	141	567	270	1,408	767	40	489	704	118	95	114	72
Yellow perch	60	18	0	38	0	0	20	0	0	20	20	0
Unidentified	141	56	0	35	0	40	0	0	0	0	81	0
July 19												
Alewife	201	279	539	222	483	542	572	296	698	398	44	43
Catostomidae	0	20	144	182	199	20	20	0	101	17	0	0
Cyprinidae	141	15	0	15	0	0	41	0	0	0	0	0
Rainbow smelt	0	0	0	0	0	0	41	20	19	19	19	0
August												
Alewife	100	19	0	8	8	61	19	0	29	9	0	9
Unidentified	0	0	0	0	0	0	0	0	10	10	0	0
Bay City												
May 31												
Rainbow smelt	529	637	312	42	0							
Yellow perch	112	18	29	8	0							
July 19												
Alewife	884	764	300	355	42							
August 17												
Alewife	41	20	20	30	29							

Table 6. Approximate dates during which young rainbow smelt, yellow perch, and alewives are first expected and maximum numbers occur in the nearshore waters of western Lake Huron. The symbols i, ii, and iii represent the first, second, and third ten days of a month, respectively. Actual dates may vary by one or two weeks depending on the rates at which water temperatures rise during spring and early summer.

Areas (Roman numerals) and locations in western Lake Huron	First Expected			Maximum Numbers		
	Rainbow Smelt	Yellow Perch	Alewife	Rainbow Smelt	Yellow Perch	Alewife
I Northern						
A. North shore	ii May	iii May	ii June	i June	i June	ii July
B. Southwest shore	iii May	i June	ii June	ii June	ii June	iii July
II Central						
A. Thunder Bay	ii May	iii May	ii June	i June	i June	ii July
B. Other	iii May	i June	ii June	ii June	ii June	iii July
III Outer Saginaw Bay						
A. North shore	ii May	iii May	ii June	i June	ii June	iii July
B. South shore	i May	ii May	i June	iii May	i June	ii July
IV Southern	ii May	iii May	ii June	i June	ii June	ii July
V Inner Saginaw Bay	i May	i May	i June	iii May	iii May	i July

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